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Volume 42

HYDROGEN HALIDES IN NON-AQUEOUS SOLVENTS

SOLUBILITY DATA SERIES

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SOLUBILITY DATA SERIES

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Volume 42

HYDROGEN HALIDES IN NON-AQUEOUS SOLVENTS

Volume Editors

PETER G. T. FOGG

WILLIAM GERRARD

Polytechnic of North London Holloway, London, UK

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Polytechnic of North London Holloway, London, UK

Contributor

H. LAWRENCE CLEVER

Emory University Atlanta, Georgia, USA



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CONTENTS

| Foreword | Vll | | | | |
|---|--|--|--|--|--|
| Preface | ix | | | | |
| The Solubility of Gases in Liquids | Xl | | | | |
| 1 Hydrogen Fluoride in Non-Aqueous Solvents | 1 | | | | |
| 2 Hydrogen Chloride in Non-Aqueous Solvents | 7 | | | | |
| 2.1 Alkanes 2.2 Mixtures of heptane and other solvents 2.3 Miscellaneous hydrocarbons 2.4 Aromatic hydrocarbons 2.5 Alkanols 2.6 Halogenated alkanols 2.7 Alkenols and alkynols 2.8 Alkanediols 2.9 Aromatic and alicyclic alcohols 2.10 Ethers and miscellaneous solvents containing carbon, hydrogen and oxygen 2.11 Aliphatic carboxylic acids 2.12 Esters of carboxylic and carbonic acids 2.13 Halogenated alkanes and halogenated alkanes | 150 196 207 | | | | |
| 2.14 Halogenated aromatic compounds 2.15 Nitrogen compounds 2.16 Sulfur compounds 2.17 Boron compounds 2.18 Phosphorus compounds 2.19 Silicon compounds 2.20 Tetrachlorostannane and titanium chloride | 314 330 342 352 365 379 | | | | |
| 3 Hydrogen Bromide in Non-Aqueous Solvents 3.1 Critical evaluation of data 3.2 Alkanes 3.3 Aromatic hydrocarbons 3.4 Alcohols, ethers and carboxylic acids 3.5 Haloalkanes and halobenzenes 3.6 Nitrogen compounds 3.7 Sulfur compounds and boron compounds | 383 383 392 401 411 424 431 434 | | | | |
| 4 Hydrogen Iodide in Non-Aqueous Solvents 4.1 Critical evaluation of data 4.2 Alcohols, ethers and carboxylic acids 4.3 Alkyl halides 4.4 Sulfur compounds and boron compounds | 437 437 440 444 449 | | | | |
| Physical Properties of the Hydrogen Halides | 451 | | | | |
| System Index | 453 | | | | |
| Registry Number Index | 470 | | | | |
| Author Index 476 | | | | | |
| Titles in the Solubility Data Series | 480 | | | | |

FOREWORD

If the knowledge is undigested or simply wrong, more is not better.

The Solubility Data Series is a project of Commission V.8 (Solubility Data) of the International Union of Pure and Applied Chemistry (IUPAC). The project had its origins in 1973, when the Analytical Chemistry Division of IUPAC set up a Subcommission on Solubility Data under the chairmanship of the late Prof. A.S. Kertes. When publication of the Solubility Data Series began in 1979, the Committee became a full commission of IUPAC, again under the chairmanship of Prof. Kertes, who also became Editor-in-Chief of the Series. The Series has as its goal the preparation of a comprehensive and critical compilation of data on solubilities in all physical systems, including gases, liquids and solids.

The motivation for the Series arose from the realization that, while solubility data are of importance in a wide range of fields in science and technology, the existing data had not been summarized in a form that was at the same time comprehensive and complete. Existing compilations of solubility data indeed existed, but they contained many errors, were in general uncritical, and were seriously out-of-date.

It was also realized that a new series of compilations of data gave educational opportunities, in that careful compilations of existing data could be used to demonstrate what constitutes data of high and lasting quality. As well, if the data were summarized in a sufficiently complete form, any individual could prepare his or her own evaluation, independently of the published evaluation. Thus, a special format was established for each volume, consisting of individual data sheets for each separate publication, and critical evaluations for each separate system, provided sufficient data from different sources were available for comparison. The compilations and, especially, the evaluations were to be prepared by active scientists who were either involved in producing new data, or were interested in using data of high quality. With minor modifications in format, this strategy has continued throughout the Series.

In the standard arrangement of each volume, the Critical Evaluation gives the following information:

(i) A text which discusses the numerical solubility information which has been abstracted from the primary sources in the form of compilation sheets. The text concerns primarily the quality of the data, after consideration of the purity of the materials and their characterization, the experimental method used, the uncertainties in the experimental values, the reproducibility, the agreement with accepted test values, and, finally, the fitting of the data to suitable functions, along with statistical tests of the fitted data.

(11) A set of recommended data, whenever possible, including weighted averages and estimated standard deviations. If applicable, one or more smoothing equations which have been computed or verified by the evaluator are also given.

(111) A graphical plot of the recommended data, in the form of phase diagrams where appropriate.

The Compilation part consists of data sheets which summarize the experimental data from the primary literature. Here much effort is put into obtaining complete coverage; many good data have appeared in publications from the late nineteenth and early twentieth centuries, or in obscure journals. Data of demonstrably low precision are not compiled, but are mentioned in the Critical Evaluation. Similarly, graphical data, given the uncertainty of accurate conversion to numerical values, are compiled only where no better data are available. The documentation of data of low precision can serve to alert researchers to areas where more work is needed.

A typical data sheet contains the following information:

- (i) list of components: names, formulas, Chemical Abstracts Registry Numbers;
- (11) primary source of the data;
- (iii) experimental variables;
- (1v) compiler's name;
 - (v) experimental values as they appear in the primary source, in modern units with explanations if appropriate;
- (vi) experimental methods used;
- (vii) apparatus and procedure used;
- (v111) source and purity of materials used;
 - (1x) estimated error, either from the primary source or estimated by the compiler;
 - (x) references relevant to the generation of the data cited in the primary source.

Each volume also contains a general introduction to the particular type of system, such as solubility of gases, of solids in liquids, etc., which contains a discussion of the nomenclature used, the principles of accurate determination of solubilities, and related thermodynamic principles. This general introduction is followed by a specific introduction to the subject matter of the volume itself.

The Series embodies a new approach to the presentation of numerical data, and the details continue to be influenced strongly by the perceived needs of prospective users. The approach used will, it is hoped, encourage attention to the quality of new published work, as authors become more aware that their work will attain permanence only if it meets the standards set out in these volumes. If the Series succeeds in this respect, even partially, the Solubility Data Commission will have justified the labour expended by many scientists throughout the world in its production.

January, 1989

J.W. Lorimer, London, Canada

PREFACE

This volume of The Solubility Data Series contains evaluated data for the solubility of hydrogen fluoride, hydrogen chloride, hydrogen bromide and hydrogen iodide in non-aqueous solvents. Information on about four hundred systems is included. Hydrogen halides take part, either as reactants or products, in many reactions of organic compounds. Measurements of solubilities of these gases have often been carried out during studies of such reactions.

There are few measurements of the solubility of hydrogen fluoride in non-aqueous solvents. The solubilities of each of the other gases show wide divergences from solvent to solvent under the same conditions of temperature and pressure. In many cases there are distinct non-linear variations of mole fraction solubility with change of partial pressure of gas at pressures less than 101.3 kPa. This must be borne in mind when attempts are made to predict solubilities at finite pressures from limiting values of Henry's law constants.

Reliance may be placed upon data when there is close agreement between measurements by different groups of workers. Unfortunately there are sometimes inconsistencies in the literature. Difficulties in attaining equilibria between gas and liquid phases are likely to be the chief cause of such discrepancies.

Equations relating mole fraction solubility at constant pressure with temperature have been derived if appropriate experimental data have been available. Errors may arise if these equations are used outside the temperature range of the original measurements.

The editors are grateful for help and encouragement from fellow members of the I.U.P.A.C. Commission on Solubility Data. In particular we should like to acknowledge the tremendous support given by the late Steven Kertes whose untimely death has caused great sorrow to members of the Commission.

Peter Fogg William Gerrard

London

July 1989

THE SOLUBILITY OF GASES IN LIQUIDS

R Battino, H L Clever and C L. Young

INTRODUCTION

The Solubility Data Project aims to make a comprehensive search of the literature for data on the solubility of gases, liquids and solids in liquids. Data of suitable accuracy are compiled into data sheets set out in a uniform format. The data for each system are evaluated and where data of sufficient accuracy are available values recommended and in some cases a smoothing equation suggested to represent the variation of solubility with pressure and/or temperature. A text giving an evaluation and recommended values and the compiled data sheets are published on consecutive pages.

DEFINITION OF GAS SOLUBILITY

The distinction between vapor-liquid equilibria and the solubility of gases in liquids is arbitrary. It is generally accepted that the equilibrium set up at 300K between a typical gas such as argon and a liquid such as water is gas liquid solubility whereas the equilibrium set up between hexane and cyclohexane at 350K is an example of vapor-liquid equilibrium. However, the distinction between gas-liquid solubility and vapor-liquid equilibrium is often not so clear. The equilibria set up between methane and propane above the critical temperature of methane and below the critical temperature of propane may be classed as vapor-liquid equilibrium or as gas-liquid solubility depending on the particular range of pressure considered and the particular worker concerned.

The difficulty partly stems from our inability to rigorously distinguish between a gas, a vapor, and a liquid, which has been discussed in numerous textbooks. We have taken a fairly liberal view in these volumes and have included systems which may be regarded, by some workers, as vapor-liquid equilibria.

UNITS AND QUANTITIES

The solubility of gases in liquids is of interest to a wide range of scientific and technological disciplines and not solely to chemistry. Therefore a variety of ways for reporting gas solubility have been used in the primary literature and inevitably sometimes, because of insufficient available information, it has been necessary to use several quantities in the compiled tables. Where possible, the gas solubility has been quoted as a mole fraction of the gaseous component in the liquid phase. The units of pressure used are bar, pascal, millimeters of mercury and atmosphere. Temperatures are reported in Kelvin.

EVALUATION AND COMPILATION

The solubility of comparatively few systems is known with sufficient accuracy to enable a set of recommended values to be presented. This is true both of the measurement near atmospheric pressure and at high pressures. Although a considerable number of systems have been studied by at least two workers, the range of pressures and/or temperatures is often sufficiently different to make meaningful comparison impossible.

Occasionally, it is not clear why two groups of workers obtained very different sets of results at the same temperature and pressure, although both sets of results were obtained by reliable methods and are internally consistent. In such cases, sometimes an incorrect assessment has been given. There are several examples where two or more sets of data have been classified as tentative although the sets are mutually inconsistent.

Many high pressure solubility data have been published in a smoothed form. Such data are particularly difficult to evaluate, and unless specifically discussed by the authors, the estimated error on such values can only be regarded as an "informed guess". Many of the high pressure solubility data have been obtained in a more general study of high pressure vapor-liquid equilibrium. In such cases a note is included to indicate that additional vapor-liquid equilibrium data are given in the source. Since the evaluation is for the compiled data, it is possible that the solubility data are given a classification which is better than that which would be given for the complete vapor-liquid data (or vice versa). For example, it is difficult to determine coexisting liquid and vapor compositions near the critical point of a mixture using some widely used experimental techniques which yield accurate high pressure solubility data. For example, conventional methods of analysis may give results with an expected error which would be regarded as sufficiently small for vapor-liquid equilibrium data but an order of magnitude too large for acceptable high pressure gas-liquid solubility.

It is occasionally possible to evaluate data on mixtures of a given substance with a member of a homologous series by considering all the available data for the given substance with other members of the homologous series. In this study the use of such a technique has been very limited.

The estimated error is often omitted in the original article and sometimes the errors quoted do not cover all the variables. In order to increase the usefulness of the compiled tables estimated errors have been included even when absent from the original article. If the error on *any* variable has been inserted by the compiler this has been noted.

PURITY OF MATERIALS

The purity of materials has been quoted in the compiled tables where given in the original publication. The solubility is usually more sensitive to impurities in the gaseous component than to liquid impurities in the liquid component. However, the most important impurities are traces of a gas dissolved in the liquid. Inadequate degassing of the absorbing liquid is probably the most often overlooked serious source of error in gas solubility measurements.

APPARATUS AND PROCEDURES

In the compiled tables brief mention is made of the apparatus and procedure. There are several reviews on experimental methods of determining gas solubilities and these are given in References 1-7.

METHODS OF EXPRESSING GAS SOLUBILITIES

Because gas solubilities are important for many different scientific and engineering problems, they have been expressed in a great many ways:

The Mole Fraction, x(q)

The mole fraction solubility for a binary system is given by:

$$x(g) = \frac{n(g)}{n(g) + n(1)}$$

$$= \frac{W(g) / M(g)}{[W(g) / M(g)] + [W(1) / M(1)]}$$

here n is the number of moles of a substance (an *amount* of substance), W is the mass of a substance, and M is the molecular mass. To be unambiguous, the partial pressure of the gas (or the total pressure) and the temperature of measurement must be specified.

The Weight Per Cent Solubility, wt%

For a binary system this is given by

wt = 100 W(g) / [W(g) + W(1)]

where W is the weight of substance. As in the case of mole fraction, the pressure (partial or total) and the temperature must be specified. The weight per cent solubility is related to the mole fraction solubility by

$$x(g) = \frac{[wt^{\&}/M(g)]}{[wt^{\&}/M(g)] + [(100 - wt^{\&})/M(1)]}$$

The Weight Solubility, C_w

The weight solubility is the number of moles of dissolved gas per gram of solvent when the partial pressure of gas is 1 atmosphere. The weight solubility is related to the mole fraction solubility at one atmosphere partial pressure by

$$x(g)$$
 (partial pressure 1 atm) = $\frac{C_w^{M(1)}}{1 + C_w^{M(1)}}$

where M(1) is the molecular weight of the solvent.

The Moles Per Unit Volume Solubility, n

Often for multicomponent systems the density of the liquid mixture is not known and the solubility is guoted as moles of gas per unit volume of liquid mixture. This is related to the mole fraction solubility by

$$x = \frac{n v^{O}(1)}{1 + n v^{O}(1)}$$

where $v^{\circ}(1)$ is the molar volume of the liquid component.

The Bunsen Coefficient, a

The Bunsen coefficient is defined as the volume of gas reduced to 273.15K and 1 atmosphere pressure which is absorbed by unit volume of solvent (at the temperature of measurement) under a partial pressure of 1 atmosphere. If ideal gas behavior and Henry's law is assumed to be obeyed,

$$\alpha = \frac{V(g)}{V(1)} \frac{273.15}{T}$$

where V(g) is the volume of gas absorbed and V(1) is the original (starting) volume of absorbing solvent. The mole fraction solubility is related to the Bunsen coefficient by

 $x(g, 1 \text{ atm}) = \frac{\alpha}{\alpha + \frac{273.15}{T} \frac{v^{\circ}(g)}{v^{\circ}(1)}}$

where $v^{\circ}(g)$ and $v^{\circ}(1)$ are the molar volumes of gas and solvent at a pressure of one atmosphere. If the gas is ideal,

$$x(g) = \frac{\alpha}{\alpha + \frac{273.15R}{v^{\circ}(1)}}$$

Real gases do not follow the ideal gas law and it is important to establish the real gas law used for calculating α in the original publication and to make the necessary adjustments when calculating the mole fraction solubility.

The Kuenen Coefficient, S

This is the volume of gas, reduced to 273.15K and 1 atmosphere pressure, dissolved at a partial pressure of gas of 1 atmosphere by 1 gram of solvent.

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The Ostwald Coefficient, L
```

The Ostwald coefficient, L, is defined at the ratio of the volume of gas absorbed to the volume of the absorbing liquid, all measured at the same temperature.

 $L = \frac{V(q)}{V(1)}$

If the gas is ideal and Henry's Law is applicable, the Ostwald coefficient is independent of the partial pressure of the gas. .It is necessary, in practice, to state the temperature and total pressure for which the Ostwald coefficient is measured. The mole fraction solubility, x, is related to the Ostwald coefficient by

-1

$$x(g) = \frac{RT}{P(g) L v^{O}(1)} + 1$$

where P is the partial pressure of gas. The mole fraction solubility will be at a partial pressure of P(g).

The Absorption Coefficient, B

There are several "absorption coefficients", the most commonly used one being defined as the volume of gas, reduced to 273.15K and 1 atmosphere, absorbed per unit volume of liquid when the total pressure is 1 atmosphere. β is related to the Bunsen coefficient by

 $\beta = \alpha (1-P(1))$

where P(1) is the partial pressure of the liquid in atmosphere.

The Henry's Law Contant

A generally used formulation of Henry's Law may be expressed as

 $P(g) = K_{H} x(g)$

where $K_{\rm H}$ is the Henry's Law constant and x the mole fraction solubility. Other formulations are

$$P(g) = K_2C(1)$$

or

 $C(g) = K_C(1)$

where K₂ and K₂ are constants, C the concentration, and (1) and (g) refer to the liquid and gas phases. Unfortunately, K_H, K₂ and K₂ are all sometimes referred to as Henry's Law constants. Henry's Law is a limiting law but can sometimes be used for converting solubility data from the experimental pressure to a partial gas pressure of 1 atmosphere, provided the mole fraction of the gas in the liquid is small, and that the difference in pressures is small. Great caution must be exercised in using Henry's Law.

The Mole Ratio, N

The mole ratio, N, is defined by

N = n(g) / n(1)

Table 1 contains a presentation of the most commonly used inter-conversions not already discussed.

For gas solubilities greater than about 0.01 mole fraction at a partial pressure of 1 atmosphere there are several additional factors which must be taken into account to unambiguously report gas solubilities. Solution densities or the partial molar volume of gases must be known. Corrections should be made for the possible non-ideality of the gas or the non-applicability of Henry's Law. TABLE 1. Interconversion of parameters used for reporting solubility.

$$L = \alpha(T/273.15)$$

$$C_{w} = \alpha/v_{o}\rho$$

$$K_{H} = \frac{17.033 \times 10^{6}\rho(\text{soln})}{\alpha M(1)} + 760$$

$$L = C_{w} v_{t,gas} \rho$$

where v_o is the molal volume of the gas in cm³ mol⁻¹ at 0°C, ρ the density of the solvent at the temperature of the measurement, ρ_{soln} the density of the solution at the temperature of the measurement, and v_{t,gas} the molal volume of the gas (cm³ mol⁻¹) at the temperature of the measurement.

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Revised: December 1984 (CLY)

| APPENDIX I. Conversion Facto | rs | k a | nd k | - 1 | • | | |
|---|-----------------|-------------------------|---------------------------------------|-------------------|---|-------------------|--|
| | 1 | | k n-SI (SI | | nit) it) | = | k^{-1} 1 (SI Unit) = k^{-1} (non-SI Unit) |
| LENGTH | | | | | | | SI Unit, m |
| <pre>Å (angstrom cm (centimeter) in (inch) ft (foot)</pre> | | 3 | 1 254 | x x | 10 ⁻¹ 10 ⁻² 10 ⁻⁴ 10 ⁻⁴ | (*) (*) | $ \begin{array}{r} 1 \times 10^{10} (*) \\ 1 \times 10^{2} (*) \\ 3 937 008 \times 10^{-5} \\ 3 280 840 \times 10^{-6} \end{array} $ |
| AREA | | | | | _ | | SI Unit, m ² |
| cm ² in ² ft ² | 9 2 | 64 290 | 516 | × | 10 ⁻⁴ 10 ⁻⁸ 10 ⁻⁸ | (*) (*) (*) | $\begin{array}{rrrr} 1 & \times & 10^{4} & (*) \\ 1 & 550 & 003 & \times & 10^{-3} \\ 1 & 076 & 391 & \times & 10^{-5} \end{array}$ |
| VOLUME | | | | | | | SI Unit, m ³ |
| cm ³ in ³ ft ³ 1 (litre) UKgal (UK gallon) USgal (US gallon) | | 831 45 | 064 685 1 461 | × × × × | $10^{6} \\ 10^{-1} \\ 10^{-8} \\ 10^{-3} \\ 10^{-7} \\ 10^{-7} \\ 10^{-7}$ | (*) | $ \begin{array}{cccccccccccccccccccccccccccccccccccc$ |
| MASS | | | | | | | SI Unit, kg |
| g (gram) t (tonne) lb (pound) 4 | 15 : | 359 | 1 | × | 10^{-3} 10^{3} 10^{-8} | (*) (*) (*) | $ \begin{array}{r} 1 \times 10^{3} (*) \\ 1 \times 10^{-3} (*) \\ 2 \ 204 \ 623 \ \times 10^{-6} \end{array} $ |
| DENSITY | | | | | | | SI Unit, kg m ⁻³ |
| g cm ⁻³ g l ⁻¹ lb in ⁻³ lb ft ⁻³ lb UKgal ⁻¹ lb USgal ⁻¹ | 1 6 | 601 99 | 1 991 847 776 | × × × | 10^{3} 10^{-2} 10^{-5} 10^{-3} 10^{-4} | | $ \begin{array}{r} 1 \times 10^{-3} (*) \\ 1 (*) \\ 3 612 728 \times 10^{-11} \\ 6 242 795 \times 10^{-6} \\ 100 224 \times 10^{-7} \\ 8 345 406 \times 10^{-9} \end{array} $ |
| PRESSURE | | | s | ſι | Jnit, | Pa (pa | ascal, kg m ⁻¹ s ⁻²) |
| lbf ft ⁻² inHg (inch of mercury) | 5 6 3 | 101 894 47 386 | 665 325 1 757 880 388 | × × × × × × | $10^{-1} \\ 10^{-1} \\ 10^{5} \\ 10^{-3} \\ 10^{-3} \\ 10^{-3} \\ 10^{-4} \\ 10^{-4}$ | (*) (*) (*) | $1 \times 10 (*)$ $1 019 716 \times 10^{-11}$ $9 869 233 \times 10^{-12}$ $1 \times 10^{-5} (*)$ $1 450 377 \times 10^{-10}$ $20 886 \times 10^{-6}$ $2 952 999 \times 10^{-10}$ $7 500 617 \times 10^{-9}$ |
| ENERGY | | | s | L L | Jnit, | J (jou | ule, kg m ² s ⁻²) |
| hp h (horse power hour) | 1 1 3 2 6 | 4 101 355 584 | 868 184 36 325 818 519 | × × × × × | 10^{-7} 10^{-4} 10^{-3} 10^{-3} 10^{-5} 10^{-3} | (*) (*) | $ \begin{array}{r} 1 \times 10^{7} (*) \\ 2 388 459 \times 10^{-7} \\ 2 390 057 \times 10^{-7} \\ 2 777 778 \times 10^{-13} \\ 9 869 233 \times 10^{-9} \\ 7 375 622 \times 10^{-7} \\ 3 725 062 \times 10^{-13} \\ 9 478 172 \times 10^{-10} \\ \end{array} $ |
| **** | | | <u> </u> | | | | |

An asterisk (*) denotes an exact relationship.

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| COMPONENTS | EVALUATOR. |
|--|--|
| Hydrogen Fluoride; HF; [7664-39-3] | Peter G. T. Fogg Department of Applied Chemistry and Life Sciences, |
| 2. Non-aqueous Solvents | Polytechnic of North London, Holloway, London, N7 8DB, U.K. January 1989 |

CRITICAL EVALUATION

The Solubility of Hydrogen Fluoride in Non-aqueous Solvents

Simons (1) measured the solubility of hydrogen fluoride in benzene over the temperature range 292.7 K to 345.9 K and pressure range 0.32 kPa to 89.2 kPa. Except at partial pressures of hydrogen fluoride below about 0.5 kPa the mole fraction solubility lies below the reference surface defined by the Raoult's law equation. i.e.

 $x_{\rm HF} = P_{\rm HF}/P_{\rm HF}^{\circ}$

where $P_{\rm HF}$ is the partial pressure of hydrogen fluoride and $P_{\rm HF}^{\circ}$ the vapor pressure of liquid hydrogen fluoride. The behaviour differs from that of the other hydrogen halides. Mole fraction solubilities in benzene of these gases lie above this reference surface. Simons' data for hydrogen fluoride are self-consistent but there are no other data on this system available for comparison. They may be accepted on a tentative basis.

Simons also measured the solubility of hydrogen fluoride in octane in the range 298.3 K to 339.5 K at a total pressure equal to barometric. Mole fraction solubilities are very low. These measurements may also be accepted on a tentative basis until further studies have been made.

Matuszak (2) reported the solubility in 1,2-ethanediol, 1,2,3-propanetriol, 1,1'-oxybis[3-methylbutane] and in 1,1'-oxybisbenzene, each at a single temperature in the range 295.4 K to 304.3 K and single pressure of either 98.93 kPa (742 mmHg) or 99.59 kPa (747 mmHg). On the basis of analogy with the behaviour of the other hydrogen halides it is to be expected that the mole fraction solubility of hydrogen fluoride in these solvents should be high relative to the reference values based upon the Raoult's law equation. Mole fraction solubilities from Matuszak's measurements are as follows :

| Solvent | ₽ _{HF} /mmHg | т/к | ^x HF | Reference value P _{HF} /P _{HF} |
|-----------------------------|-----------------------|-------|-----------------|--|
| 1,2-ethanediol | 742 | 302.0 | 0.916 | 0.705 |
| 1,2,3-propanetriol | 747 | 295.4 | 0.946 | 0.886 |
| 1,1'-oxybis[3-methylbutane] | 742 | 297.6 | 0.799 | 0.820 |
| 1,1'-oxybisbenzene | 742 | 304.3 | 0.583 | 0.653 |

This author's measurement of the solubility of hydrogen chloride in 1,2-ethanediol is consistent with measurements by Gerrard & Macklen. His values for the solubility of hydrogen chloride in 1,1'-oxybis[3-methylbutane] and in 1,1'-oxybisbenzene are lower than those reported by others. The evaluator recommends that these solubility data for hydrogen fluoride should be treated as semi-qualitative until they have been confirmed by other workers.

Hartman (4) reported the solubility in fluorosulfuric acid at four temperatures from 299.8 K to 333.2 K at a pressure of 101.3 kPa. Mole fraction solubilities are high, relative to the reference line based upon the Raoult's law equation, and are self-consistent. No experimental details were given. No other measurements are available for comparison and the reliability of these data cannot be judged.

REFERENCES

| 1. | Simons, J. H. J. Am. Chem. Soc. <u>1931</u> , 53, 83-87. |
|----|--|
| 2. | Matuszak, M. P. <i>U. S. Patent</i> 2,520,947 September 5, <u>1950</u> . |
| 3. | Gerrard, W.; Macklen, E. D. J. Appl. Chem. <u>1960</u> , 10, 57-62. |
| 4. | Hartman, B. F. <i>U. S. Patent</i> 2,434,040 January 6, <u>1948</u> . |

| COMPONENTS: | UF. | | ORIGINAL MEASUREMENTS: Simons, J. H. |
|---|----------|---|---|
| <pre>(1) Hydrogen fluoride; HF; [7664-39-3]</pre> | | | Simons, J. H. |
| (2) Octane; C ₈ H ₁₈ ; [111-65-9] | | J. Am. Chem. Soc. <u>1931</u> , 53, 83 - 87. | |
| | | | |
| | | | |
| VARIABLES: | | | PREPARED BY: |
| T/K: 298.3 - HF P/kPa: 85.7 - 9 | | | W. Gerrard |
| HF P/kPa: $85.7 - 9$ (643 - 7) | | | (smoothed data calculated by H.L. Clever) |
| EXPERIMENTAL VALUES: | | | |
| EXPERIMENTAL VALUES. | т/к | Pressu | re Mol Fraction |
| | | p_1/mm | |
| | [293.15 | 735 | 0.00372] |
| | 298.3 | | 0.00338 |
| | [303.15 | 727 | 0.00305] |
| | 309.2 | | 0.00276 |
| | [313.15 | 714 | 0.00253] |
| | 318.2 | | 0.00235 |
| | [323.15 | 695 | 0.00213] |
| | 324.2 | | 0.00194 |
| j | [333.15 | 666 | 0.00181] |
| | 339.5 | | 0.00170 |
| The HF vapor pressur pressure at each tem assumed to be 745 mm | perature | alculat from th | ed by subtracting the octane vapor e barometric pressure which was |
| | | | |
| | A | | INFORMATION |
| METHOD/APPARATUS/PROCEDURE: Three vessels were connected by taps. Vessel X contained the liquid HF, and was furnished with an inlet tube passing to the bottom. The exit tube was flush with the top of X, and it then became the inlet tube for vessel Y which contained the octane. This inlet tube passed to the bottom of the absorption vessel, Y. The outlet tube from Y was flush with the top of Y; but it was not clear where it went after that. These two vessels were immersed in separate thermostats. A vertical tube carrying a tap passed from the bottom of vessel Y, and was attached to a tapped vessel Z of about 20 cm ³ capacity for the reception of a sample of solution for the determina- tion of hydrogen fluoride by titra- tion with sodium hydroxide (excess) and hydrochloric acid. | | HF, and be it tube nd it vessel This m of sh with lear se two ate bottom to a 3 a ermina- itra- | <pre>as described by Simons (1). It was distilled directly into the dry apparatus filled with nitrogen. (2) Octane. Self prepared. Dried with phosphorus pentoxide and sodium, and distilled directly into the apparatus. ESTIMATED ERROR: REFERENCES:</pre> |
| | | | |

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| 4 | e | |
|---|---|---|
| | 1 | |
| | ł | , |
| | | |

| [7664-3 | en fluoride 39-3] e; C ₆ H ₆ ; [7 | | | | 9. <u>1931</u> , 53, |
|-------------------|---|--------------------|----------------|------------|--------------------------------|
| T/K | Pressure | Mol Fraction | Т/К | | Mol Fraction |
| | p1/mmHg | <i>x</i> 1 | | p1/mmHg | <i>x</i> 1 |
| Equilib liquid | HF at 292.6 | pressure of 5 K | | F at 273.1 | pressure of 5 K (continued) |
| [293.15 | 669 | 0.0673] | [323.15 | 214 | 0.0196] |
| 294.6 294.7 | | 0.0653 0.0650 | 325.1 329.4 | | 0.0181 0.0150 |
| 295.1 | | 0.0648 | [333.15 | 160 | 0.0117] |
| 296.2 297.3 | | 0.0530 0.0625 | 334.3 | | 0.0108 |
| 297.3 | | 0.0620 | 338.2 | | 0.0084 |
| 298.9 300.3 | | 0.0596 0.0588 | Equilibr | ium vapor | pressure of |
| 302.4 | | 0.0556 | liquid H | F at 255.1 | |
| 302.5 [303.15 | 625 | 0.0548 | [293.15 | 147 | 0.0385] |
| 304.2 | 640 | 0.0548] | 293.9 294.0 | | 0.0382 0.0381 |
| 306.0 | | 0.0525 0.0507 | 294.1 | | 0.0375 |
| 307.0 | | 0.0495 | 296.1 | | 0.0355 |
| 308.7 309.8 | | 0.0510 0.0468 | 301.1 | | 0.0327 |
| 312.2 | | 0.0442 | [303.15 | 137 | 0.0315] |
| 312.3 312.5 | | 0.0437 0.0427 | 304.3 304.9 | | 0.0306 0.0323 |
| | 541 | | 304.9 311.1 | | 0.0258 |
| [313.15 | 561 | 0.0422] | [313.15 | 123 | 0.0244] |
| 315.4 317.8 | | 0.0394 0.0382 | 313.9 | | 0.0244 |
| 317.9 | | 0.0365 | 322.1 | | 0.0184 |
| 319.1 | 470 C | 0.0332 | [323.15 | 104 | 0.0173] |
| [323.15 | 473.6 | 0.0298] | 325.9 | | 0.0161 |
| 324.1 327.1 | | 0.0280 0.0246 | 331.2 | | 0.0117 |
| 327.2 | | 0.0248 | [333.15 | 77.5 | 0.0102] |
| 327.2 | | 0.0243 | 333.7 | | 0.0098 |
| [333.15 | 354.9 | 0.0180] | | | pressure of |
| 334.1 335.5 | | 0.0167 0.0150 | - | F at 196.1 | |
| 335.6 | | 0.0155 | 292.7 | · - | 0.0249 |
| 345.9 | | 0.00395 | [293.15 | 4.5 | 0.0248] |
| liquid H | HF at 273.1 | | 296.7 303.1 | | 0.0227 0.0208 |
| [293.15 | 303 | 0.0432] | [303.15 | 4.2 | 0.0203] |
| 294.1 | | 0.0425 | 311.4 | | 0.0163 |
| 298.7 | | 0.0384 | [313.15 | 3.8 | 0.0158] |
| 300.6 | | 0.0368 | 318.1 | | 0.0128 |
| [303.15 | 283 | 0.0355] | [323.15 | 3.2 | 0.0112] |
| 303.3 | | 0.0346 | 326.0 | | 0.0098 |
| 306.0 | | 0.0330 | 329.1 | ÷ . | 0.00825 |
| [313.15 | 254 | 0.0275] | [333.15 | 2.4 | 0.0071] |
| 313.6 | | 0.0277 | 333.9 338.1 | | 0.0067 0.00557 |
| | | 0 0777 | | | V • • • • • • • • |

| COMPONENTS: | ORIGINAL MEASUREMENTS: |
|--|--|
| <pre>(1) Hydrogen fluoride; HF; [7664-39-3] (2) Benzene; C₆H₆; [71-43-2]</pre> | Simons, J. H. J. Am. Chem. Soc. <u>1931</u> , 53, 83 - 87. |
| VARIABLES: T/K: 296.1 - 345.9 P/kPa: 0.32 - 89.20 (2.4 - 669 mmHg) | PREPARED BY: W. Gerrard |

EXPERIMENTAL VALUES:

See preceeding page.

The mole fraction values in [] are smoothed values of the author.

The HF partial pressure values were calculated from the data below and the equation:

p1/mmHg =[(p_{barometer}/mmHg - p⁰₂/mmHg)/p_{barometer}/mmHg] p⁰₁/mmHg

where p_1^{\uparrow} is the equilibrium vapor pressure of HF at the HF liquid temperature, and p_2^{\downarrow} is the solvent equilibrium vapor pressure at the temperature of the solubility measurement. The author's values are below.

| T/K | Hydrogen Fluoride | Benzene | Average Barometer |
|---------|----------------------|---------|----------------------|
| | p1/mmHg | p₂/mmHg | p barometer/mmHg |
| | | | ······ |
| 196.15 | 5.1 | | 750 |
| 255.15 | 166 | | 740 |
| 273.15 | 342 | | 742 |
| 292.15 | 760 | | 745 |
| 293.15 | 768 | 75.6 | |
| 303.15 | 1070 | 120.2 | |
| 313.15 | 1470 | 183.6 | |
| 323.15 | 1990 | 271.4 | |
| 333.15 | 2630 | 390.1 | |
| | | | |

AUXILIARY INFORMATION

| METHOD/APPARATUS/PROCEDURE: | SOURCE AND PURITY OF MATERIALS: |
|--|--|
| Three vessels are connected by taps. Vessel I contains the liquid HF. It is furnished with an inlet tube passing to the bottom. The exit tube is flush with the top of I, and passes to the bottom of vessel II. The outlet tube from II is flush with the top and can be opened to the atm. The two vessels are immersed in separate thermostats. Vessel I | Hydrogen fluoride. Prepared as described by Simons (1). It was distilled directly into the dry apparatus filled with nitrogen. |
| controls the partial pressure of HF, vessel II contains the solvent at the temperature of the solubility measure- | |
| ment. A vertical tube passes from the bottom of II to vessel III for the reception of a sample of solution for chemical titration. The sample is reacted with excess NaOH, and back | |
| titrated with HCl. | REFERENCES: |
| Vessel I is maintained at a chosen temperature of 292.65 K (normal b.p. | <pre>1. Simons, J. H. J. Am. Chem. Soc. <u>1924</u>, 46, 2179.</pre> |
| of HF) or lower to control the HF partial pressure. The partial pressur in II is calculated from the vapor pre of solvent in II, and the barometric p | ssure of HF in I, the vapor pressure |

4

| Hydrogen Fluoriae in | non-Aqueous Solver | 115 | 5 | |
|--|---|--|---------------------------------------|--|
| COMPONENTS: | ORIGINAL MEASU | REMENTS: | | |
| <pre>(1) Hydrogen fluoride; HF; [7664-39-3]</pre> | Matuszak, M. F | Matuszak, M. F. | | |
| <pre>(2) 1,2-Ethanediol 1,2,3-Propanediol 1,1'-Oxybis[3-methylbutane] 1,1'-Oxybisbenzene</pre> | U.S. Patent 2,520,947 September 5, 1950 Chem. Abstr. 1950, 44, 11044g | | | |
| VARIABLES: T/K: 295.2 - 304.3 P/kPa : 98.93 - 99.59 (742 - 747 mmHg) | PREPARED BY: W. Gerrar | rd | | |
| EXPERIMENTAL VALUES: | . I <u></u> | | | |
| | HF Absorbed* Mo HF per 100 g component 2 | ole Ratio** ⁿ HF ^{/n} 2 | Mole Fraction** [*] HF | |
| 1,2-Ethanediol, (ethvlene glycol); ^C 2 ^H 6 ^O 2; [107-21-1] 84 302.0 742 | 350 | 10.86 | 0.916 | |
| 1,2,3-Propanetriol, (glvcerol); C ₃ H ₈ O ₃ ; [56-81-5] 72 295.4 747 | 382 | 17.6 | 0.946 | |
| 1,1'-Oxybis[3-methylbutane], (<i>diisoam</i> ^C 10 ^H 22 ^O ; [544-01-4] 76 297.6 742 | v1 ether); 50.5 | 4.00 | 0.799 | |
| 1,1'-Oxybisbenzene, (diphenvl ether); C _{12^H10^O; [101-84-8] 88 304.3 742} | 16.4 | 1.396 | 0.583 | |
| * The author's statement was "HF at oxycompound." ** calculated by the compiler. | sorbed, weight p | er cent of | | |
| | | | | |
| AUXILIARY | INFORMATION | | | |
| METHOD/APPARATUS/PROCEDURE | SOURCE AND PURI | TY OF MATER | IALS: | |
| No information | No information | | | |
| | ESTIMATED ERROR | : | | |
| | REFERENCES: | | | |

| 0 | | | | | |
|---|---|--------------------------|----------------------|-----------------------|---------------------------------------|
| COMPONENTS : | | | ORIGINAL MEASURE | MENTS: | |
| (1) Hydrogen i | fluoride; HF; | | Hartman, B. H | 2. | |
| [7664-39-3 | [7664-39-3] | | 11. S. Patent | 2,434,040, Jan. | 6 1948 |
| <pre>(2) Fluorosulfuric acid or fluo- sulfonic acid; FHO₃S;[7789-21-1]</pre> | | | o. b. rutent | 2,454,040, ball. | 0, <u>1940</u> . |
| VARIABLES: | | | PREPARED BY: | | |
| VARIABLES: $T/K = 299.8 - 333.2$ p/kPa = 101.325 (1 atm) | | | } | H. L. Clever | |
| EXPERIMENTAL VALU | ES: | | | , | |
| | Temperature | Hydroge | en Fluoride | Mol Fraction | |
| | - | $10^2 \omega_1 / w$ | t % dissolved | | |
| | $t/{}^{\circ}\mathbf{F}$ T/\mathbf{K} | in fluc <u>at one</u> | sulfonic acid atm | <i>x</i> ₁ | |
| | 80 299.8 | | 58.0 | 0.874 | |
| | 100 310.9 120 322.0 | | 33.0 | 0.711 | |
| | 120 322.0 140 333.2 | | 18.0 11.0 | 0.523 0.382 | |
| | The compiler ca | alculated | the mole frac | ction values. | |
| | | AUXILIARY | INFORMATION | | |
| METHOD/APPARATUS/ | PROCEDURE : | | SOURCE AND PURI | TY OF MATERIALS: | |
| No inf | Cormation. | | No inform | nation. | |
| | | | ESTIMATED ERROR | : | · · · · · · · · · · · · · · · · · · · |
| | | | | | |
| | | | REFERENCES : | | |

| (1) Hydrogen chloride; HCl; [7647-01-0] (2) Alkanes H. Lawrence Clever Chemistry Department Emory University Atlanta, GA 30322 USA 1986, November |
|--|
| |

CRITICAL EVALUATION:

The Solubility of Hydrogen Chloride in Alkanes.

Seven papers (ref 1 - 7) report measurements of the solubility of hydrogen chloride in seven normal alkanes and one branched alkane. Some of the measurements were made as a function of pressure at partial pressures well below atmospheric pressure. Other measurements were made at only one pressure at or near atmospheric pressure. The measurements cover the temperature interval of 194.6 to 475 K.

Two trends have been observed in evaluating the solubility of gases in normal alkanes which are also expected for hydrogen chloride. The trends are:

(i) the temperature coefficient of solubility of a gas is the same for all alkanes at a given temperature. This is because a given gas has nearly the same enthalpy of solution in all normal alkanes.

(ii) at a given temperature and gas partial pressure the mole fraction solubility increases with normal alkane chain length. The increasing contact area of the alkane with carbon number will allow more solute molecules to contact the alkane which results in a larger mole fraction solubility.

Henry's law can be a helpful relationship in the evaluation of gas solubility data. The hydrogen halides are non-ideal gases, their solutions are non-ideal, and there is a question as to whether or not their solutions obey Henry's law over even a low partial pressure range, especially for solvents with some basic character. Of all the solvents the normal alkanes probably show the least basic character. The HCl + heptane solubility data of Brown and Brady (ref 3) and Strohmeir and Echte (ref 4) at eight temperatures between 194.6 and 272.9 K strongly indicate that Henry's law is a good approximation to the solubility behavior of the system. The evidence is presented in Figure 1. When Henry's law, in the form

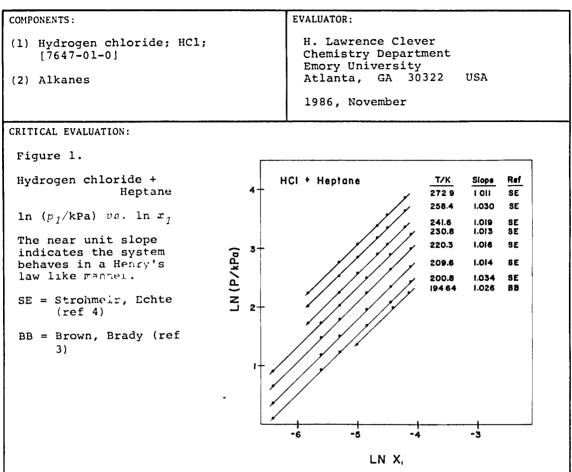
 $(p_1/kPa) = (k_H/kPa)x_1$, is put in logarithmic form $\ln(p_1/kPa) = \ln k_H + \ln x_1$,

it is seen that a plot of $\ln (p_1/kPa) vs. \ln x_1$ should be linear and of unit slope. The HCl + heptane data plotted in Figure 1 is linear and averages within 2 percent of unit slope. The gas partial pressures range from 1.1 to 47.8 kPa. Thus the present evaluation will assume a Henry's law like model can be used to help evaluate the data. It is further assumed that the relationship is valid to 101.3 kPa (atmospheric pressure).

Both O'Brien and Kenny (ref 2) and Ryabov et al. (ref 7) present pressure dependent solubility data for the HCl + hexane system. The Ryabov et al. experiment appears to be seriously flawed. The data scatter badly, and the atmospheric pressure values at several temperatures appear to be too small when compared with other data. The O'Brien and Kenny data when plotted in logarithmic form are approximately linear, but the slope is 7 per cent larger than unity. Although these experiments do not support the Henry law model well, we believe the Strohmeir and Echte experiments on HCl + heptane are definitive, and accept Henry's law for all of the HCl + alkane systems.

The HCl + alkane mole fraction solubilities at 101.3 kPa are shown in Figure 2 and given in Table 1 as a function of temperature. In the figure is plotted $\ln x_1 vs$. 1000/(T/K). The HCl vapor pressure and Raoults law were used to construct an ideal solubility line at 101.3 kPa partial pressure (the line also represents the 101.3 kPa solubility predicted by the Gerrard reference line). Also given in Table 1 are Henry's constants in kPa. The Henry's constants reproduce the low pressure solubility values of the HCl + heptane system with an average deviation of 0.9 percent.

Figure 2 allows the expected trends of a similar temperature coefficient of solubility and of an increasing solubility with increasing chain length for the HCl + alkane systems to be checked. The results are disappointing. The figure indicates the HCl + alkane data do not make up a self-consistent set of solubility data. The figure shows that the HCl +



heptane data of Brown and brady (ref 3) and Strohmeir and Echte (ref 4), and the HCl + decane data of Gerrard, Mincer and Wyvill (ref 5) best represent the behavior of HCl in alkanes. The HCl + hexane data of Ryabov *et al.* (ref 7) appear to be too low and of a different temperature coefficient of solubility. The HCl + hexadecane data of Tremper and Prausnitz (ref 6) do not fit the expected pattern well. Near 300 K the mole fraction solubility values are smaller than expected on comparison with the heptane and decane data. Above 400 K the values are nearer the expected magnitude. However, the temperature coefficient of solubility is quite different from that of the systems considered most reliable.

Not all of the data points of Bell (ref 1) and Ryabov *et al.* (ref 7) are shown on Figure 2. Bell reported one solubility value at 293.2 K for each of four hydrocarbons. From the location of Bell's solubility values on Figure 2 we believe his values are reliable with the possible exception of the hexadecane value.

Each HCl + alkane system is discussed further below.

1. Hydrogen chloride + Pentane; C₅H₁₂; [109-66-0]

Ryabov $et \ al.$ (Ref 7) report one mole fraction solubility value at 101.3 kPa and 298.2 K. It appears to be too small and is classified as doubtful.

2. Hydrogen chloride + Hexane; C₆H₁₄; [110-54-3]

Three papers report rather discordant measurements of the solubility of HCl in hexane. Probably the most reliable value is the single value reported by Bell (ref 1) at 101.3 kPa and 293.2 K. O'Brien and Kenny (ref 2) report four values measured at pressures between 2.10 and 10.84 kPa HCl at 298.2 K. The data recalculated as Henry's constant show some scatter and lead to an atmospheric pressure value that is nearly 20 per cent below the Bell value. Ryabov *et al.* (ref 7) report solubility values at 101.3 kPa

8

| COMPONENTS: | EVALUATOR: |
|--|---|
| (1) Hydrogen chloride; HCl; [7647-01-0] (2) Alkanes | H. Lawrence Clever Chemistry Department Emory University Atlanta, GA 30322 USA |
| | 1986, November |

CRITICAL EVALUATION:

at six temperatures between 283.2 and 313.2 K. It appears that they made measurements at a number of HCl partial pressures, but a complete data set is given for only the 298.2 K measurements. As discussed earlier their experiment appears to be flawed. The pressure dependent data at 298.2 K scatter badly, and all of their values appear to be low. The results are classed as doubtful.

3. Hydrogen chloride + Heptane; C₇H₁₆; [142-82-5]

The data reported by Brown and Brady (ref 3) and Strohmeir and Echte (ref 4) are classed as tentative. However, they may be the most reliable data available for HCl + alkane systems. Their pressure dependent data appears to obey Henry's law (Figure 1). The Henry's constants given in Table 1 regenerate the experimental data from these papers with an average deviation of 0.9 percent. The lol.3 kPa mole fraction solubilities calculated from these data are plotted in Figure 2. A single value at lol.3 kPa and 298.2 K of Ryabov *et al.* (ref 7) appears to be too small and is classed as doubtful.

4. Hydrogen chloride + Octane; C₈H₁₈; [111-65-9]

Bell (ref 1) reports a single value at 101.3 kPa and 293.2 K which is classed tentative. Ryabov $et \ al$. (ref 7) report a single value at 101.3 kPa and 298.2 K which is classed doubtful.

5. Hydrogen chloride + 2,2,4-Trimethylpentane; C₈H₁₈; [540-84-1]

One value at 101.3 kPa and 298.2 K is reported (ref 7). The branched alkanes do not always fit a predictable pattern of gas solubility. The present value is suspected of being low. It is classed doubtful.

6. Hydrogen chloride + Decane; $C_{10}H_{22}$; [124-18-5]

Gerrard, Mincer, and Wyvill (ref 5) report the only data on the system. They report eleven measurements at 101.3 kPa between the temperatures of 269.2 and 319.2 K. The data show some scatter (Figure 2), but they do show the expected trends in mole fraction solubility and temperature coefficient of solubility relative to the HCl + heptane data.The data are classed as tentative.

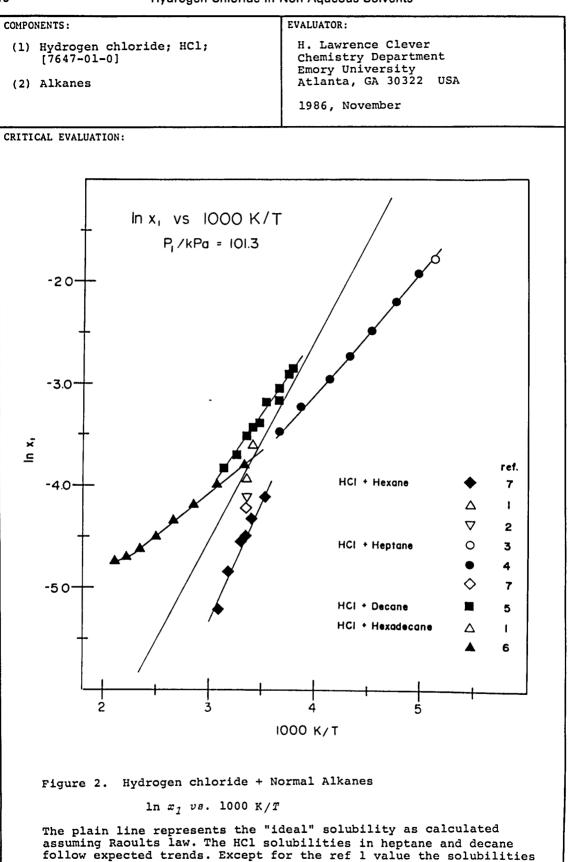
7. Hydrogen chloride + Dodecane; C₁₂H₂₆; [112-40-3]

Bell (ref 1) reports a single measurement at 101.3 kPa and 293.2 K. The value fits the expected pattern of solubility in alkanes fairly well, and it is classed as tentative.

8. Hydrogen chloride + Hexadecane; C₁₆H₃₄; [544-76-3]

Bell (ref 1) reports a single solubility value at 101.3 kPa and 293.2 K. Tremper and Prausnitz (ref 6) report seven Henry's constant values at temperatures between 300 and 475 K. The Henry's constant values have been converted to mole fraction values at 101.3 kPa. They are shown in Figure 2 and given in Table I. At 293.2 K the extrapolated solubility value of Tremper and Prausnitz is 12 percent lower than the Bell value. Bell's value already appears to be low when compared with the solubility values of HCl in heptane and decane at 293.2 K.

Tremper and Prausnitz used modern equipment, established techniques, and took account of the non-ideality of the gas state in their calculations. They state their reproducibility is one percent. Thus, it is of concern to inspect Figure 2 and see that their data does not fit the overall pattern well. Their results near 300 K appear to be too small when compared to the HCl solubility in other alkanes. Their temperature coefficient of solubility differs from that of other systems. At this time it is not possible to decide whether the HCl + dodecane or the HCl + heptane and decane solubility curves (Fig 2) best represent the typical behavior of HCl in a normal alkane. New experimental results are needed.



assuming Raoults law. The HCl solubilities in heptane and decane follow expected trends. Except for the ref l value the solubilities in hexane appear to be too small. The solubilities in hexadecane are smaller magnitude than expected at the lower temperatures, but near expected magnitudes at the higher temperatures. The HCl + hexadecane slope agrees poorly with the slopes of the other systems. ſ

| 94.6 90.8 99.6 20.3 30.8 41.6 58.4 72.9 33.2 93.2 | 4/kPa | <i>x</i> ₁ | 6220 7680 | | k _H /kPa 600 689 901 1206 1554 1941 | 0.169 0.147 0.1125 0.0842 0.0657 | k _H /kPa | <i>ω</i> ₁ | 3 4 4 4 |
|---|--------------------|-----------------------|--|--|--|--|---|---|--|
| 00.8 09.6 20.3 30.8 41.6 58.4 72.9 33.2 93.2 93.2 93.2 93.2 93.2 93.2 93.2 93.2 93.2 93.2 | L600 | | | | 689 901 1206 1554 1941 | 0.147 0.1125 0.0842 0.0657 | | | 4 4 4 |
|)3.2 13.2 | L600 | | 5140 | 0.0163 0.0132 0.0197 | 2572 3206 | 0.0522 0.0394 0.0316 | 3420 | 0.0296 | 4 4 4 7 7 1 |
|)3.2 13.2 | | 0.0047 | | 0.0112 | 6890 | 0.0147 | | 0.0163 | 7 |
| 13.2 | | 0.0017 | 6220 | 0.0163 | 0000 | 0.011/ | 0220 | 0.0100 | 2 |
| | | | 9560 L2840 L8730 | 0.0106 0.00789 0.00541 | | | | | 7 7 7 |
| | ,2,4-Tr ethylpe | | Decane | | Dodecan | e | Hexadec | ane | |
| $\overline{k_E}$ | y/kPa | <i>x</i> ₁ | k _H /kPa | <i>x</i> ₁ | k _H /kPa | <i>x</i> ₁ | k _H /kPa | <i>x</i> ₁ | |
| 54.2 57.2 73.2 73.4 79.2 33.2 88.4 93.2 93.4 | | | 1745 1865 2140 2170 2405 2465 3015 3155 | 0.0581 0.0544 0.0473 0.0467 0.0421 0.0411 0.0336 0.0321 | 3230 | 0.0314 | 3750 | 0.0270 | 5 5 5 5 5 5 5 1 5 5 |
| | 5580 | 0.0154 | 3400 | 0.0298 | | | | | 5 7 |
| 00 06.7 19.2 25 50 75 50 25 50 75 | | | 4100 4690 | 0.0247 0.0216 | | | 4565 5505 6665 7915 9210 10340 11250 11750 | 0.0222 0.0184 0.0152 0.0128 0.0110 0.00980 0.00901 0.00862 | 655666666 6666666 |

| COMPONENTS : | ORIGINAL MEASUREMENTS: |
|--|--|
| | Ryabov, V. G.; Solomonov, A. B.; |
| <pre>(1) Hydrogen chloride; HCl; 7647-01-0</pre> | Ketov, A. N.; Bugaichuk, A. M. |
| (2) Alkanes; $C_{5}H_{12}$, $C_{6}H_{14}$, $C_{7}H_{16}$, | 2h. Fiz. Khim. <u>1979</u> , 53, 2915 - 6. |
| and $C_{8}H_{18}$ | Ruвв. J. Phys. Chem. <u>1979</u> , 53, 1667 - 8. |
| VARIABLES: | PREPARED BY: |
| T/K: 298.15 P/kPa: 101.325 | H. L. Clever |
| EXPERIMENTAL VALUES: | |
| T/K Mol | Fraction ¹ ^x 1 |
| Pentane; C ₅ H ₁₂ ; [] | .09-66-0] |
| 298.15 0 | 0.0047 ± 0.0001 |
| Hexane; C ₆ H ₁₄ ; [1] | .0-54-3] |
| 298.15 0 | 0.0112 ± 0.0001 |
| Heptane; C ₇ H ₁₆ ; [] | .42-82-5] |
| 298.15 0 | 0.0147 ± 0.0003 |
| Octane; C ₈ H ₁₈ ; [1] | 1-65-9] |
| 298.15 0 | 0.0163 ± 0.0004 |
| 2,2,4-Trimethylper C ₈ H ₁₈ ; [540-84-1] | tane or isooctane; |
| 298.15 0 | 0.0154 ± 0.0002 |
| ¹ The authors report mole per cent. The c point and reports mo | ted the solubility as compiler moved the decimal ple fraction. |
| AUXILIARY | INFORMATION |
| METHOD/APPARATUS/PROCEDURE: | SOURCE AND PURITY OF MATERIALS: |
| The hydrogen chloride was bubbled through a thermostated layer of the hydrocarbon. | No information. |
| Samples were removed at specified times, washed with distilled water, and the aqueous extract titrated with 0.1 N sodium hydroxide. | |
| Saturation was confirmed by taking 2 to 3 more samples after the time concentration curve leveled. | |
| | ESTIMATED ERROR: |
| | The uncertainty is described by the authors as a fiducial probability of 0.99. |
| | REFERENCES: |
| | |
| | |
| | |
| | |

| COMPONENTS: | ORIGINAL MEASUREMENTS: | | |
|--|---|--|--|
| | | | |
| <pre>(1) Hydrogen chloride; HCl; [7647-01-0]</pre> | Bell, R. P. | | |
| (2) Alkanes; C_6H_{14} , C_8H_{18} , $C_{12}H_{26}$, and $C_{16}H_{34}$ | J. Chem. Soc. <u>1931</u> , 1371 - 1382. | | |
| VARIABLES: | PREPARED BY: | | |
| T/K = 293.15 P/kPa = 101.325 (1 atm) | W. Gerrard | | |
| EXPERIMENTAL VALUES: | Lengen | | |
| T/K Partition Coefficient c1,1/c1,9 | Mol Fraction #1 | | |
| Hexane; C ₆ H ₁₄ ; | [110-54-3] | | |
| 293.15 3.64 | 0.0197 | | |
| Octane; C ₈ H ₁₈ ; | [111-65-9] | | |
| 293.15 4.50 | | | |
| Dodecane; C ₁₂ H ₂ | | | |
| 293.15 3.42 | | | |
| | H ₃₄ ;[544-76-3] ^a | | |
| 293.15 2.28 | 0.0270 | | |
| | | | |
| The ideal gas concentra | tion at $p_1 = 1$ atm | | |
| is $c_{1,g}/mol dm^{-3} = n/V$ | r = p/RT = 0.0417. | | |
| ^a named cetane in the c | riginal paper. | | |
| AUXILIARY | INFORMATION | | |
| METHOD/APPARATUS/PROCEDURE: | SOURCE AND PURITY OF MATERIALS: | | |
| The apparatus consisted of a 50 cm ³ bulb extended at the top as a graduated tube, and sealed at the bottom to a capillary U-tube. The liquid was saturated with gas at atmospheric pressure. The gas was displaced from the saturated solu- tion by a current of dry CO ₂ free air, absorbed in water, and titrated with a solution of NaOH. The solubility, c/mol dm ⁻³ , was | Hydrogen chloride. Prepared by dropping pure concentrated hydrochloric acid into pure sulfuric acid. Alkanes. Good specimens were dried over calcium chloride, and distilled. Boiling points are given in paper. | | |
| by dividing by the ideal gas con- centration of HCl in the gas phase. | ESTIMATED ERROR: $\delta T/K = 0.01$ $\delta c/c = 0.01$ | | |
| The mole fraction solubility was calculated on the assumption that the density of the solution obeys the ideal mixture law. | REFERENCES : | | |
| | L | | |

| | | | | | NAL MEASUREME | NTS: |
|--|---|--|---|------------------------------|--|---|
| <pre>(1) Hydrogen chloride; HCl; [7647-01-0]</pre> | | | | O'Brien, S. J.; Kenny, C. L. | | |
| (2) Hexane; C ₆ H ₁₄ ; [110-54-3] | | | J. 118 | Am. Chem. 9 - 1192. | 50c. <u>1940</u> , 62, | |
| VARIABLES: | | | | PREPA | RED BY: | ······ |
| T/K: 298.15 P/kPa: 2.09 - 10.87 (15.7 - 81.5 mmHg) | | | ънд) | | | Gerrard |
| EXPERIMENTAL VALUES: | | | | | | |
| т/к | Pressure | Molality | Henry | | Mol Ratio | Mol Fraction |
| | p1/mmHg | ml/mol kg ⁻¹ | Const k ¹ | | n1/n2 | <i>x</i> 1 |
| 298.15 | 15.7 28.3 49.2 81.5 | 0.0042 0.0073 0.0111 0.020 | 4.9 5.1 5.8 5.4 | | 0.000362 0.000629 0.000956 0.00172 | 0.000629 0.000956 |
| | (760 | | 5.3 | | | 0.0160) ² |
| 2 | | | | | | |
| | | AU | XILIARY | INFORM | 1ATION | |
| METHOD /APP | ARATUS / PROCED | | XILIARY | | | OF MATERIALS. |
| The meth Saylor (<i>al</i> . (2). use of a 7 day eq The appa which ar solvent the gas, the lower | as modiling The main of the main of the | DURE: aratus are th fied by O'Bri difference is y instead of | ose of en <i>et</i> the a 5 to ulbs he with to | SOURC (1) (2) | E AND PURITY Hydrogen o chemically chloride a by phospho Hexane. Ea Attested 1 n ²⁰ 1.37 | OF MATERIALS: chloride. Prepared from y pure potassium and sulfuric acid. Drie orus pentoxide. astman Kodak Co. by refractive index, 41. |
| The meth Saylor (<i>al</i> . (2). use of a 7 day eq The appa which ar solvent the gas, the lowe partiall and the thermost | od and app 1) as modi The main of 1 to 2 day uilibration ratus cons e separate is partial and the se r bulb. The y evacuated whole appar at from 1 | DURE: aratus are th fied by O'Bri difference is y instead of n time. ists of two b d by a tap. T ly saturated olution added e bulbs are d, the tap op ratus put in | ose of en <i>et</i> the a 5 to ulbs he with to ened, a | SOURC (1) (2) | E AND PURITY Hydrogen o chemically chloride a by phospho Hexane. Ea Attested 1 n ² 0 1.374 | chloride. Prepared from y pure potassium and sulfuric acid. Drie orus pentoxide. astman Kodak Co. by refractive index, |

| COMPONENTS: | | | ORIGINAL MEASU | REMENTS : | |
|---|--|--|-------------------------------------|-------------------------|---------------------------------|
| | | | | | |
| (1) Hydrod [7647- | gen chloride -01-0] | ; HC1; | | | onov, A. B.; ichuk, A. M. |
| (2) Hexane | (2) Hexane; C ₆ H ₁₄ ;[110-54-3] | | | | 53, 2915 - 6. |
| | | | Russ. J. P 1667 - 8. | hys. Chem. | <u>1979</u> , 53, |
| VARIABLES: | | · · · · · · · · · · · · · · · · · · · | PREPARED BY: | | |
| | /к: 298.15 | | | H. L. Cl | ever |
| P/R | Pa: 9.626 - (0.095 | - 1,00 atm) | | | |
| EXPERIMENTAL | | | | | |
| т/к | Gas Phase HCl Mol % ¹ | Order of Ma Measurement | ol Fraction ² x1 | Standard Error | Confidence Interval |
| 298.15 | 9.5 | 2 | 0.00027 | 0.001 | ±0.001 |
| 230.13 | 22.1 | 6 | 0.00175 | 0.001 | ±0.004 |
| | 24.2 | 8 | 0.00208 | 0.005 | ±0.009 |
| | 35.5 | 9 | 0.0032 | 0.012 | ±0.02 |
| | 47.8 | 3 | 0.00252 | 0.002 0.004 | ±0.003 ±0.006 |
| | 56.7 74.1 | 5 7 | 0.00445 0.01018 | 0.004 | ±0.008 |
| | 76.3 | 10 | 0.0103 | 0.006 | ±0.01 |
| | 76.6 | 4 | 0.0089 | 0.029 | ±0.05 |
| | 88.0 | 12 | 0.01045 | 0.009 | ±0.019 |
| | 97.1 | 11 | 0.01099 0.0112 | 0.003 0.0024 | ±0.006 ±0.01 |
| | 100.0 | 1 | 0.0112 | 0.0024 | 10.01 |
| | | | | | |
| | | AUXILIARY | INFORMATION | | |
| METHOD /APPAR | TUS /PROCEDURE | • | SOURCE AND PUL | RITY OF MATE | RTALS. |
| | | | | | 11.00 |
| The hydro through a hydrocarb | thermostate | e was bubbled ed layer of the | No informa | ation. | |
| times, wa and the a | ere removed shed with di queous extra | at specified | 1 | | |
| with 0.1 | N sodium hyd | istilled water, act titrated | | | |
| Saturatio 2 to 3 mo | N sodium hyd n was confi re samples a | istilled water, act titrated droxide. rmed by taking after the time | | | |
| Saturatio 2 to 3 mo | N sodium hyd n was confi | istilled water, act titrated droxide. rmed by taking after the time | ESTIMATED ERR | OR: | |
| Saturatio 2 to 3 mo concentra The measu | N sodium hyd n was confi: re samples a tion curve i | istilled water, act titrated droxide. rmed by taking after the time leveled. e made in the | See table | above for rd error a | authors values nd confidence |
| Saturatio 2 to 3 mo concentra The measu random or | N sodium hyd n was confin re samples a tion curve i rements were | istilled water, act titrated droxide. rmed by taking after the time leveled. e made in the | See table of standa | above for rd error a | authors values nd confidence |
| Saturatio 2 to 3 mo concentra The measu random or | N sodium hyd n was confin re samples a tion curve i rements were | istilled water, act titrated droxide. rmed by taking after the time leveled. e made in the | See table of standa interval. | above for rd error a | authors values nd confidence |
| Saturatio 2 to 3 mo concentra The measu random or | N sodium hyd n was confin re samples a tion curve i rements were | istilled water, act titrated droxide. rmed by taking after the time leveled. e made in the | See table of standa interval. | above for rd error a | authors values nd confidence |
| Saturatio 2 to 3 mo concentra The measu random or | N sodium hyd n was confin re samples a tion curve i rements were | istilled water, act titrated droxide. rmed by taking after the time leveled. e made in the | See table of standa interval. | above for rd error a | authors values nd confidence |
| Saturatio 2 to 3 mo concentra The measu random or | N sodium hyd n was confin re samples a tion curve i rements were | istilled water, act titrated droxide. rmed by taking after the time leveled. e made in the | See table of standa interval. | above for rd error a | authors values nd confidence |
| Saturatio 2 to 3 mo concentra The measu random or | N sodium hyd n was confin re samples a tion curve i rements were | istilled water, act titrated droxide. rmed by taking after the time leveled. e made in the | See table of standa interval. | above for rd error a | authors values nd confidence |

Hydrogen Chloride in Non-Aqueous Solvents

| | Noll-Aqueous Solvents |
|---|---|
| COMPONENTS: | ORIGINAL MEASUREMENTS: |
| <pre>(1) Hydrogen chloride; HCl; [7647-01-0]</pre> | Ryabov, V. G.; Solomonov, A. B.; Ketov, A. N.; Bugaichuk, A. M. |
| (2) Hexane; C ₆ H ₁₄ ; [110-54-3] | Zh. Fiz. Khim. <u>1979</u> , 53, 2915 - 6. |
| | Russ. J. Phys. Chem. <u>1979</u> , 53, 1667 - 8. |
| VARIABLES: T/K: 283.15 - 323.15 P/kPa: 101.325 (1 atm) | PREPARED BY: H. L. Clever |
| EXPERIMENTAL VALUES: | |
| т/к Мс | ol Fraction #1 |
| 283.15 293.15 298.15 303.15 313.15 323.15 | 0.0112 ± 0.0001 0.01060 0.00789 |
| The standard deviation was | results on a computer to $3.143/(t + 50) - 9055.09/(t + 50)^2$ 3.0.029 mole per cent, and the per cent) ² . In the equation the |
| temperature is t/ºC. | |
| AUXILIARY | INFORMATION |
| METHOD/APPARATUS/PROCEDURE: | SOURCE AND PURITY OF MATERIALS: |
| The hydrogen chloride was bubbled through a thermostated layer of the hydrocarbon. Samples were removed at specified | No information. |
| times, washed with distilled water, and the aqueous extract titrated with 0.1 N sodium hydroxide. | |
| Saturation was confirmed by taking 2 to 3 more samples after the | |
| time concentration curve leveled. | ESTIMATED ERROR: |
| | |
| | REFERENCES : |
| | |
| | |

| COMPONENTS : | | | 1 | ODICTN | T MEACHIDELE | PC . | |
|---|---|--|---|--|--|--|-------------|
| | en chlorid | le: HCl: | | | L MEASUREMENT | | |
| (1) Hydrog [7647- | | | | | | | |
| (2) Heptan | e; C _{7^H16} ; | [142-82-5] | | J. Am. Chem. Soc. <u>1952</u> , 74, 3570 - 3582. | | | |
| VARIABLES: | /K: 194.6 | | | PREPARI | D BY: | | |
| T P/k | Pa: 3.921 | 4 - 9.503 1 - 71.28 m | nmHg) | | | Gerrard | |
| EXPERIMENTAL | VALUES: | | | | | | |
| Т/К | Pressure p ₁ /mmHg | | um Mixtu n ₂ /mm | | 1 Fraction | Henry's Constan K/mmHg = p_1/x_1 | t |
| 194.64 | | 0.217 | 32.5 | | 0.00662 | 4443 | |
| 194.04 | 29.41 55.30 | 0.402 | | | 0.01219 | 4443 | |
| | 71.28 | 0.520 | 32.5 | 7 | 0.01571 | 4537 | |
| | | | | | | 4520 ¹ (5.947 atm |) |
| to calc maximum | ulate valu recorded | es of mole | fractio | n for | pressures o | sed indiscriminat greater than the | егу |
| mixture | | | | | | | |
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| | | A | AUXILIARY | INFORMA | TION | | |
| ME THOD / APPAR | RATUS / PROCEDU | | AUXILIARY | | ATION AND PURITY O | F MATERIALS: | |
| y means of | f high pre | JRE: cision high | n vacuum | SOURCE (1) H | AND PURITY O ydrogen chl | oride. Not stat | ed, |
| y means of quipment a he pressu: | f high pre and proced re of the | JRE: cision high ure the cha gas phase d | n vacuum ange of lue to | SOURCE (1) H b | AND PURITY O ydrogen chl | | ed, |
| by means of equipment a the pressu bsorption | f high pre and proced re of the | JRE: cision high ure the cha | n vacuum ange of lue to | SOURCE (1) H b q | AND PURITY O ydrogen chl ut may be t uality. | oride. Not stat aken as of high | |
| y means of equipment a the pressu bsorption 94.64 K. | f high pre and proced re of the was accur | JRE: cision high ure the cha gas phase d ately measu | n vacuum ange of due to ured at | SOURCE (1) H b q (2) H o | AND PURITY O ydrogen chl ut may be t uality. eptane. Th f high qual | oride. Not stat taken as of high horoughly atteste tity. Values of | d as the |
| by means of equipment a be pressu- bsorption 94.64 K. The mole find the lique | f high pre and proced re of the was accur raction of uid phase | JRE: cision high ure the cha gas phase d ately measu hydrogen c was calcula | n vacuum ange of due to ured at chloride ated. | SOURCE (1) H b q (2) H o b | AND PURITY O ydrogen chl ut may be t uality. eptane. Th f high qual oiling poir | oride. Not stat aken as of high horoughly atteste | d as the |
| by means of equipment a be pressu- bsorption 94.64 K. The mole f: n the liquite the solubi | f high pre and proced re of the was accur raction of uid phase lity was f | JRE: cision high ure the cha gas phase d ately measu hydrogen c was calcula inally expr | n vacuum ange of lue to ired at chloride ated. ressed | SOURCE (1) H b q (2) H o b | AND PURITY O ydrogen chl ut may be t uality. eptane. Th f high qual oiling poir | oride. Not stat taken as of high horoughly atteste tity. Values of ht and refractive | d as the |
| y means or quipment he pressu bsorption 94.64 K. The mole fin the liqu the solubits the Hen | f high pre and proced re of the was accur raction of uid phase lity was f | JRE: cision high ure the cha gas phase d ately measu hydrogen c was calcula inally expr ant, K/mmHg | n vacuum ange of lue to ired at chloride ated. ressed | SOURCE (1) H b q (2) H o b | AND PURITY O ydrogen chl ut may be t uality. eptane. Th f high qual oiling poir | oride. Not stat taken as of high horoughly atteste tity. Values of ht and refractive | d as the |
| by means of equipment a the pressure bsorption 94.64 K. The mole fr the solubit the solubit the Henry pressure/mon | f high pre- and proced re of the was accur raction of uid phase lity was f ry's const ole fraction nstant is | JRE: cision high ure the cha gas phase d ately measu hydrogen c was calcula inally expr ant, K/mmHg | n vacuum ange of due to ured at chloride ated. ressed g = HCl | SOURCE (1) H b q (2) H o b i | AND PURITY O ydrogen chl ut may be t uality. eptane. Th f high qual oiling poir | oride. Not stat taken as of high horoughly atteste tity. Values of ht and refractive | d as the |
| By means of equipment a the pressu absorption 94.64 K. The mole find the solubit is the Hent pressure/mo fenry's con funmerical may deviate | f high pre- and proced re of the was accur raction of uid phase lity was f ry's const ole fraction nstant is ly) at which e widely f | JRE: cision high ure the cha gas phase d ately measu hydrogen c was calcula inally expr ant, K/mmHg on. the pressur | n vacuum ange of due to ured at chloride ated. ressed g = HCl re and it ported | SOURCE (1) H b q (2) H o b i | AND PURITY O ydrogen chl ut may be t uality. eptane. Th f high qual oiling poir ndex are in | oride. Not stat taken as of high horoughly atteste tity. Values of ht and refractive | d as the |
| By means of equipment a the pressu absorption 194.64 K. The mole find the solubit as the lique the solubit as the Hent pressure/me thenry's con (numerical) may deviate value of plate the vapor p | f high pre- and proced re of the was accur raction of uid phase lity was f ry's const. ole fraction nstant is ly) at which e widely f 1 = 1.43 a | JRE: cision high ure the cha gas phase d ately measu hydrogen c was calcula inally expr ant, K/mmHg on. the pressur ch $x_1 = 1$, rom the rep tm (1087 mm f pure liqu | n vacuum ange of lue to ired at chloride ated. ressed g = HCl re and it ported nHg), | SOURCE (1) H b q (2) H o b i | AND PURITY O ydrogen chl ut may be t uality. eptane. Th f high qual oiling poir ndex are in | oride. Not stat taken as of high horoughly atteste tity. Values of ht and refractive | d as the |
| By means of equipment a the pressu absorption 194.64 K. The mole find the solubit as the lique the solubit oressure/me lenry's con (numerical) may deviate value of p the vapor p | f high pre- and proced re of the was accur raction of uid phase lity was f ry's const. ole fraction nstant is ly) at which e widely f 1 = 1.43 accursts | JRE: cision high ure the cha gas phase d ately measu hydrogen c was calcula inally expr ant, K/mmHg on. the pressur ch $x_1 = 1$, rom the rep tm (1087 mm f pure liqu | n vacuum ange of lue to ired at chloride ated. ressed g = HCl re and it ported nHg), | SOURCE (1) H b q (2) H o b i | AND PURITY O ydrogen chl ut may be t uality. eptane. Th f high qual oiling poir ndex are in | oride. Not stat taken as of high horoughly atteste tity. Values of ht and refractive | d as the |
| By means of equipment a the pressu absorption 194.64 K. The mole find the solubit as the lique the solubit as the Hent pressure/me thenry's con (numerical) may deviate value of plate the vapor p | f high pre- and proced re of the was accur raction of uid phase lity was f ry's const. ole fraction nstant is ly) at which e widely f 1 = 1.43 accursts | JRE: cision high ure the cha gas phase d ately measu hydrogen c was calcula inally expr ant, K/mmHg on. the pressur ch $x_1 = 1$, rom the rep tm (1087 mm f pure liqu | n vacuum ange of lue to ired at chloride ated. ressed g = HCl re and it ported nHg), | SOURCE (1) H b q (2) H o b i i | AND PURITY O ydrogen chl ut may be t uality. eptane. Th f high qual oiling poir ndex are in | oride. Not stat taken as of high horoughly atteste tity. Values of ht and refractive | d as the |
| By means of equipment a the pressu absorption 194.64 K. The mole find the solubit as the lique the solubit oressure/me tenry's con (numerical) may deviate value of p the vapor p | f high pre- and proced re of the was accur raction of uid phase lity was f ry's const. ole fraction nstant is ly) at which e widely f 1 = 1.43 accursts | JRE: cision high ure the cha gas phase d ately measu hydrogen c was calcula inally expr ant, K/mmHg on. the pressur ch $x_1 = 1$, rom the rep tm (1087 mm f pure liqu | n vacuum ange of lue to ired at chloride ated. ressed g = HCl re and it ported nHg), | SOURCE (1) H b q (2) H o b i i | AND PURITY O ydrogen chl ut may be t uality. eptane. Th f high qual oiling poir ndex are in | oride. Not stat taken as of high horoughly atteste tity. Values of ht and refractive | d as the |
| By means of equipment a the pressu absorption 194.64 K. The mole find the solubit as the lique the solubit as the Hent pressure/me thenry's con (numerical) may deviate value of plate the vapor p | f high pre- and proced re of the was accur raction of uid phase lity was f ry's const. ole fraction nstant is ly) at which e widely f 1 = 1.43 accursts | JRE: cision high ure the cha gas phase d ately measu hydrogen c was calcula inally expr ant, K/mmHg on. the pressur ch $x_1 = 1$, rom the rep tm (1087 mm f pure liqu | n vacuum ange of lue to ired at chloride ated. ressed g = HCl re and it ported nHg), | SOURCE (1) H b q (2) H o b i i | AND PURITY O ydrogen chl ut may be t uality. eptane. Th f high qual oiling poir ndex are in | oride. Not stat taken as of high horoughly atteste tity. Values of ht and refractive | d as the |

| COMPONENTS: (1) Hydrogen chloride; HCl; [7647-01-0] | ORIGINAL MEASUREMENTS: Strohmeir, W.; Echte, A. Z. Elektrochem. <u>1957</u> , 61, 549-555. |
|--|--|
| (2) Heptane; C ₇ H ₁₆ ; [142-82-5] | |
| VARIABLES: T/K: 200.8 - 272.9 p ₁ /mmHg: 8.3 - 358.8 | PREPARED BY: W. Gerrard |
| EXPERIMENTAL VALUES: | |
| T/K 200.8 209.6 220 | 0.3 230.8 241.6 258.4 272.9 |
| Mole Fraction x ₁ | p ₁ /mmHg |
| 0.001651 8.3 10.8 1 0.003677 18.9 24.8 3 0.005000 25.9 33.9 4 0.007823 40.8 53.3 7 0.011646 60.5 79.3 10 | $\begin{array}{c ccccccccccccccccccccccccccccccccccc$ |
| 0.002983 0.004964 0.006764 0.009337 0.011088 0.014766 | 42.2 56.6 71.0 71.4 94.8 119.0 98.9 130.1 162.6 137.1 181.0 223.9 162.8 215.0 267.9 219.3 288.6 358.8 |
| Henry's constant for $x_1 + 0$ Henry's constant: H/mmHg = (| at 272.9 K was given as 24,000 mmHg. $p_1/mmHg)/x_1$. |
| AUXILIA | Y INFORMATION |
| METHOD/APPARATUS/PROCEDURE: The same in principle as the high vacuum technique of Brown and Brady (1), except that the temperature wa increased and the corresponding pressure of the gas phase measured. | |
| | ESTIMATED ERROR: |
| | REFERENCES: 1. Brown, H. C.; Brady, J. C. J. Am. Chem. Soc. <u>1952</u> , 74, 3570. |

| COMPONENTS: | ORIGINAL MEASUREMENTS: |
|--|--|
| <pre>(1) Hydrogen chloride; HCl; [7647-01-0]</pre> | Gerrard, W.; Mincer, A. M. A.; Wyvill, P. L. |
| (2) Decane; C ₁₀ H ₂₂ ; [124-18-5] | J. Appl. Chem. <u>1959</u> , 9, 89 - 93. |
| | |
| VARIABLES: | PREPARED BY: |
| T/K: 264.15 - 319.15 | W. Gerrard |
| Total P/kPc: 101.325 (1 atm) | |
| | (smoothed data calculated by H.L. Clever) |
| EXPERIMENTAL VALUES: | |
| T/K Mol Ratio | Mol Fraction |
| · · · · · · · · · · · · · · · · · · · | |
| ⁿ HCl/ ⁿ C ₁₀ H ₂₂ | ^x HCl |
| 264.15 0.0617 | 0.0581 |
| 267.15 0.0575 | 0.0544 |
| 273.15 0.0496 | 0.0473 |
| 273.35 0.0490 | 0.0467 |
| 279.15 0.0440 283.15 0.0429 | 0.0421 0.0411 |
| 288.35 0.0348 | 0.0336 |
| 293.95 0.0332 | 0.0321 |
| 298.15 0.0307 | 0.0298 |
| 306.65 0.0253 | 0.0247 |
| | 0.0216 |
| The mole fraction values were calcula | ted by the compiler. |
| Smoothed Data: $\ln x_{HCl} = -8.716 + 15$ | .491/(T/100) |
| HCI Standard error about | regression line = 1.03×10^{-3} |
| Standard erfor about | |
| T/K Ma | ol Fraction |
| | ^x HC1 |
| | |
| 263.15 273.15 | 0.0591 |
| 273.15 | 0.0476 0.0390 |
| 293.15 | 0.0323 |
| 303.15 | 0.0272 |
| 313.15 | 0.0231 |
| 323.15 | 0.0198 |
| AUXILIARY | INFORMATION |
| | |
| METHOD/APPARATUS/PROCEDURE: | SOURCE AND PURITY OF MATERIALS: |
| The solvent was weighed in a bubbler | (1) Hydrogen chloride. Good specimen |
| tube. The amount of gas absorbed was | |
| determined by reweighing to constant weight. The total pressure was | dried. |
| barometric, very nearly 1 atm. | (2) Decane. Carefully purified, |
| For determination at temperatures | and purity rigorously attested. |
| below 273 K, a chemical titration was | |
| Carried out. After the maximum | |
| absorption at the stated temperature, | |
| the bubbler tube was attached to a | |
| flask containing 1 dm ³ of water, and allowed to warm slowly (12 hours) to | |
| room temperature. The contents of | ESTIMATED ERROR: |
| the bubbler tube were then added to | |
| the water, and the total chloride ion | $\delta T/K = 2 < 273 K$ $\delta x/x = 0.025$ |
| was determined by the Volhard method. | |
| A low temperature, Teddington-type YM | |
| thermostat was used for temperatures below 273 K, the control being within | REFERENCES: |
| + 2 K. | |
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| COMPONENTS: | ORIGINAL MEASUREMENTS: | |
|---|--|--|
| | | |
| <pre>(1) Hydrogen chloride; HCl; [7647-01-0]</pre> | Tremper, K. L.; Prausnitz, J. M. | |
| (2) Hexadecane; C ₁₆ H ₃₄ ; [544-76-3] | J. Chem. Eng. Data <u>1976</u> , 21, 295 - 299. | |
| VARIABLES : | PREPARED BY: | |
| T/K = 300 - 475 $p_{1}/kPa < 133.3$ (1000 mmHg) | W. Gerrard | |
| EXPERIMENTAL VALUES: | | |
| T/K Partial Mola Entropy of S $\Delta \overline{s}_1/cal K^-$ | olution | |
| 300 -4.06 | 45.0 | |
| 325 -5.06 | 54.3 | |
| 350 -5.14 375 -4.81 | 65.8 78.3 | |
| 400 -4.22 | 90.7 | |
| 425 -3.47 | 102.0 | |
| 450 -2.52 | 111.0 | |
| 475 -1.61 | 116. | |
| Henry's constant was defined as $H_{1,2}/\text{atm} = \lim_{x_1 \to 0} (f_1/\text{atm})/x_1$ | | |
| where f_1 is the fugacity of the gas; the numeral 2 indicates the hexadecane. | | |
| The partial nolar entropy of solu | | |
| $\Delta \overline{s}_{1} \equiv \overline{s}_{1}^{L}(T, x_{1} = 1/H_{1,2}) - \overline{s}_{pure 1}^{G}(T, f_{1} = 1 \text{ atm}) = -R(d \ln H_{1,2})/d\ln T$ | | |
| The partial molar enthalpy of solution is related by | | |
| $\Delta \overline{n}_1 = T \Delta \overline{\sigma}_1.$ | | |
| The compiler states that caution should be exercized in using the expression $1/$ "Henry's constant" to calculate the mole fraction, x_1 , for 1 atm. | | |
| AUXILIARY | INFORMATION | |
| METHOD/APPARATUS/PROCEDURE: | SOURCE AND PURITY OF MATERIALS: | |
| A known amount of gas is added from a precision gas buret to a known amount of the hexadecane. Only the temperature and pressure need be measured to specify the system completely (1). | Not specified; but may be deemed of acceptable purity. | |
| The experimental pressures were not stated. They were described as being low; "total pressures were always less than 1000 mmHg and usually much less." | ESTIMATED ERROR: | |
| The authors state that Henry's law was checked in some experiments, however, there is no definite state- | $\delta x_1/x_1 = \pm 0.01$ | |
| ment that Henry's law was checked for | REFERENCES : | |
| HCl. Note compiler's caution below the table. | <pre>I. Cukor, P. M.; Prausnitz, J. M. Ind. Eng. Chem. Fundam. <u>1971</u>, 10, 638.</pre> | |
| | | |
| | | |

| COMPONENTS: | EVALUATOR: |
|--|---|
| Hydrogen Chlorid [7647-01-0] | e; HCl; Peter G. T. Fogg Department of Applied Chemistry and Life Sciences, |
| 2. Organic Solvents | Polytechnic of North London, Holloway, London, N7 8DB, U.K. |
| 3. Heptane; C _{7H16} ; | [142-82-5] January 1989 |

CRITICAL EVALUATION:

The Solubility of Hydrogen Chloride in Mixtures of Heptane with Other Solvents.

Strohmeir & Echte (1) measured the solubility of hydrogen chloride in heptane at partial pressures from 1.1 kPa (8.3 mmHg) to 47.8 kPa (359 mmHg) in the temperature range 200.8 K to 272.9 K. Mixed solvents were prepared which, in most cases, consisted of 0.020 mole of heptane and 0.001 mole of a second solvent. The dioxane-heptane mixture under test however, consisted of 0.040 mole of heptane with 0.001 mole of dioxane. Solubility of hydrogen chloride was measured in each of the mixed solvents at 272.9 K and, in most cases, at other temperatures in the range 200.8 K to 272.9 K, over pressure ranges below barometric pressure. The variation of mole fraction solubility with partial pressure of hydrogen chloride deviates increasingly from linearity the greater the solubility of the gas in the mixed solvent.

The authors have calculated limiting values of Henry's constant, $k_{\rm H}$, for dissolution hydrogen chloride in the mixtures at 272.9 K from the variation of mole fraction solubility with pressure. These constants are defined by the relationship:

$$k_{\rm H}/{\rm mmHg} = \lim_{x_{\rm HCl} \neq 0} (P_{\rm HCl}/x_{\rm HCl})$$

The evaluator has estimated mole fraction solubilities of hydrogen chloride in the mixtures for a temperature of 272.9 K and a partial pressure of 101.3 kPa. It has been assumed that the variation of partial pressure of hydrogen chloride with concentration in the solution can be represented by a Margules equation of the form :

$$P_{HCl} = P_{HCl}^{\circ} x_{HCl} \exp(\alpha(1-x_{HCl})^2)$$

The contribution of the heptane to the dissolution of the hydrogen chloride under these conditions has then been estimated. It has been assumed that this is given by the solubility of the gas in pure heptane multiplied by the mole fraction of heptane in the original mixed solvent i.e. 20/21 in most cases. The contribution of the second solvent in a mixture has been taken to be the difference between the total solubility and the contribution of the heptane. This has then been used to estimate the solubility of hydrogen chloride per mole of the second solvent and hence the apparent mole fraction solubility in this second solvent. Values are listed below.

For many of these second solvents there are independent values of mole fraction solubility at 273.15 K and a partial pressure of 101.3 kPa. These values are also listed below.

| COMPONENTS. | EVALUATOR: | |
|---|--|--|
| <pre>1. Hydrogen Chloride; HCl; [7647-01-0]</pre> | Peter G. T. Fogg Department of Applied Chemistry | |
| 2. Organic Solvents | and Life Sciences, Polytechnic of North London, Holloway, London, N7 8DB, U.K. | |
| 3. Heptane; C ₇ H ₁₆ ; [142-82-5] | January 1989 | |
| CRITICAL EVALUATION. | | |
| Solvent | Mixed solvent Pure solvent | |
| | x _{HCl (272.9 K)} x _{HCl (273.15 K)} x _{HCl (273.15 K)} | |
| (Heptane) | (0.032) 0.032 (1) | |
| 1,1'-Oxybisethane 1,1'-Oxybispropane | 0.556 0.543 (2) 0.502 (0.529)+ | |
| 1,1'-Oxybisbutane | 0.502 0.515 (3) | |
| 1,1'-0xybis[2-chloroethane] | 0.235 0.229 (3) | |
| Methoxybenzene 1,1'-Oxybisbenzene | 0.199 0.195 (3) 0.175 0.105 (3) | |
| 1,1'-[Oxybis(methylene)]bisbenzene | 0.413 - | |
| Tetrahydrofuran | 0.633 0.624 (3) | |
| 1,4-Dioxane | 0.610 0.548 (3) | |
| Tetrahydro-2H-pyran | 0.552 - 0.381 (0.397)¶(5) | |
| 1,1'-Thiobisethane Nitrobenzene | 0.381 (0.397)¶(5) 0.198 0.123 (4) | |
| 1-Methyl-2-nitrobenzene | (0.193) $(0.129)*(6)$ | |
| Tetrachloromethane | 0.017 0.022 § | |
| Nitric acid, ethyl ester (ethyl nitrate) 0.092 - | | |
| <pre>† mean of values for 1,1'-oxybisethane and 1,1'-oxybisbutane</pre> | | |
| <pre>¶ value for 1,1'-thiobispropane</pre> | | |
| * estimated from the value at 298.15 K from measurements by O'Brien & Kenny on the assumption that the temperature coefficient of solubility at this temperature is the same as that for nitrobenzene | | |
| § see page 236 | | |
| Agreement is good, except in the case of nitrobenzene, 1-methyl-2- nitrobenzene and 1,1'-oxybisbenzene. | | |
| Brown & Brady (7) studied the solubility of hydrogen chloride in mixtures of heptane or methylbenzene with another solvent. In this case, however, the maximum partial pressure of hydrogen chloride was 9.67 kPa and extrapolation of solubilities to a partial pressure of 101.3 kPa is not justified. (see pages 38-40, 70-72) | | |
| REFERENCES | | |
| 1. Strohmeir, W.; Echte, A. Z. E. | lektrochem. 1957, 61, 549-555. | |
| Kapoor, K. P.; Luckcock, R. G. Biotech. <u>1971</u>, 21, 97-100. | ; Sandbach, J. A. J. Appl. Chem. | |
| 3. Gerrard, W.; Macklen, E. D. J. | . Appl. Chem. <u>1960</u> , 10, 57-62. | |
| 4. Ahmed, W.; Gerrard, W.; Maladka 109-119. | ar, V. K. J. Appl. Chem. <u>1970</u> , 20, | |
| 5. Frazer, M. J.; Gerrard, W. Nat | ture, <u>1964</u> , 204, 1299-1300. | |
| 6. O'Brien, S. J.; Kenny, C. L. | J. Am. Chem. Soc. <u>1940</u> , 62, 1189-1192. | |
| 7. Brown, H. C.; Brady, J. D. J. | Am. Chem. Soc. <u>1952</u> , 74,3570-3582. | |
| | | |

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| nyurogon omorido m | Non-Aqueous Solvents 23 |
|---|---|
| COMPONENTS: (1) Hydrogen chloride; HCl; [7647-01-0] | ORIGINAL MEASUREMENTS: Strohmeir, W.; Echte, A. |
| (2) 1,1'-Oxybisethane or diethyl ether; $C_4H_{10}O$; [60-29-7] | Z. Elektrochem. <u>1957</u> , 61, 549-555. |
| (3) Heptane; $C_{7^{H}16}$; [142-82-5] | |
| VARIABLES: | PREPARED BY: |
| T/K: 200.8 - 272.9 P ₁ /mmHg: 0.1 - 479.6 | W. Gerrard |
| EXPERIMENTAL VALUES: | |
| T/K 200.8 209.6 220.3 | 230.8 241.6 258.4 272.9 |
| Mole Fraction | p ₁ /mmHg |
| $\begin{array}{c ccccccccccccccccccccccccccccccccccc$ | 5.5 14.2 33.5 70.9 8.7 20.3 49.2 101.5 12.7 27.5 66.1 137.3 9.19.7 36.5 92.9 176.1 8.27.9 53.1 122.3 221.7 8.40.2 73.4 158.7 278.4 58.0 97.7 200.7 334.0 7.81.5 127.8 253.1 405.6 113.0 166.7 312.9 479.6 272.9 K was given as 4000 mmHg. pmponent (2) + 0.020 mole of ch measurement. |
| AUXILIARY | INFORMATION |
| METHOD/APPARATUS/PROCEDURE: The same in principle as the high vacuum technique of Brown and Brady (1), except that the temperature was increased and the corresponding pressure of the gas phase measured. | <pre>SOURCE AND PURITY OF MATERIALS: (1) Hydrogen chloride. Not specified; but may be taken as of good quality. (2) Diethyl ether. Treated with Na-K alloy. (3) Heptane. Purified as for optical measurements. Dried over sodium-potassium alloy. ESTIMATED ERROR: REFERENCES: 1. Brown, H. C.; Brady, J. C. J. Am. Chem. Soc. <u>1952</u>, 74, 3570.</pre> |
| | |

| COMPONENTS: (1) Hydrogen chloride; HCl; | ORIGINAL MEASUREMENTS: Strohmeir, W.; Echte, A. |
|---|--|
| [7647-01-0] (2) 1,1'-Oxybispropane or dipropyl ether; C ₆ H ₁₄ O; [111-43-3] | 2. Elektrochem. <u>1957</u> , 61, 549-555. |
| (3) Heptane; C ₇ H ₁₆ ; [142-82-5] | |
| | |
| VARIABLES: T/K: 200.8 - 272.9 | PREPARED BY: |
| $p_1/\text{mmHg}: 0.25 - 556.0$ | W. Gerrard |
| EXPERIMENTAL VALUES: | |
| Т/К 200.8 209.6 220.3 | 3 230.8 241.6 258.4 272.9 |
| Wala | n (mmlig |
| Mole Fraction x ₁ | p ₁ /mmHg |
| 0.005 0.25 0.5 1.2 | 2 2.1 5.3 15.8 27.0 |
| 0.010 0.4 1.0 2.0 | 5 5.4 11.7 29.3 58.1 |
| $\begin{array}{cccccccccccccccccccccccccccccccccccc$ | |
| 0.025 1.4 3.7 8. | |
| 0.030 2.1 5.2 12. 0.035 3.4 7.8 18.2 | 5 26.9 56.8 123.9 222.3 2 38.5 76.6 159.8 276.8 |
| 0.035 3.4 7.8 18.2 0.040 5.7 12.5 27.0 | |
| 0.045 10.5 20.6 39. | 7 72.9 130.3 245.7 404.0 |
| 0.050 18.1 31.3 57. 0.055 28.0 46.0 77. | |
| component (3) (heptane) for eac Henry's constant: H/mmHg = (p | |
| AUXILIARY | INFORMATION |
| METHOD/APPARATUS/PROCEDURE: The same in principle as the high vacuum technique of Brown and Brady (1), except that the temperature was increased and the corresponding pressure of the gas phase measured. | SOURCE AND PURITY OF MATERIALS: (1) Hydrogen chloride. Not specified; but may be taken |

| COMPONENTS: OBLIGNAL HEASUREMENTS: (1) Hydrogen chloride; HC1; (7647-01-0] (2) 1,1'-Oxybisbutane or dibutyl ether; $C_{g}H_{16}0$; (142-96-1] OBLIGNAL HEASUREMENTS: (2) 1,1'-Oxybisbutane or dibutyl ether; $C_{g}H_{16}0$; (142-96-1] DELOMMENT, W.; Echte, A. (3) Heptane; $C_{r}H_{16}$; (142-82-5) PREPARED BY: VARIABLES: $p_{f}/mmlig$: 0.25 - 556.0 PREPARED BY: W. Gerrard T/K 200.8<209.6<220.3 230.8 241.6 258.4 272.9 Noie Fraction $p_{f}/mmlig$ $p_{2.5}$ $p_{1.7}/mmlig$ $p_{2.6}$ $p_{2.7}$ 0.010 0.4 1.0 2.6 5.4 1.7 29.3 58.1 0.010 0.4 1.0 2.6 5.4 1.7 29.3 58.1 0.020 0.9 2.5 6.1 11.5 29.4 69.1 150.7 0.025 1.4 3.7 15.4 21.2 22.2 22.2 23.5 76.6 159.8 23.6 27.6 159.6 23.5 24.5 76.6 159.6 27.6 169.6 236.0 <th></th> <th>25</th> | | 25 |
|--|--|---|
| (2) 1,1'-Oxybisbutane or dibuty1 ether: $C_{gH_{16}0}^{(1)}$ (142-92-5) 2. Elektrochem. <u>1957</u> , 61, 549 - 555. VARIABLES: T/K: 200.8 - 272.9 $p_{j}/mmlig$: 0.25 - 556.0 PREPARED BY: W. Gerrard EXPERIMENTAL VALUES: T/K: 200.8 209.6 220.3 230.8 241.6 256.4 272.9 Wole Fraction $p_{j}/mmlig$ $\frac{z_{j}}{0.005}$ 0.25 0.5 1.2 0.015 0.625 0.5 1.2 2.1 0.020 0.9 2.5 6.1 13.5 29.4 0.030 2.1 5.2 12.5 26.9 56.8 12.9 22.3 0.045 0.5 2.0 38.5 76.6 159.6 36.9 36.9 0.035 1.8.1 31.3 57.3 97.3 164.4 297.0 474.0 0.055 28.0 46.0 77.8 127.5 208.6 349.0 556.0 Henry's constant for $x_{j} + 0$ at 272.9 K was given as 5200 mmlig. The solvent is 0.001 mole of component (2) + 0.020 mole of component (3) (heptane) for each measurement. 10.14 Hydrogen chloride. Not sportade but may be taken as of good quality. as of good quality. 11 Hydrogen chloride. Not sportade but may be taken as of good quality. | (1) Hydrogen chloride; HCl; | Strohmeir, W.; Echte, A. |
| VARIABLES: T/K: 200.8 - 272.9 $p_{j}/mmlig: 0.25 - 556.0$ PREPARED BY: W. Gerrard EXPERIMENTAL VALUES: T/K 200.8 209.6 220.3 230.8 241.6 258.4 272.9 Mole $p_{j}/mmlig$ Fraction $p_{j}/mmlig$ $\frac{x_{j}}{0.005}$ 0.25 0.5 1.2 2.1 5.3 15.8 27.0 0.005 0.25 0.5 1.2 2.1 5.3 15.8 27.0 0.005 0.25 0.5 1.2 2.1 5.3 15.8 27.0 0.010 0.4 1.0 2.6 5.4 11.7 29.3 58.1 0.025 0.5 1.2 2.1 5.3 12.7 9.3 47.9 92.1 0.025 0.6 1.7 8.7 19.1 41.2 93.7 174.2 $6.633.7$ 72.9 10.3 245.7 464.0 $66.139.7$ 72.9 10.3 245.7 404.0 0.655 28.0 46.0 77.8 127.5 208.6 349.0 556.0 Henry's constant for $x_{1} + 0$ at 272.9 K | (2) 1,1'-Oxybisbutane or dibutyl | 2. Elektrochem. <u>1957</u> , 61, 549 - 555 . |
| T/K: 200.8 - 272.9 W. Gerrard EXPERIMENTAL VALUES: T/K 200.8 209.6 220.3 230.8 241.6 258.4 272.9 Mole T/K 200.8 209.6 220.3 230.8 241.6 258.4 272.9 Mole T/K 200.8 209.6 220.3 230.8 241.6 258.4 272.9 Mole T_1 T/K 200.8 209.6 220.3 230.8 241.6 258.4 272.9 Mole T_1 T/K 200.8 209.6 220.3 230.8 241.6 258.4 272.9 Mole T/K 200.8 209.6 220.3 230.8 241.6 258.4 272.9 38.1 30.7 39.1 30.1 30.7 30.2 30.2 1.1 7.7 12.5 26.9 56.8 123.9 222.3 30.03 24.1 59.8 276.8 30.6.9 30.6.9 30.6.9 30.6.9 30.6.9 30.6.9 30.6.9 30.6.9 30.6.9 30.6.9 30.6.9 30.5.0 56.0 | (3) Heptane; C ₇ H ₁₆ ; [142-82-5] | |
| $\begin{array}{c c c c c c c c c c c c c c c c c c c $ | T/K: 200.8 - 272.9 | |
| $\begin{array}{c c c c c c c c c c c c c c c c c c c $ | EXPERIMENTAL VALUES: | |
| Fraction $\frac{x_1}{0.005}$ 0.010 0.4 1.0 2.6 5.4 11.7 29.3 58.1 0.010 0.4 1.0 2.6 5.4 11.7 29.3 58.1 0.010 0.4 1.0 2.6 5.4 11.7 29.3 58.1 0.010 0.4 3.7 8.7 19.1 41.2 93.7 174.2 0.025 1.4 3.7 8.7 19.1 41.2 93.7 174.2 0.035 3.4 7.8 18.2 38.5 76.6 159.6 276.8 0.045 10.5 20.6 39.7 72.9 130.3 245.7 404.0 0.055 28.0 46.0 77.8 127.5 208.6 349.0 556.0 Henry's constant for $x_1 + 0$ at 272.9 K was given as 5200 mmHg. The solvent is 0.001 mole of component (2) + 0.020 mole of component (3) (heptane) for each measurement. Henry's constant: H/mmHg = ($p_1/mmHg)/x_1$ MUNILIARY INFORMATION MUNILIARY INFORMATION </td <td></td> <td>230.8 241.6 258.4 272.9</td> | | 230.8 241.6 258.4 272.9 |
| $0.005 \ 0.25 \ 0.5 \ 1.2 \ 2.1 \ 5.3 \ 15.8 \ 27.0 \ 0.010 \ 0.4 \ 1.0 \ 2.6 \ 5.4 \ 11.7 \ 29.3 \ 58.1 \ 0.010 \ 0.4 \ 1.0 \ 2.6 \ 5.4 \ 11.7 \ 29.3 \ 58.1 \ 0.010 \ 0.4 \ 1.0 \ 2.6 \ 5.4 \ 11.7 \ 29.3 \ 58.1 \ 0.020 \ 0.9 \ 2.5 \ 6.1 \ 13.5 \ 29.4 \ 69.1 \ 130.7 \ 0.025 \ 1.4 \ 3.7 \ 8.7 \ 19.1 \ 41.2 \ 93.7 \ 174.2 \ 0.307 \ 2.5 \ 20.5 \ 26.9 \ 56.8 \ 123.9 \ 92.1 \ 30.7 \ 174.2 \ 0.330 \ 2.1 \ 5.2 \ 12.5 \ 26.9 \ 56.8 \ 123.9 \ 222.3 \ 0.035 \ 3.4 \ 7.8 \ 16.2 \ 38.5 \ 76.6 \ 159.8 \ 276.8 \ 0.0400 \ 5.7 \ 12.5 \ 27.0 \ 54.0 \ 101.6 \ 198.0 \ 336.9 \ 0.045 \ 10.5 \ 20.6 \ 39.7 \ 72.9 \ 130.3 \ 245.7 \ 404.0 \ 0.055 \ 18.1 \ 31.3 \ 57.3 \ 97.3 \ 164.4 \ 297.0 \ 474.0 \ 0.055 \ 28.0 \ 46.0 \ 77.8 \ 127.5 \ 208.6 \ 349.0 \ 556.0 \ 0.055 \ 28.0 \ 46.0 \ 77.8 \ 127.5 \ 208.6 \ 349.0 \ 556.0 \ 0.055 \ 28.0 \ 46.0 \ 77.8 \ 127.5 \ 208.6 \ 349.0 \ 556.0 \ 0.055 \ 28.0 \ 46.0 \ 77.8 \ 127.5 \ 208.6 \ 349.0 \ 556.0 \ 0.055 \ 28.0 \ 46.0 \ 77.8 \ 127.5 \ 208.6 \ 349.0 \ 556.0 \ 0.055 \ 28.0 \ 46.0 \ 77.8 \ 127.5 \ 208.6 \ 349.0 \ 556.0 \ 0.055 \ 28.0 \ 46.0 \ 77.8 \ 127.5 \ 208.6 \ 349.0 \ 556.0 \ 0.056 $ | Fraction | p ₁ /mmHg |
| METHOD/APPARATUS/PROCEDURE: SOURCE AND PURITY OF MATERIALS: The same in principle as the high vacuum technique of Brown and Brady (1), except that the temperature was increased and the corresponding pressure of the gas phase measured. (1) Hydrogen chloride. Not specified; but may be taken as of good quality. (2) Dibutyl ether. Treated with KOH, distilled, and treated with Na-K alloy. (3) Heptane. Purified as for optical measurements. Dried over sodium-potassium alloy. ESTIMATED ERROR: REFERENCES: | $\begin{array}{c ccccccccccccccccccccccccccccccccccc$ | 5.4 11.7 29.3 58.1 8.9 19.3 47.9 92.1 13.5 29.4 69.1 130.7 19.1 41.2 93.7 174.2 26.9 56.8 123.9 222.3 38.5 76.6 159.8 276.8 54.0 101.6 198.0 336.9 72.9 130.3 245.7 404.0 97.3 164.4 297.0 474.0 127.5 208.6 349.0 556.0 272.9 K was given as 5200 mmHg. mponent (2) + 0.020 mole of th measurement. |
| METHOD/APPARATUS/PROCEDURE: SOURCE AND PURITY OF MATERIALS: The same in principle as the high vacuum technique of Brown and Brady (1), except that the temperature was increased and the corresponding pressure of the gas phase measured. (1) Hydrogen chloride. Not specified; but may be taken as of good quality. (2) Dibutyl ether. Treated with KOH, distilled, and treated with Na-K alloy. (3) Heptane. Purified as for optical measurements. Dried over sodium-potassium alloy. ESTIMATED ERROR: REFERENCES: | AUXILIARY | INFORMATION |
| J. Am. Chem. Soc. <u>1952</u> , 74, 3570. | METHOD/APPARATUS/PROCEDURE: The same in principle as the high vacuum technique of Brown and Brady (1), except that the temperature was increased and the corresponding | <pre>SOURCE AND PURITY OF MATERIALS: (1) Hydrogen chloride. Not specified; but may be taken as of good quality. (2) Dibutyl ether. Treated with KOH, distilled, and treated with Na-K alloy. (3) Heptane. Purified as for optical measurements. Dried over sodium-potassium alloy. ESTIMATED ERROR: REFERENCES: 1. Brown, H. C.; Brady, J. C.</pre> |

| | • |
|---|---|
| COMPONENTS : | ORIGINAL MEASUREMENTS: |
| <pre>(1) Hydrogen chloride; HCl; [7647-01-0]</pre> | Strohmeir, W.; Echte, A. |
| <pre>(2) 1,1'-Oxybis[2-chloroethane] or 2,2'-dichloroethyl ether; C₄H₈Cl₂O; [111-44-4]</pre> | 2. Elektrochem. <u>1957</u> , 61, 549 - 555. |
| (3) Heptane; C ₇ H ₁₆ ; [142-82-5] | |
| VARIABLES: | PREPARED BY: |
| T/K: 258.4, 272.9 P_{j} /mmHg: 16.2 - 562.0 | W. Gerrard |
| EXPERIMENTAL VALUES: | |
| T/K Pressur | e Mol |
| p ₁ /mmHc | Fraction x_1 |
| 258.4 76.2 | |
| 139.4 | |
| 198.2 256.5 | |
| 319.1 | 0.02766 |
| 387.4 | 0.03234 |
| 272.9 109.6 | 0 00613 |
| 272.9 109.6 | |
| 290.7 | 0.01689 |
| 373.1 | |
| 480.0 | |
| · <u>····································</u> | |
| Henry's constant for $x_1 \rightarrow 0$ at 272.9 | K was given as 17,300 mmHg. |
| 1 | |
| The solvent is 0.001 mole of componen (3) (heptane) for each measurement. | $c(2) \neq 0.020$ more of component |
| | |
| Henry's constant: $H/mmHg = (p_1/mmHg)$ | |
| | |
| | |
| | |
| AUXILIARY | INFORMATION |
| METHOD/APPARATUS/PROCEDURE: | SOURCE AND PURITY OF MATERIALS; |
| The same in principle as the high | (1) Hydrogen chloride. Not |
| vacuum technique of Brown and Brady (1), except that the temperature was increased and the corresponding | specified; but may be taken as of good quality. |
| pressure of the gas phase measured. | <pre>(2) 1,1'-Oxybis[2-chloroethane]. Distilled in a vacuum.</pre> |
| | (3) Heptane. Purified as for optical measurements. Dried over sodium-potassium alloy. |
| | |
| | ESTIMATED ERROR: |
| | |
| | |
| | REFERENCES ; |
| | 1. Brown, H. C.; Brady, J. C. J. Am. Chem. Soc. <u>1952</u> , 74, 3570. |
| | |
| | |
| 1 | 1 |
| | |

| COMPONENTS:(1) Hydrogen chloride; HCl; $[7647-01-0]$ ORIGINAL MEASUREMENTS:(2) Methoxybenzene or methyl phenyl ether or anisole; C_7H_8O ; $[100-66-3]$ Strohmeir, W.; Echte, A.(3) Heptane; C_7H_{16} ; $[142-82-5]$ Z. Elektrochem. 1957, 61, 549-5VARIABLES: T/K: 209.6 - 272.9PREPARED BY: | 55. |
|--|-------|
| (2) Methoxybenzene or methyl phenyl ether or anisole; C_7H_8O ; [100-66-3] (3) Heptane; C_7H_{16} ; [142-82-5] VARIABLES: T/Y: 209.6 - 272.9 | 55. |
| (3) Heptane; C_7H_{16} ; [142-82-5] VARIABLES: T/K: 209.6 - 272.9 | |
| π/r , 209 6 - 272 9 | |
| т/к: 209.6 - 272.9 | |
| $p_1/mmHg: 12.8 - 635.0$ W. Gerrard | |
| EXPERIMENTAL VALUES: | |
| T/K 209.6 220.3 230.8 241.6 258.4 272.9 | |
| Mole $p_1/mmHg$ Fraction x_1 | |
| $ \begin{array}{c ccccccccccccccccccccccccccccccccccc$ | |
| The solvent is 0.001 mole of component (2) + 0.020 mole of component (3) (heptane) for each measurement. Henry's constant: $H/mmHg = (p_1/mmHg)/x_1$ | |
| AUXILIARY INFORMATION | |
| METHOD/APPARATUS/PROCEDURE: SOURCE AND PURITY OF MATERIALS: | |
| The same in principle as the high vacuum technique of Brown and Brady (1), except that the temperature was increased and the corresponding pressure of the gas phase measured. (1) Hydrogen chloride. Not specified; but may be taken as of good quality. (2) Methoxybenzene. Dried with CaCl ₂ , distilled, and treat | 1 |
| with Na-K alloy. | |
| (3) Heptane. Purified as for optical measurements. Drie over sodium-potassium alloy | |
| ESTIMATED ERROR: | |
| REFERENCES : | |
| 1. Brown, H. C.; Brady, J. C. J. Am. Chem. Soc. <u>1952</u> , 74, | 3570. |
| | |

| ORIGINAL MEASUREMENTS: Strohmeir, W.; Echte, A. |
|---|
| 2. Elektrochem. <u>1957</u> , 61, 549 - 555. |
| |
| PREPARED BY: W. Gerrard |
| |
| are Mol |
| $\frac{\text{Fraction}}{\frac{x_1}{2}}$ |
| 5 0.00454 3 0.01120 8 0.01727 6 0.02348 |
| 0 0.00454 7 0.01120 4 0.01727 7 0.02348 |
| K was given as 21,100 mmHg. |
| |
| nt (2) + 0.020 mole of component |
| |
| |
| INFORMATION |
| SOURCE AND PURITY OF MATERIALS: (1) Hydrogen chloride. Not specified; but may be taken as of good quality. |
| (2) Diphenyl ether. Distilled in a vacuum. |
| (3) Heptane. Purified as for optical measurements. Dried over sodium-potassium alloy. |
| ESTIMATED ERROR: |
| |
| REFERENCES : |
| <pre>1. Brown, H. C.; Brady, J. C. J. Am. Chem. Soc. 1952, 74, 3570.</pre> |
| |
| |

| COMPONENTS: (1) Hydrogen chloride; HCl; [7647-01-0] | ORIGINAL MEASUREMENTS: Strohmeir, W.; Echte, A. |
|---|---|
| <pre>(2) 1,1'-[Oxybis(methylene)] bisbenzene or dibenzyl ether; C₁₄H₁₄O; [103-50-4]</pre> | 2. Elektrochem. <u>1957</u> , 61, 549 - 555. |
| (3) Heptane; C ₇ H ₁₆ ; [142-82-5] | |
| VARIABLES: | PREPARED BY: |
| T/K: 258.4, 272.9 p ₁ /mmHg: 36.9 - 534.5 | W. Gerrard |
| EXPERIMENTAL VALUES: | *************************************** |
| T/I: Pres | sure Mol |
| <u> </u> | $\frac{1}{2}$ |
| | 6.9 0.00610 |
| | 5.2 0.01243 5.7 0.01813 |
| | 2.6 0.02491 |
| | 1.4 0.03102 |
| - | 1.1 0.03783 1.5 0.04335 |
| 272.9 6 | 3.3 0.00610 |
| | 1.9 0.01243 |
| | 7.3 0.01813 8.8 0.02491 |
| | 1.8 0.03102 |
| | 4.9 0.03783 |
| 53 | 4.5 0.04335 |
| Henry's constant: $H/mmHg = (p_1/mmHg)$ | / x ₁ |
| AUXILIARY | INFORMATION |
| METHOD/APPARATUS/PROCEDURE: | COUNCE AND DUDITY OF MATERIALC. |
| The same in principle as the high vacuum technique of Brown and Brady | SOURCE AND PURITY OF MATERIALS: (1) Hydrogen chloride. Not specified; but may be taken as of good quality. |
| (1), except that the temperature was increased and the corresponding pressure of the gas phase measured. | (2) Dibenzyl ether. Dried with CaCl₂, distilled, treated with |
| | Na-K alloy. |
| | (3) Heptane. Purified as for optical measurements. Dried over sodium-potassium alloy. |
| | ESTIMATED ERROR: |
| | |
| | REFERENCES : |
| | <pre>1. Brown, H. C.; Brady, J. C. J. Am. Chem. Soc. <u>1952</u>, 74, 3570.</pre> |
| 1 | |

| COMPONENTS: (1) Hydrogen chloride; HCl; [7647-01-0] | ORIGINAL MEASUREMENTS: Strohmeir, W.; Echte, A. |
|---|---|
| (2) Tetrahydrofuran; $C_4 H_8 O;$ (109-99-9] | 2. Elektrochem. 1957, 61, 549-555. |
| (3) Heptane; C ₇ H ₁₆ ; [142-82-5] | |
| | |
| VARIABLES: | PREPARED BY: |
| T/K: 200.8 - 272.9 P_1 /mmHg: 0.0 - 371.8 | W. Gerrard |
| EXPERIMENTAL VALUES: | |
| T/K 200.8 209.6 220.3 | 230.8 241.6 258.4 272.9 |
| | |
| Mole | p,/mmHg |
| Fraction | - <u>1</u> , J |
| <u> </u> | |
| 0.005 0.0 0.1 0.1 | 0.8 1.9 5.1 11.7 |
| 0.010 0.0 0.3 0.3 0.015 0.1 0.5 0.7 | $\begin{array}{cccccccccccccccccccccccccccccccccccc$ |
| $\begin{array}{cccccccccccccccccccccccccccccccccccc$ | 3.6 9.0 24.4 57.9 |
| | |
| 0.030 0.4 1.3 3.3 | 8.2 20.3 52.3 108.1 12.1 29.1 72.1 144.6 |
| 0.035 0.5 1.8 4.9 0.040 0.7 2.7 7.3 | 12.1 29.1 72.1 144.6 18.4 43.0 99.3 188.2 |
| 0.045 2.0 4.4 12.0 | 28.0 62.0 133.6 239.3 44.4 88.3 176.3 297.3 |
| 0.050 5.1 7.9 19.4 | 44.4 88.3 176.3 297.3 |
| 0.055 10.7 17.2 28.9 | 66.2 127.8 228.1 371.8 |
| Henry's constant for $x_1 + 0$ a The solvent is 0.001 mole of component (3) (Heptane) for e Henry's constant: H/mmHg = (| ach measurement. |
| AUXILIARY | INFORMATION |
| | |
| METHOD/APPARATUS/PROCEDURE: The same in principle as the high vacuum technique of Brown and Brady | SOURCE AND PURITY OF MATERIALS: (1) Hydrogen chloride. Not specified; but may be taken as of good quality. |
| (1), except that the temperature was increased and the corresponding | (2) Tetrahydrofuran. Treated with |
| pressure of the gas phase measured. | KOH, distilled, and treated with Na-K alloy. |
| | (3) Heptane. Purified as for optical measurements. Dried over sodium-potassium alloy. |
| | ESTIMATED ERROR: |
| | |
| | |
| | REFERENCES : |
| | 1. Brown, H. C.; Brady, J. C. J. Am. Chem. Soc. <u>1952</u> , 74, 3570. |
| | |
| | |

| COMPONENTS: | ORIGINAL MEASUREMENTS: |
|--|---|
| <pre>(1) Hydrogen chloride; HCl; [7647-01-0]</pre> | Strohmeir, W.; Echte, A. |
| (2) Dioxane; C ₄ H ₈ O ₂ ; [123-91-1] | 2. Elektrochem. <u>1957</u> , 61, 549 - 555. |
| (3) Heptane; C ₇ H ₁₆ ; [142-82-5] | |
| | |
| VARIABLES : | PREPARED BY: |
| T/K: 230.8 - 272.9 p_1 /mmHg: 5.0 - 716.0 | W. Gerrard |
| EXPERIMENTAL VALUES: | |
| т/к 230.8 | 241.6 258.4 272.9 |
| | |
| Mole p ₁ /mmHg | |
| Fraction | |
| <u> </u> | |
| 0.005 5.0 0.010 10.6 | 9.6 21.3 39.0 20.7 45.5 85.0 |
| 0.015 17.7 | 35.9 76.7 136.0 |
| 0.020 28.1 | 54.0 112.0 189.5 |
| 0.025 41.7 | 78.6 152.6 252.5 |
| 0.030 | 110.0 202.5 320.5 |
| 0.035 0.040 | 141.8 257.3 400.0 177.9 315.4 488.5 |
| 0.045 | 222.4 377.5 558.5 |
| 0.050 | 270.8 441.5 637.0 |
| 0.055 | 320.0 506.0 716.0 |
| The solvent is 0.001 m mole of component (3) Henry's constant: H/m | whole of component (2) + 0.040 (heptane) for each measurement. $mHg = (p_1/mmHg)/x_1$ |
| AUXILIARY | INFORMATION |
| | |
| METHOD/APPARATUS/PROCEDURE: | SOURCE AND PURITY OF MATERIALS: |
| The same in principle as the high vacuum technique of Brown and Brady (1), except that the temperature was | (1) Hydrogen chloride. Not specified; but may be taken as of good quality. |
| increased and the corresponding | (2) Dioxane. Treated with KOH, |
| pressure of the gas phase measured. | distilled, and treated with Na-K alloy. |
| | (3) Heptane. Purified as for optical measurements. Dried over sodium-potassium alloy. |
| | ESTIMATED ERROR: |
| | |
| | |
| | REFERENCES : |
| | 1. Brown, H. C.; Brady, J. C. J. Am. Chem. Soc. <u>1952</u> , 74, 3570. |
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|--------------------------|------------------------|-----------------------|--|----------------------|----------------------------------|------------------------|-----------------------------|
| COMPONENTS : | | | | ORIGINAL | MEASUREMENT | S: | |
| (1) Hydrod [7647- | | ide; HCl; | | | eir, W.; | | 540 555 |
| (2) Tetrah [142-6 | nydro-2#-1 68-7] | pyran; C ₅ | H ₁₀ 0; | 2. Ele | ktrocnem. | <u>1957</u> ,67, | 549 - 555. |
| (3) Heptar | ne, C7 ^H 16 | : [142-82 | -5] | | | | |
| VARIABLES: | | | | PREPARED | BY: | | |
| | r/K: 200.8 nHg: 0.0 | | | | W. Ge | rrard | |
| EXPERIMENTAL | VALUES: | | | | | | |
| Т/К | 200.8 | 209.6 | 220.3 | 230.8 | 241.6 | 258.4 | 272.9 |
| Mole Fraction | | | | r ₁ /mmHg | | | |
| x 1 | | | | | | | |
| 0.005 | 0.0 | 0.3 | 0.7 1.2 | 1.3 | | 6.7 14.1 | 13.3 29.9 |
| 0.010 0.015 | 0.1 | 0.0 | 1.2 | 4.1 | 8.7 | 22.6 | 48.9 |
| 0.020 | 0.3 | 0.9 1.2 | 2.8 | 5.8 | 13.1 | 34.8 | 73.0 |
| 0.025 | 0.4 | | 3.8 | 8.4 | 18.6 | 48.8 | |
| 0.030 | 0.5 | 1.5 | 5.3 7.9 | 12.0 17.8 | 26.9 39.1 | 66.6 90.5 | 134.6 171.6 |
| 0.035 0.040 | 0.8 1.7 | | 12.4 | 27.5 | 57.3 | 122.9 | |
| 0.045 | ~ • | 8.5 - | 20.1 | 46.1 | 80.0 | 161.3 | 277.8 |
| 0.050 | 3.4 8.0 | 16.2 | | 64.3 | | 209.6 270.2 | 343.3 403.8 |
| 0.055 | 16.7 | 27.4 | 48.6 | 92.1 | 138.5 | 270.2 | 403.8 |
| The solve (3) (hept | ent 1s 0. tane) for | 001 mole each mea | 0 at 272.9 of compone surement. = (p ₁ /mmHc | ent (2) | + 0.020 | mole of c | component |
| | | | AUXILIARY | INFORMATIO | ол С | | |
| METHOD/APPAR | ATUS/PROCED | URE: | | SOURCE AN | D PURITY OF | MATERIALS | |
| The same : vacuum teo | chnique o | f Brown a | e high nd Brady ature was | but | lrogen chl may be t llity. | oride. No aken as c | ot specified; of good |
| increased pressure | and the | correspon | ding | (2) Tet KOH | rahydro-2 | H-pyran. .ed, treat | Treated with ed with Na- |
| | | | | (3) Her mea | otane. Pur | . Dried d | for optical over sodium- |
| | | | | ESTIMATEI | ERROR: | | |
| | | | | | | | |
| | | | | REFERENCE | ES : | | |
| | | | | | vn, H. C.; Am. Chem. | | J. C. 2, 74, 3570. |
| | | | | | | | |

| COMPORENTS: (1) Hydrogen chloride; HCl; (1) Hydrogen chloride; HCl; (2) $1, 1'-Fhiobisethane or diethyl sulfide; C_4H_10^5; (352-93-2) (3) Heptane; C_7H_{6}; (142-82-5) VARIARESS: T/K: 200.8 - 272.9 p_j/mmHg: 1.4 - 544.4EXPERIMENTAL VALUES:T/K 200.8 209.6 220.3 230.8 241.6 258.4 272.9MoleFraction\frac{z_j}{0.00555} 1.4 3.0 6.3 12.0 22.4 44.9 74.70.010654 2.6 5.4 11.0 21.1 39.3 70.0 126.70.02655 1.4 3.0 6.3 12.0 22.4 44.9 74.70.01055 2.6 5.4 11.0 21.1 39.3 70.0 126.70.02659 3.5 16.7 35.7 64.5 111.1 207.7 324.60.03399 11.7 22.9 44.3 79.9 137.3 250.3 389.10.04131 21.6 39.1 74.2 129.9 210.9 365.8 544.4Henry's constant for x_j + 0 at 272.9 K was given as 11,400 mmHg.The solvent is 0.001 mole of component (2) + 0.020 mole ofcomponent (3) (heptane) for each measurement.Henry's constant: H/mmHg = (p_j/mmHg)/x_j(1) Mydrogen chloride. Notspecified; but may be takenincreased and the correspondingpressure of the gas phase measure.HETHENCES:1. Brown, H. C.; Brady, J. C.J. Am. Chem. Soc. 1952, 74, 3570.$ | | |
|---|--|---|
| $\frac{1}{5647-01-01}$ (2) 1,1'-Thiobisethane or disthyl sulfide; C ₄ H ₁₀ S; (352-93-2) (3) Hoptane; C ₇ H ₁₆ ; (142-82-5) VARIABLES: T/K: 200.8 - 272.9 p ₁ /mmlig: 1.4 - 544.4 EXPERIMENTAL VALUES: T/K 200.8 209.6 220.3 230.8 241.6 258.4 272.9 Mole Fraction T/K 200.8 209.6 220.3 230.8 241.6 258.4 272.9 Mole Fraction Mole Fraction Mole Fraction Mole Fraction Mole Fraction Mole Fraction Mole Fraction Mole Mole Fraction Mole Mole Fraction Mole Mole Mole Fraction Mole Mole Fraction Mole M | COMPONENTS : | ORIGINAL MEASUREMENTS: |
| (2) 1.1 - THIODISECTATE OF LIGENCY 1 sulfise: $C_{1}^{H}(_{16}; (142-82-5)]$ (3) Heptane: $C_{7}H_{16}; (142-82-5)$ VARIABLES: T/K: 200.8 - 272.9 p_{1} /mmHg: 1.4 - 544.4 EXPERIMENTAL VALUES: T/K: 200.8 209.6 220.3 230.8 241.6 258.4 272.9 Noie p_{2} /mmHg: 1.4 - 544.4 Praction $\frac{\pi_{1}}{0.00655}$ 0.00655 1.4 0.01085 2.6 0.01085 2.6 0.01085 2.6 0.01085 2.6 0.02075 6.0 0.02075 6.0 0.0339 11.7 0.0339 11.7 0.0311 21.6 0.0311 21.6 0.04131 21.6 0.04131 21.6 0.04131 21.6 0.04131 21.6 1.7 7.4 Merny's constant for $x_1 + 0$ at 272.9 K was given as 11,400 mmHg. The solvent is 0.001 mole of component (2) + 0.020 mole of component (2) (1) Hydrocin chi citals. Not specified childs. Not specified childs | | |
| VARIABLES: T/K: 200.8 - 272.9 $p_1/mmHg$: 1.4 - 544.4 PREPARED BY: W. Gerrard EXPERIMENTAL VALUES: T/K 200.8 209.6 220.3 230.8 241.6 258.4 272.9 Mole T/K 200.8 209.6 220.3 230.8 241.6 258.4 272.9 Mole T/K 200.8 209.6 220.3 230.8 241.6 258.4 272.9 0.01085 2.6 5.4 11.0 0.02075 6.0 12.5 24.7 47.2 0.03399 11.7 21.9 44.3 79.9 137.3 250.3 389.1 0.03396 15.9 30.0 58.6 102.1 175.6 309.7 470.3 0.04131 21.6 39.1 74.2 129.9 210.9 365.8 544.4 Henry's constant for $x_1 \div 0$ at 272.9 K was given as 11,400 mmHg. The solvent is 0.001 mole of component (2) + 0.020 mole of component (3) (heptane) for each measurement. Henry's constant: H/mmHg = ($p_1/mmHg$)/ x_1 AUXILLARY INFORMATION METHOD/APPARATUS/PROCEDURE: The same in principle as the high (1) Hydrogen chlori | <pre>(2) 1,1'-Thiobisethane or diethyl sulfide; C4H10S; [352-93-2]</pre> | 2. Elektrochem. <u>1957</u> , 61, 549-555. |
| T/K: 200.8 - 272.9 $p_{1}/mmHg$: 1.4 - 544.4 EXPERIMENTAL VALUES: T/K 200.8 209.6 220.3 230.8 241.6 258.4 272.9 Nole Fraction $\frac{x_{1}}{0.00655 \ 1.4 \ 3.0 \ 6.3 \ 12.0 \ 22.4 \ 44.9 \ 74.7 \ 0.01085 \ 2.6 \ 5.4 \ 11.0 \ 21.1 \ 39.3 \ 70.0 \ 126.7 \ 0.01054 \ 4.3 \ 8.5 \ 18.2 \ 35.8 \ 64.5 \ 123.2 \ 200.8 \ 0.02075 \ 6.0 \ 12.5 \ 24.7 \ 47.2 \ 85.1 \ 159.1 \ 252.2 \ 0.02593 \ 8.5 \ 16.7 \ 35.7 \ 64.5 \ 111.1 \ 207.7 \ 324.6 \ 0.03039 \ 11.7 \ 21.9 \ 44.3 \ 79.9 \ 137.3 \ 250.3 \ 389.1 \ 0.03596 \ 15.9 \ 30.0 \ 58.6 \ 102.1 \ 175.6 \ 309.7 \ 470.3 \ 0.04131 \ 21.6 \ 35.1 \ 74.2 \ 129.9 \ 210.9 \ 35.8 \ 54.4 \ 44.4 \ 44.4 \ 472.9 \ 470.3 \ 0.04131 \ 21.6 \ 33.1 \ 74.2 \ 129.9 \ 210.9 \ 35.8 \ 54.4 \ 44$ | (3) Heptane; C ₇ H ₁₆ ; [142-82-5] | |
| p_{1} /mmilg: 1.4 - 544.4 W. Gerfald EXPERIMENTAL VALUES: T/K 200.8 209.6 220.3 230.8 241.6 258.4 272.9 Nole p_{1} /mmHg Praction p_{1} /mmHg $\frac{x_{1}}{0.00655 1.4 3.0 6.3}$ 12.0 22.4 44.9 74.7 0.01654 4.3 8.5 18.2 35.8 64.5 123.2 200.8 0.02075 6.0 12.5 24.7 47.2 85.1 159.1 252.2 0.8 0.03596 15.9 30.0 58.6 102.1 175.6 309.7 470.3 0.03596 15.9 30.0 58.6 102.1 175.6 309.7 470.3 0.04131 21.6 39.1 74.2 129.9 210.9 365.8 544.4 Henry's constant for $x_{1} + 0$ at 272.9 K was given as 11,400 mmHg. The solvent is 0.001 mole of component (2) + 0.020 mole of component (3) (heptane) for each measurement. Henry's constant: H/mmHg = (p_{1} /mmHg)/ x_{1} Source AND PURITY OF MATERIALS: (1), except that the temperature was increased and the corresponding pressure of the gas phase measured. (2) Diethyl sulfide. Treated with H90, P205, and distilled. (3) Heptane. Purified as for optical measurements. Dried over sodium-potassium alloy. ESTIMATED ERKOR: EETERENCES: 1. Brown, H. C.; Brady, J. C. | VARIABLES: | PREPARED BY: |
| T/K 200.8 209.6 220.3 230.8 241.6 258.4 272.9 Mole Fraction x_1 $p_1/mmHg$ $p_1/mmHg$ $p_1/mmHg$ $p_2/mmHg$ 0.00655 1.4 3.0 6.3 12.0 22.4 44.9 74.7 0.01085 2.6 5.4 11.0 21.1 39.3 70.0 126.7 0.02075 6.0 1.25 24.7 47.2 85.1 159.1 22.22 0.02075 6.0 1.25 24.7 47.2 85.1 159.1 252.2 0.03039 11.7 21.9 44.3 79.9 137.3 250.3 389.1 0.04131 21.6 39.1 74.2 129.9 210.9 365.8 544.4 Henry's constant for $x_1 \rightarrow 0$ at 272.9 K was given as 11,400 mmHg. The same in principle as the high vacuum technique of Brown and Brady (1) Hydrogen chloride. Not specified; but may be taken as of good quality. (1) Hydrogen chloride. Treated | | W. Gerrard |
| Mole Fraction $p_1/mmHg$ $\frac{x_1}{0.00655}$ $\frac{1.4}{3.0}$ $\frac{6.3}{6.3}$ $\frac{12.0}{22.4}$ $\frac{21.4}{44.9}$ $\frac{74.7}{74.7}$ 0.01085 2.6 5.4 11.0 21.1 39.3 70.0 126.7 0.01085 2.6 5.4 11.0 21.1 39.3 70.0 126.7 0.02075 6.0 12.5 24.7 47.2 85.1 159.1 $22.22.2$ 0.02075 6.0 12.5 24.7 47.2 85.1 159.1 $22.22.2$ 0.02075 6.0 12.5 24.7 47.2 85.1 159.1 $22.22.2$ 0.03391 11.7 21.9 85.6 102.1 175.6 309.7 470.3 0.04131 21.6 39.1 74.2 129.9 210.9 365.8 544.4 Henry's constant for $x_1 + 0$ at 272.9 K was given as 11.400 mmHg. The solvent is 0.001 mole of component $(2) + 0.020$ mole of MULLIARY INFORMATION METHOD/APPARATUS/PROCEDURE: <td>EXPERIMENTAL VALUES:</td> <td></td> | EXPERIMENTAL VALUES: | |
| Auxiliary Source And Pressure of the gas phase measured. x_1 x_1 0.00655 1.4 3.0 6.3 12.0 22.4 44.9 74.7 0.01654 4.3 8.5 18.2 35.8 64.5 123.2 200.8 0.02075 6.0 12.5 24.7 47.2 85.1 159.1 252.2 0.02593 8.5 16.7 35.7 64.5 111.1 207.7 324.6 0.03399 11.7 21.9 44.3 79.9 137.3 250.3 389.1 0.04131 21.6 39.1 74.2 129.9 210.9 365.8 544.4 Henry's constant for $x_1 + 0$ at 272.9 K was given as 11,400 mmHg. The solvent is 0.001 mole of component (2) + 0.020 mole of component (3) (heptane) for each measurement. Henry's constant: H/mmHg = $(p_1/mmHg)/x_1$ AUXILIARY INFORMATION METHOD/APPARATUS/FROCEDURE: The same in principle as the high vacuum technique of Brown and Brady (1), except that the temperature was increased and the corresponding Source AND PURITY OF MATERIALS: (1) | T/K 200.8 209.6 220.3 | 230.8 241.6 258.4 272.9 |
| $\frac{1}{0.00655 \ 1.4 \ 3.0 \ 6.3 \ 12.0 \ 22.4 \ 44.9 \ 74.7 \ 0.01085 \ 2.6 \ 5.4 \ 11.0 \ 21.1 \ 39.3 \ 70.0 \ 126.7 \ 0.01654 \ 4.3 \ 8.5 \ 18.2 \ 35.8 \ 64.5 \ 123.2 \ 200.8 \ 0.02075 \ 6.0 \ 12.5 \ 24.7 \ 47.2 \ 85.1 \ 159.1 \ 252.2 \ 0.02593 \ 8.5 \ 16.7 \ 35.7 \ 64.5 \ 11.1 \ 207.7 \ 324.6 \ 0.03039 \ 11.7 \ 21.9 \ 44.3 \ 79.9 \ 137.3 \ 250.3 \ 389.1 \ 0.03596 \ 15.9 \ 30.0 \ 56.6 \ 102.1 \ 175.6 \ 309.7 \ 470.3 \ 0.04131 \ 21.6 \ 39.1 \ 74.2 \ 129.9 \ 210.9 \ 365.8 \ 544.4 \ 44.4$ | Fraction | p ₁ /mmHg |
| $\begin{tabular}{ c c c c c c c c c c c c c c c c c c c$ | 0.00655 1.4 3.0 6.3 0.01085 2.6 5.4 11.0 0.01654 4.3 8.5 18.2 | 21.1 39.3 70.0 126.7 35.8 64.5 123.2 200.8 |
| The solvent is 0.001 mole of component (2) + 0.020 mole of component (3) (heptane) for each measurement. Henry's constant: $H/mmHg = (p_1/mmHg)/x_1$ AUXILIARY INFORMATION METHOD/APPARATUS/PROCEDURE: The same in principle as the high vacuum technique of Brown and Brady (1), except that the temperature was increased and the corresponding pressure of the gas phase measured. (2) Diethyl sulfide. Treated with HgO, P_2O_5 , and distilled. (3) Heptane. Purified as for optical measurements. Dried over sodium-potassium alloy. ESTIMATED ERROR: REFERENCES: 1. Brown, H. C.; Brady, J. C. | 0.03039 11.7 21.9 44.3 0.03596 15.9 30.0 58.6 | 79.9 137.3 250.3 389.1 102.1 175.6 309.7 470.3 |
| METHOD/APPARATUS/PROCEDURE: The same in principle as the high vacuum technique of Brown and Brady (1), except that the temperature was increased and the corresponding pressure of the gas phase measured. SOURCE AND PURITY OF MATERIALS: (1) Hydrogen chloride. Not specified; but may be taken as of good quality. (2) Diethyl sulfide. Treated with HgO, P₂O₅, and distilled. (3) Heptane. Purified as for optical measurements. Dried over sodium-potassium alloy. ESTIMATED ERROR: | | |
| The same in principle as the high vacuum technique of Brown and Brady (1), except that the temperature was increased and the corresponding pressure of the gas phase measured. (1) Hydrogen chloride. Not specified; but may be taken as of good quality. (2) Diethyl sulfide. Treated with HgO, P2O5, and distilled. (3) Heptane. Purified as for optical measurements. Dried over sodium-potassium alloy. ESTIMATED ERROR: | AUXILIARY | INFORMATION |
| | METHOD/APPARATUS/PROCEDURE: The same in principle as the high vacuum technique of Brown and Brady (1), except that the temperature was increased and the corresponding | SOURCE AND PURITY OF MATERIALS: Hydrogen chloride. Not specified; but may be taken as of good quality. (2) Diethyl sulfide. Treated with HgO, P2O5, and distilled. (3) Heptane. Purified as for optical measurements. Dried over sodium-potassium alloy. ESTIMATED ERROR: REFERENCES: Brown, H. C.; Brady, J. C. |

| COMPONENTS : | ORIGINAL MEASUREMENTS: |
|---|---|
| (1) Hydrogen chloride; HCl; | Strohmeir, W.; Echte, A. |
| [7647-01-0] (2) Nitrobenzene; C ₆ H ₅ NO ₂ ; [98-95-3] | 2. Elektrochem. <u>1957</u> , 61, 549 - 555. |
| | |
| (3) Heptane; C ₇ H ₁₆ ; [142-82-5] | |
| | |
| VARIABLES: T/K: 272.9 | PREPARED BY: |
| p_1/mmHg : 76.2 - 549.7 | W. Gerrard |
| EXPERIMENTAL VALUES: | |
| T/K Pressur | e Mol |
| P ₁ /mmHe | Fraction |
| ******************************* | |
| 272.9 76.2 | |
| 203.6 | |
| 284.2 | 0.01580 |
| 375.4 | |
| 460.6 549.7 | |
| 549.7 | 0.02955 |
| Henry's constant for $x_1 \neq 0$ at 272.9 | K was given as 18,300 mmHg. |
| The solvent is 0.001 mole of componer (3) (heptane) for each measurement. | |
| | |
| | |
| Henry's constant: $H/mmHg = (p_1/mmHg)$ | /x ₁ |
| Henry's constant: H/mmHg = (p ₁ /mmHg) | /x ₁ |
| Henry's constant: H/mmHg = (p ₁ /mmHg) | /x ₁ |
| Henry's constant: H/mmHg = (p ₁ /mmHg) | /x ₁ |
| Henry's constant: H/mmHg = (p ₁ /mmHg) | /x ₁ |
| Henry's constant: H/mmHg = (p ₁ /mmHg) | /x ₁ |
| Henry's constant: H/mmHg = (p ₁ /mmHg) | /x ₁ |
| Henry's constant: H/mmHg = (p ₁ /mmHg) | /x ₁ |
| Henry's constant: H/mmHg = (p ₁ /mmHg) | /x ₁ |
| | |
| AUXILIARY | INFORMATION |
| AUXILIARY METHOD/APPARATUS/PROCEDURE: | INFORMATION SOURCE AND PURITY OF MATERIALS: |
| AUXILIARY METHOD/APPARATUS/PROCEDURE: The same in principle as the high | INFORMATION SOURCE AND PURITY OF MATERIALS: (1) Hydrogen chloride. Not |
| AUXILIARY METHOD/APPARATUS/PROCEDURE: The same in principle as the high vacuum technique of Brown and Brady (1), except that the temperature was | INFORMATION SOURCE AND PURITY OF MATERIALS: |
| AUXILIARY METHOD/APPARATUS/PROCEDURE: The same in principle as the high vacuum technique of Brown and Brady (1), except that the temperature was increased and the corresponding | INFORMATION SOURCE AND PURITY OF MATERIALS: (1) Hydrogen chloride. Not specified; but may be taken as of good quality. |
| AUXILIARY METHOD/APPARATUS/PROCEDURE: The same in principle as the high vacuum technique of Brown and Brady (1), except that the temperature was | INFORMATION SOURCE AND PURITY OF MATERIALS: (1) Hydrogen chloride. Not specified; but may be taken as of good quality. (2) Nitrobenzene. Dried with |
| AUXILIARY METHOD/APPARATUS/PROCEDURE: The same in principle as the high vacuum technique of Brown and Brady (1), except that the temperature was increased and the corresponding | <pre>INFORMATION SOURCE AND PURITY OF MATERIALS: (1) Hydrogen chloride. Not specified; but may be taken as of good quality. (2) Nitrobenzene. Dried with CaCl₂, and distilled, in a</pre> |
| AUXILIARY METHOD/APPARATUS/PROCEDURE: The same in principle as the high vacuum technique of Brown and Brady (1), except that the temperature was increased and the corresponding | <pre>INFORMATION SOURCE AND PURITY OF MATERIALS: (1) Hydrogen chloride. Not specified; but may be taken as of good quality. (2) Nitrobenzene. Dried with CaCl₂, and distilled, in a vacuum.</pre> |
| AUXILIARY METHOD/APPARATUS/PROCEDURE: The same in principle as the high vacuum technique of Brown and Brady (1), except that the temperature was increased and the corresponding | <pre>INFORMATION SOURCE AND PURITY OF MATERIALS: (1) Hydrogen chloride. Not specified; but may be taken as of good quality. (2) Nitrobenzene. Dried with CaCl₂, and distilled, in a vacuum. (3) Heptane. Purified as for</pre> |
| AUXILIARY METHOD/APPARATUS/PROCEDURE: The same in principle as the high vacuum technique of Brown and Brady (1), except that the temperature was increased and the corresponding | <pre>INFORMATION SOURCE AND PURITY OF MATERIALS: (1) Hydrogen chloride. Not specified; but may be taken as of good quality. (2) Nitrobenzene. Dried with CaCl₂, and distilled, in a vacuum. (3) Heptane. Purified as for optical measurements. Dried</pre> |
| AUXILIARY METHOD/APPARATUS/PROCEDURE: The same in principle as the high vacuum technique of Brown and Brady (1), except that the temperature was increased and the corresponding | <pre>INFORMATION SOURCE AND PURITY OF MATERIALS: (1) Hydrogen chloride. Not specified; but may be taken as of good quality. (2) Nitrobenzene. Dried with CaCl₂, and distilled, in a vacuum. (3) Heptane. Purified as for</pre> |
| AUXILIARY METHOD/APPARATUS/PROCEDURE: The same in principle as the high vacuum technique of Brown and Brady (1), except that the temperature was increased and the corresponding | <pre>INFORMATION SOURCE AND PURITY OF MATERIALS: (1) Hydrogen chloride. Not specified; but may be taken as of good quality. (2) Nitrobenzene. Dried with CaCl₂, and distilled, in a vacuum. (3) Heptane. Purified as for optical measurements. Dried</pre> |
| AUXILIARY METHOD/APPARATUS/PROCEDURE: The same in principle as the high vacuum technique of Brown and Brady (1), except that the temperature was increased and the corresponding | <pre>INFORMATION SOURCE AND PURITY OF MATERIALS: (1) Hydrogen chloride. Not specified; but may be taken as of good quality. (2) Nitrobenzene. Dried with CaCl₂, and distilled, in a vacuum. (3) Heptane. Purified as for optical measurements. Dried over sodium-potassium alloy.</pre> |
| AUXILIARY METHOD/APPARATUS/PROCEDURE: The same in principle as the high vacuum technique of Brown and Brady (1), except that the temperature was increased and the corresponding | <pre>INFORMATION SOURCE AND PURITY OF MATERIALS: (1) Hydrogen chloride. Not specified; but may be taken as of good quality. (2) Nitrobenzene. Dried with CaCl₂, and distilled, in a vacuum. (3) Heptane. Purified as for optical measurements. Dried over sodium-potassium alloy.</pre> |
| AUXILIARY METHOD/APPARATUS/PROCEDURE: The same in principle as the high vacuum technique of Brown and Brady (1), except that the temperature was increased and the corresponding | <pre>INFORMATION SOURCE AND PURITY OF MATERIALS: (1) Hydrogen chloride. Not specified; but may be taken as of good quality. (2) Nitrobenzene. Dried with CaCl₂, and distilled, in a vacuum. (3) Heptane. Purified as for optical measurements. Dried over sodium-potassium alloy. ESTIMATED ERROR:</pre> |
| AUXILIARY METHOD/APPARATUS/PROCEDURE: The same in principle as the high vacuum technique of Brown and Brady (1), except that the temperature was increased and the corresponding | <pre>INFORMATION SOURCE AND PURITY OF MATERIALS: (1) Hydrogen chloride. Not specified; but may be taken as of good quality. (2) Nitrobenzene. Dried with CaCl₂, and distilled, in a vacuum. (3) Heptane. Purified as for optical measurements. Dried over sodium-potassium alloy.</pre> |
| AUXILIARY METHOD/APPARATUS/PROCEDURE: The same in principle as the high vacuum technique of Brown and Brady (1), except that the temperature was increased and the corresponding | <pre>INFORMATION SOURCE AND PURITY OF MATERIALS: (1) Hydrogen chloride. Not specified; but may be taken as of good quality. (2) Nitrobenzene. Dried with CaCl₂, and distilled, in a vacuum. (3) Heptane. Purified as for optical measurements. Dried over sodium-potassium alloy. ESTIMATED ERROR: REFERENCES:</pre> |
| AUXILIARY METHOD/APPARATUS/PROCEDURE: The same in principle as the high vacuum technique of Brown and Brady (1), except that the temperature was increased and the corresponding | <pre>INFORMATION SOURCE AND PURITY OF MATERIALS: (1) Hydrogen chloride. Not specified; but may be taken as of good quality. (2) Nitrobenzene. Dried with CaCl₂, and distilled, in a vacuum. (3) Heptane. Purified as for optical measurements. Dried over sodium-potassium alloy. ESTIMATED ERROR:</pre> |
| AUXILIARY METHOD/APPARATUS/PROCEDURE: The same in principle as the high vacuum technique of Brown and Brady (1), except that the temperature was increased and the corresponding | <pre>INFORMATION SOURCE AND PURITY OF MATERIALS: (1) Hydrogen chloride. Not specified; but may be taken as of good quality. (2) Nitrobenzene. Dried with CaCl₂, and distilled, in a vacuum. (3) Heptane. Purified as for optical measurements. Dried over sodium-potassium alloy. ESTIMATED ERROR: REFERENCES: 1. Brown, H. C.; Brady, J. C.</pre> |
| AUXILIARY METHOD/APPARATUS/PROCEDURE: The same in principle as the high vacuum technique of Brown and Brady (1), except that the temperature was increased and the corresponding | <pre>INFORMATION SOURCE AND PURITY OF MATERIALS: (1) Hydrogen chloride. Not specified; but may be taken as of good quality. (2) Nitrobenzene. Dried with CaCl₂, and distilled, in a vacuum. (3) Heptane. Purified as for optical measurements. Dried over sodium-potassium alloy. ESTIMATED ERROR: REFERENCES: 1. Brown, H. C.; Brady, J. C.</pre> |
| AUXILIARY METHOD/APPARATUS/PROCEDURE: The same in principle as the high vacuum technique of Brown and Brady (1), except that the temperature was increased and the corresponding | <pre>INFORMATION SOURCE AND PURITY OF MATERIALS: (1) Hydrogen chloride. Not specified; but may be taken as of good quality. (2) Nitrobenzene. Dried with CaCl₂, and distilled, in a vacuum. (3) Heptane. Purified as for optical measurements. Dried over sodium-potassium alloy. ESTIMATED ERROR: REFERENCES: 1. Brown, H. C.; Brady, J. C.</pre> |

| Hydrogen Chloride in l | Non-Aqueous Solvents 35 |
|---|---|
| COMPONENTS : | ORIGINAL MEASUREMENTS: |
| <pre>(1) Hydrogen chloride; HCl; [7647-01-0]</pre> | Strohmeir, W.; Echte, A. |
| <pre>(2) 1-Methyl-2-nitrobenzene or</pre> | 2. Elektrochem. <u>1957</u> , 61, 549 - 555. |
| (3) Heptane; C ₇ H ₁₆ ; [142-82-5] | |
| VARIABLES: | PREPARED BY: |
| T/K: 258.4, 272.9 p ₁ /mmHg: 39.0 - 522.6 | W. Gerrard |
| EXPERIMENTAL VALUES: | |
| T/K Pressur | e Mol |
| n /mmH | Fraction |
| $p_1/mmHq$ | $\frac{x_1}{1}$ |
| 258.4 39.0 90.6 | |
| 149.4 | |
| 211.6 | |
| 261.1 | |
| 319.1 | |
| 378.0 | 0.02801 |
| 272.9 53.1 | 0.00293 |
| 125.3 | |
| 207.4 | |
| 294.7 361.9 | |
| 442.6 | |
| 522.6 | 0.02801 |
| The solvent is 0.001 mole of componen (3) (heptane) for each measurement. Henry's constant: $H/mmHg = (p_1/mmHg)$ | |
| AUXILIARY | INFORMATION |
| METHOD/APPARATUS/PROCEDURE: | SOURCE AND PURITY OF MATERIALS: |
| The same in principle as the high vacuum technique of Brown and Brady | (1) Hydrogen chloride. Not specified; but may be taken as of good quality. |
| (1), except that the temperature was increased and the corresponding | (2) o-nitrotoluene. Dried with |
| pressure of the gas phase measured. | CaCl ₂ and distilled in a vacuum. |
| | (3) Heptane. Purified as for optical measurements. Dried over sodium-potassium alloy. |
| | |
| | ESTIMATED ERROR: |
| | |
| | |
| | REFERENCES: |
| | Brown, H. C.; Brady, J. C. J. Am. Chem. Soc. <u>1952</u>, 74, 3570. |
| | |
| | |

| So Hydrogen enionde in r | ton Aqueeus contents |
|--|---|
| COMPONENTS: | ORIGINAL MEASUREMENTS: |
| <pre>(1) Hydrogen chloride; HCl; [7647-01-0]</pre> | Strohmeir, W.; Echte, A. |
| (2) Tetrachloromethane or carbon tetrachloride; CCl ₄ ; [56-23-5] | 2. Elektrochem. <u>1957</u> , 61, 549-555. |
| (3) Heptane; C ₇ H ₁₆ ; [142-82-5] | |
| VARIABLES: | PREPARED BY: |
| T/K: 200.8 - 272.9 | W. Gerrard |
| p ₁ /mmHg: 22.3 - 498.4 | |
| EXPERIMENTAL VALUES: | |
| T/K 200.8 209.6 220.3 | 230.8 241.6 258.4 272.9 |
| | |
| Mole | p ₁ /mmHg |
| Fraction | 1 |
| <u> </u> | |
| 0.00430 22.3 28.8 39.0 | 50.9 63.7 84.8 105.4 |
| 0.00831 42.9 56.1 75.3 0.01160 60.0 78.0 105.2 | 96.8 124.6 163.8 203.3 |
| | 135.3 174.1 229.5 287.1 193.7 249.2 328.9 407.7 |
| 0.01663 85.4 110.4 150.5 0.02016 103.7 134.6 181.5 | 193.7 249.2 328.9 407.7 234.4 300.7 399.3 498.4 |
| | |
| AUXILIARY | INFORMATION |
| ME THOD /APPARATUS / PROCEDURE : | SOURCE AND PURITY OF MATERIALS: |
| The same in principle as the high vacuum technique of Brown and Brady (1), except that the temperature was | (1) Hydrogen chloride. Not specified; but may be taken as of good quality. |
| increased and the corresponding pressure of the gas phase measured. | (2) Carbon Tetrachloride. Dried with P ₂ O ₅ . |
| | (3) Heptane. Purified as for optical measurements. Dried over sodium-potassium alloy. |
| 1 | ESTIMATED ERROR: |
| | DITIONED LANDA. |
| | |
| | |
| | REFERENCES: 1. Brown, H. C.; Brady, J. C. J. Am. Chem. Soc. <u>1952</u> , 74, 3570. |
| | |
| | |

| , | 37 |
|---|--|
| COMPONENTS: (1) Hydrogen chloride; HCl; [7647-01-0] | ORIGINAL MEASUREMENTS: Strohmeir, W.; Echte, A. |
| <pre>(2) Nitric acid ethyl ester or ethyl nitrate; C₂H₅NO₃; [625-58-1]</pre> | 2. Elektrochem. <u>1957</u> , 61, 549-555. |
| (3) Heptane; C ₇ H ₁₆ ; [142-82-5] | |
| VARIABLES: T/K: 200.8 - 272.9 p ₁ /mmHg: 13.7 - 659.0 | PREPARED BY: W. Gerrard |
| EXPERIMENTAL VALUES: | |
| T/K 200.8 209.6 220.3 | 230.8 241.6 258.4 272.9 |
| Mole Fraction x_1 | p ₁ /mmHg |
| $\begin{array}{c ccccccccccccccccccccccccccccccccccc$ | 80.7108.3151.0196.591.8125.3172.9233.9123.3165.9230.3298.0157.4211.4291.7376.8212.4285.5394.7507.3 |
| | |
| AUXILIARY | INFORMATION |
| METHOD/APPARATUS/PROCEDURE: The same in principle as the high vacuum technique of Brown and Brady (1), except that the temperature was increased and the corresponding pressure of the gas phase measured. | <pre>SOURCE AND PURITY OF MATERIALS: (1) Hydrogen chloride. Not specified; but may be taken as of good quality. (2) Ethyl nitrate. Not stated.</pre> |
| pressure of the gas phase measured. | (3) Heptane. Purified as for optical measurements. Dried over sodium-potassium alloy. |
| | ESTIMATED ERROR: |
| | REFERENCES: 1. Brown, H. C.; Brady, J. C. J. Am. Chem. Soc. <u>1952</u> , 74, 3570. |
| | |

| COMPONENTS: (1) Hydrogen Ch | loride: HC | ·]• | 1 | NAL MEASURI | EMENTS: rady, J. D. | |
|--|---|--------------------------------------|-------------------------|---|--|---|
| Hydrogen Chloride; HCl; [7647-01-0] Hydrocarbons and halogenated hydrocarbons Heptane; C₇H₁₆; [142-82-5] | | | J. Am | | z. <u>1952</u> , 74 | |
| VARIABLES: | · · · | | PREPA | RED BY: | | ······ |
| T/K: 194.6 P ₁ /kPa: 1. (s | | 6 | | W. Gerrard | 3 | |
| EXPERIMENTAL VAL Temperature = 19 | | | | | | |
| Component (2) | P/mmHg | - | orium mi | | | Henry's Constant |
| | | n ₁ /mmol 1 | 2 ^{/mmol} | n ₃ /mmol | <i>*</i> 1 | K/mmHg |
| Benzene; C ₆ H ₆ ; [71-43-2] | 35.10 47.40 72.50 | 0.461 | 0.629 1.629 1.629 | 32.57 32.57 32.57 | 0.00996 0.01330 0.02070 | 3524 3564 3502 3500 ¹ |
| Methylbenzene; C [108-88-3] | -Ho; | | | | (4 | .605 atm) |
| [108-88-3] | ' 31.45 49.05 61.10 | 0.538 | .629 .629 .629 | 32.57 32.57 32.57 | 0.00993 0.01549 0.01916 | 3167 3167 3189 3170 ¹ |
| | | 0.320 | 2.500 2.500 2.500 | 32.62 ² 32.582 ² 32.59 ² | 0.00397 0.00904 0.01369 | .171 atm) 2783 2801 2795 2790 ¹ .671 atm) |
| ¹ The authors' value. The plot of pressure vs. mole fraction was read as linear. The Henry's constant value should not be used indiscriminately to calculate values of mole fraction for pressures greater than the maximum recorded above. ² Values calculated by the compiler. These experiments were carried out at a constant 2.5 mmol of component 2 in sufficient heptane to make a total volume of 4.803 cm³ of solution. | | | | minately the ied out | | |
| The compiler calculated the values of Henry's constant for the mixtures. | | | | mixtures. | | |
| | | AUXILIARY | INFORMA | TION | · | |
| METHOD/APPARATUS | /PROCEDURE | : | SOURC | E AND PURIT | TY OF MATER | IALS: |
| vacuum equipment change of the pr | By means of high precision high vacuum equipment and procedure the change of the pressure of the gas phase due to absorption was accurately measured at 194.64 K. The mole fraction of hydrogen chloride in the liquid phase was calculated. The solubility was finally expressed as the Henry's constant, K/mmHg = HCl pressure/mole fraction, p_1/x_1 . | | | | nloride. N taken as o | |
| accurately measu The mole fractio | | | | high qualit boıling poi | ly attested ty. Values ints and re given in | of the fractive |
| calculated. The finally expresse constant, K/mmHg | | | | ATED ERROR: | | |
| Henry's constant (numerically) at it may deviate w reported value o (1087 mmHg), th of pure liquid h 194.64 K. | which x_1 idely from f $p_1^\circ = 1.4$ e vapor | = 1, and the 3 atm pressure | REFER | ENCES: | | |

| COMPONENTS: (1) Hydrogen Chl [7647-01-0] (2) Hydrocarbons hydrocarbons | and halo | genated | Brown J. Am | NAL MEASURE , H. C.; Bi . Chem. Soc - 3582. | rady, J. D. | |
|--|--------------------------|----------------------|---------------------------------|--|--------------------|---------------------------------|
| (3) Heptane; C ₇ H ₁₆ ; [142-82-5] | | | | | | |
| EXPERIMENTAL VALU Temperature = 194 | | | | | | |
| Component (2) | P/mmHg | | ibrium mi | | Mole Fraction | Henry's Constant |
| | | n ₁ /mmol | ⁿ 2 ^{/mmol} | n ₃ /mmol | ×1 | K/mmHg |
| Ethylbenzene; | | | | | | |
| C ₈ H ₁₀ ; [100-41-4] | 12.22 | 0.167 | 2.500 | 32.642 | 0.00473 | 2584 |
| | 24.80 40.42 | 0.328 0.537 | 2.500 2.500 | 32.59 ² 32.60 ² | 0.00926 0.01507 | 2678 2682 |
| | 10.42 | 0.337 | 2.300 | 52.00 | | 2680¹ |
| 1,3-Dimethylbenze | ene; | | | | (. | 3.526 atm) |
| C ₈ H ₁₀ ; [108-38-3] | 25.00 | 0.300 | 1.629 | 32.57 | 0.00869 | 2877 |
| | 39.99 45.95 | 0.468 0.537 | 1.629 1.629 | 32.57 32.57 | 0.01350 0.01545 | 2962 2974 |
| | 10.00 | 0.00. | | | | 2980 ¹ |
| | 10 50 | 0 100 | 2 500 | 32.59² | | 3.921 atm) |
| | 13.53 30.86 | 0.193 0.441 | 2.500 2.500 | 32.59 ⁻ 32.59 ² | 0.00547 0.01241 | 2473 2487 |
| | 46.82 | 0.678 | 2.500 | 30.79 ² | 0.01996 | 2346 |
| | | | | | 13 | 2460 ¹ 3.237 atm) |
| 1,3,5-Trimethylbe | enzene, (m | esitylene |); | | (- | 3.23/ atia; |
| C ₉ H ₁₂ ; [108-67-8] |] 12.11 | 0.113 | 0.326 | 32.57 | 0.00342 | 3541 |
| | 34.64 44.79 | 0.300 0.381 | 0.326 0.326 | 32.57 32.57 | 0.00903 0.01144 | 3836 3915 |
| | 44.79 62.83 | 0.381 | 0.326 | 32.57 | 0.01588 | 3957 |
| | | | | | | 3910 ¹ |
| | 20 50 | 0 105 | 0.051 | 22 57 | | 5.145 atm) |
| | 20.50 30.79 | 0.195 0.292 | 0.651 0.651 | 32.57 32.57 | 0.00583 0.00871 | 3516 3535 |
| | 40.55 | 0.386 | 0.651 | 32.57 | 0.01148 | 3532 |
| | | | | | | 3510 ¹ |
| | 30.25 | 0.415 | 1.629 | 32.57 | 0.01199 | 1.618 atm) 2523 |
| | 41.46 | 0.562 | 1.629 | 32.57 | 0.01617 | 2564 |
| | 49.92 | 0.676 | 1.629 | 32.57 | 0.01938 | 2576 |
| | | | | | | 2550 ¹ 3.355 atm) |
| | 7.65 | 0.126 | 2.500 | 32.67² | 0.00357 | 2143 |
| | 19.16 | 0.309 | 2.500 | 32.59² | 0.00873 | 2195 |
| | 32.65 | 0.524 | 2.500 | 32.53² | 0.01474 | 2215 2210 ¹ |
| | | | | | () | 2210- 2.908 atm) |
| (1-Methylethyl)be | | | | umene); | • - | · · · · · · · · · |
| ^C 9 ^H 12; [98-82-8] | 15.30 | | 2.500 2.500 | 32.63^{2} 32.61^{2} | 0.00614 0.01082 | 2492 2492 |
| | 26.96 38.69 | | 2.500 | 32.01 32.59^{2} | 0.01560 | 2492 |
| | 30.05 | 0.000 | 2,000 | 52105 | | 2490 ¹ |
| | | | | | (3 | 3.276 atm) |
| ¹ The authors' va linear. The He to calculate va maximum recorde | enry's con alues of m | stant val | ue should | not be use | ed indiscr: | iminately |
| ² Values calculat at a constant 2 total volume of | 2.5 mmol o | f compone | nt 2 in s | | | |
| total volume or | : 4.803 Cm | • OI SOLU | tion. | | | |
| The compiler ca | lculated | the value | s of Henr | y's constan | nt for the | mixtures |

Hydrogen Chloride in Non-Aqueous Solvents

| <pre>COMPONENTS: (1) Hydrogen Chloride; HCl; [7647-01-0] (2) Hydrocarbons and halogenated hydrocarbons (3) Heptane; C₇H₁₆; [142-82-5]</pre> | | | Brown, J. Am. | ORIGINAL MEASUREMENTS: Brown, H. C.; Brady, J. D. J. Am. Chem. Soc. <u>1952</u> , 74, 3570 - 3582. | | |
|---|-------------------------------------|---------------------------------------|------------------------------------|---|-------------------------------------|--|
| EXPERIMENTAL VALUE Temperature = 194. | | | I | | | 6. 60 1 <u>1.</u> |
| Component (2) | P/mmHg | Equil: | ibrium mix | ture | Mole Fraction | Henry's Constant |
| (2) | | n ₁ /mmol | ⁿ 2 ^{/mmol} | $n_3/mmol$ | ×1 | K/mmHg |
| (2-Methylpropyl)be C ₁₀ H ₁₄ ; [538-93-2] | nzene, (14.78 25.15 39.56 | t-butylber 0.219 0.378 0.589 | nzene); 2.500 0.500 2.500 | 32.60 ² 32.58 ² 32.59 ² | 0.00620 0.01066 0.01651 (3 | 2384 2359 2396 2380 ¹ .132 atm) |
| Fluorobenzene; C ₆ H ₅ F; [462-06-6] | 14.21 26.37 39.64 | 0.162 0.288 0.426 | 2.500 2.500 2.500 | 32.63 ² 32.59 ² 32.60 ² | 0.00459 0.00814 0.01199 (4 | 3096 3240 3306 3260 ¹ .289 atm) |
| Trifluoromethylben C ₇ H ₅ F ₃ ; [98-08-8] | zene; 30.30 45.66 64.60 | 0.251 0.368 0.529 | 1.629 1.629 1.629 | 32.57 32.57 32.57 | 0.00728 0.01064 0.01523 (5 | 4162 4291 4242 4220 ¹ .553 atm) |
| Chlorobenzene; C ₆ H ₅ Cl; [108-90-7] | 13.40 39.75 72.32 | 0.117 0.346 0.628 | 1.629 1.629 1.629 | 32.57 32.57 32.57 | 0.00341 0.01001 0.01803 | 3960 3971 4011 4000 ¹ .263 atm) |
| | 14.53 26.23 41.67 | 0.145 0.258 0.413 | 2.500 2.500 2.500 | 32.63 ² 32.58 ² 32.60 ² | 0.00411 0.00730 0.01163 | 3535 3593 3583 3570 ¹ .697 atm) |
| Bromobenzene; C ₆ H ₅ Br; [108-86-1] | 10.50 21.30 33.90 | 0.101 0.201 0.325 | 2.500 0.500 0.500 | 32.59 ² 32.62 ² 32.58 ² | 0.00287 0.00569 0.00918 (4 | 3658 3743 3693 3660 ¹ .816 atm) |
| Iodobenzene; C ₆ H ₅ I; [591-50-4] | 11.58 30.58 39.86 | 0.111 0.289 0.375 | 2.500 2.500 2.500 | 32.63 ² 32.58 ² 32.60 ² | 0.00315 0.00817 0.01057 (4 | 3676 3743 3771 3750 ¹ .934 atm) |
| (100% Heptane) | | 0.217 0.402 0.520 | - - - | 32.57 32.57 32.57 | 0.00662 0.01219 0.01571 (5 | 4443 4537 4537 4520 ¹ .947 atm) |
| ¹ The authors' val linear. The Hen to calculate val maximum recorded | ry's con ues of m | stant valı | le should | not be use | ed indıscri | minately |
| ² Values calculate at a constant 2. total volume of | 5 mmol o | f componer | nt 2 in su | xperiments fficient h | were carr Neptane to | ied out make a |

The compiler calculated the values of Henry's constant for the mixtures.

40

| COMPONENTS: | EVALUATOR: |
|---|---|
| Hydrogen Chloride; HCl; [7647-01-0] Niscellanceus Hudrogarbens | Peter G. T. Fogg Department of Applied Chemistry and Life Sciences, Polytechnic of North London, |
| Miscellaneous Hydrocarbons | Holloway, London, N7 8DB, U.K. January 1989 |

CRITICAL EVALUATION:

The Solubility of Hydrogen Chloride in Miscellaneous Hydrocarbons.

Chesterman (1) found that the solubility in a sample of petroleum boiling between 333.2 K and 353.2 K. was 0.3 wt.% at 298.15 K and a total pressure of 100.9 kPa. This may be compared with the solubility in hexane (b.pt. 341.9 K) of 0.54 wt.% under the same conditions as estimated by the evaluator from measurements by O'Brien & Kenny (2).

Solubility in cyclohexane was reported by Bell (3) at 293.15 K for a partial pressure of 101.3 kPa, by Wiegner (4) at 292.99 K and 313.15 K for a partial pressures from 0.025 to 89.1 kPa and by Tsiklis & Svetlova (5) at 283.15 K to 313.15 K for partial pressures from 0.133 to 106.7 kPa. There are discrepancies between the measurements as may be seen by comparing mole fraction solubilities at a partial pressure of 101.3 kPa based upon data from the three sources.

<u>Mole fraction solubilities in cyclohexane at a partial pressure of</u> 101.3 kPa from different sources.

| | 292.99 K | 293.15 K | 313.15 K |
|--------------------|----------|----------|----------|
| Bell | | 0.0154 | |
| Wiegner | 0.0144 | | 0.0106 |
| Tsiklis & Svetlova | 0.0180 | 0.0179 | 0.0133 |

Further measurements on this system are required before reliable solubility data can be established.

Brown & Brady (6) measured solubilities in 2,4,4-trimethyl-1-pentene and in 2,4,4-trimethyl-2-pentene at 194.64 K and at partial pressures of gas between 0.509 kPa and 1.432 kPa. The solubility is greater in the latter than the former. These measurements cannot be linearly extrapolated to give a meaningful estimate of the mole fraction solubility at a partial pressure of 101.3 kPa. Such an extrapolation would give values greater than unity. However if the variation of mole fraction solubility with pressure approximates to a Margules equation then mole fraction solubilities at this partial pressure would be about 0.74.

Rajalo and co-workers (7) have published equations for Henry's law constants for dissolution in mixtures of dienes and chlorides from reaction with hydrogen chloride. If it is assumed that the equations are valid for 298.15 K over the whole of the mole fraction range and that the Henry's law constants can be used to calculate solubilities at 101.3 kPa then mole fraction solubilities at this temperature in the compounds under test are as follows :

1,3-pentadiene 0.049 2-methyl-1,3-butadiene 0.062 2,3-dimethyl-1,3-butadiene 0.017 (or 2-methyl-1,3-pentadiene; see the compilation)

In view of the lack of numerical data in the papers and the uncertainties involved in their interpretation the mole fraction solubilities can only be considered to be of semi-quantitative significance.

Scher *et al.* (8) measured the solubility of hydrogen chloride in 1-hexadecene at pressures from 23.3 kPa to 100.0 kPa and at four temperatures from 298.15 K to 328.15. Values of Henry's constants were reported. The data are self consistent and appear to be reliable. The corresponding mole fraction solubility at 298.15 K and a partial pressure of 101.3 kPa is 0.0357. This may be compared with a value of 0.0225 for dissolution in hexadecane from measurements by Tremper & Prausnitz (9). The reference value for this temperature from the Raoult's law equation is 0.0218. No other data for 1-hexadecene are available for comparison.

| COMPON | IENTS : | EVALUATOR: |
|--------|--|--|
| 1. | Hydrogen Chloride; HCl; [7647-01-0] | Peter G. T. Fogg Department of Applied Chemistry |
| 2. | Miscellaneous Hydrocarbons | and Life Sciences, Polytechnic of North London, Holloway, London, N7 8DB, U.K. |
| | | January 1989 |
| CRITIC | AL EVALUATION: | |
| | | |
| REFE | RENCES | |
| 1. | Chesterman, D. R. J. Chem. Soc | . <u>1935</u> , 906-910. |
| 2. | O'Brien, S. J.; Kenny, C. L. J | . Am. Chem. Soc. <u>1940</u> , 62, 1189-1192. |
| 3. | Bell, R. P. J. Chem. Soc. <u>1931</u> | , 1371–1382. |
| 4. | Wiegner, F. Z. Elektrochem. <u>19</u> | <u>41</u> , 47, 163-164. |
| 5. | Tsıklis, D. S.; Svetlova, G. M. | Zh. Fiz. Khim. <u>1958</u> , 32, 1476-1480. |
| 6. | Brown, H. C.; Brady, J. D. J. | Am. Chem. Soc. <u>1952</u> , 74, 3570-3582. |
| 7. | Savich, T. O.; Dement'eva, V.; 1 Toım. Keem. Geol. <u>1977</u> , 26, 83- Volens, T.; Rajalo G. 1b. <u>1981</u> | |
| 8. | Scher, M.; Gill, W. N.; Jelinek <u>1963</u> , 2, 107–112. | , R. V. Ind. Eng. Chem., Fundam. |
| 9. | Tremper, K. L.; Prausnitz, J. M 295-299. | . J. Chem. Eng. Data <u>1976</u> , 21, |
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| COMPONENTS: | | | | | |
|--|------------|--------------------|---|--|--|
| | ide, ucl. | | ORIGINAL MEASUREMENTS: Chesterman, D. R. | | |
| <pre>(1) Hydrogen chloride; HCl; [7647-01-0]</pre> | | | Chesterman, D. R. | | |
| (2) Petroleum | | | J. Chem. Soc. <u>1935</u> , 906 - 910. | | |
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| VARIABLES: T/K: 298. | 15 | | PREPARED BY: | | |
| Total P/kPa: 101 | (∿l atm) | | W. Gerrard | | |
| | | | | | |
| EXPERIMENTAL VALUES: | | | | | |
| | T/K | Observed | Solubility | | |
| | | Pressure p/mmHg | g HCl g ⁻¹ Solution | | |
| | | | | | |
| | 298.15 | 757 | 0.003 | | |
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| | | AUXILIARY | INFORMATION | | |
| METHOD /APPARATUS / PROCE | DURE : | | SOURCE AND PURITY OF MATERIALS: | | |
| The apparatus was | | for the | (1) Hydrogen chloride. Prepared from | | |
| conductivity. A s | ample of · | the | conc. sulfuric acid and pure | | |
| saturated solution weighed, the hydro | | | sodium chloride. Passed through | | |
| reacted with exces | | | sulfuric acid and over P ₂ O ₅ . | | |
| which was back tit | | h a | (2) Petroleum. Was stated to be | | |
| standard acid solu | tion. | | the purest obtainable. "Light petroleum," dried with sodium, | | |
| | | | b.p./°C (750 mmHg) = 60 - 80. | | |
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| | | | ESTIMATED ERROR: | | |
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| | | | REFERENCES: | | |
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| COMPONENTS: (1) Hydrogen chloride; HCl; [7647-01-0] (2) Cyclohexane; C ₆ H ₁₂ ; [110-82-7] | ORIGINAL MEASUREMENTS: Bell, R. P. J. Chem. Soc. <u>1931</u> , 1371 - 1382. |
|---|--|
| (2) Cyclonexane; $C_6^{n_{12}}$, [110-02 /] | |
| VARIABLES: T/K: 293.15 P/kPa: 101.325 (1 atm) | PREPARED BY: W. Gerrard |
| EXPERIMENTAL VALUES: | ······································ |
| T/K Partition Coefficien ^c l, l ^{/c} l,g | |
| 293.15 3.42 | 0.0154 |
| The ideal gas concentr | ation at $n_{\rm c} = 1$ atm |
| is $c_{1,q}/mol dm^{-3} = n/V$ | |
| $15 C_{1,g}$ mor $dm = m/v$ | |
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| | INFORMATION |
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| METHOD/APPARATUS/PROCEDURE: The apparatus consisted of a 50 cm ³ bulb extended at the top as a graduated tube, and sealed at the bottom to a capillary U-tube. The liquid was saturated with gas at | SOURCE AND PURITY OF MATERIALS: (1) Hydrogen chloride. Prepared by dropping pure concentrated hydrochloric acid into pure sulfuric acid. |
| atmospheric pressure. The gas was displaced from the saturated solu- tion by a current of dry CO ₂ free | (2) Cyclohexane. Good specimen was dried over calcium chloride, and distilled. Boiling point is given in paper. |
| air, absorbed in water, and titrated with a solution of NaOH. | is given in paper. |
| The solubility, c/mol dm ⁻³ , was | |
| converted to a partition coefficient | ESTIMATED ERROR: |
| converted to a partition coefficient by dividing by the ideal gas con- centration of HCL in the gas phase. | $\delta T/K = 0.01$ |
| by dividing by the ideal gas con- centration of HCl in the gas phase. | |
| by dividing by the ideal gas con- | $\delta T/K = 0.01$ |
| by dividing by the ideal gas con- centration of HCl in the gas phase. The mole fraction solubility was calculated on the assumption that the density of the solution obeys | $\delta T/K = 0.01$ $\delta c/c = 0.01$ |
| by dividing by the ideal gas con- centration of HCl in the gas phase. The mole fraction solubility was calculated on the assumption that the density of the solution obeys | $\delta T/K = 0.01$ $\delta c/c = 0.01$ |

| Hydrogen Chioria | le in Non-Aqueous Solvents 45 |
|---|--|
| COMPONENTS : | ORIGINAL MEASUREMENTS: |
| (1) Hydrogen chloride; HCl; | Wiegner, F. |
| [7647-01-0] (2) Cyclohexane; C ₆ H ₁₂ ; [110-82-7] | 2. Elektrochem. <u>1941</u> , 47, 163 - 164. |
| VARIABLES : | PREPARED BY: |
| T/K = 292.99, 313.15 $p_1/kPa = 2.506 - 89.059$ (18.8 - 668 mmHg) | W. Gerrard |
| EXPERIMENTAL VALUES: | |
| Temperature Hydr | lrogen Chloride Mol Fraction |
| Part | tial Pressure |
| t/°C T/K | <i>p</i> ₁ /mmHg <i>x</i> ₁ |
| 19.84 292.99 | $\begin{array}{cccccccccccccccccccccccccccccccccccc$ |
| | 58.0 0.00094 164.9 0.00238 271.5 0.00401 366.3 0.00516 465.4 0.00681 543.4 0.00787 (760.0 0.0106) ¹ |
| | K the enthalpy of solution was 2.19 kcal mol ⁻¹ (-9.16 J mol ⁻¹). |
| | LIARY INFORMATION |
| METHOD/APPARATUS/PROCEDURE: Hydrogen chloride was passed into cyclohexane until saturation was attained. The HCl content was deter mined by chemical titration. The partial pressure, p_1 , appears have been calculated by subtraction the vapor pressure of cyclohexane (over the pure liquid) from the measured total pressure, the vapor pressure lowering being deemed negligible for these small mole fraction, x_1 , values. | er- (2) Cyclohexane was rigorously purified. F.p./ ⁰ C = 6.34, to b. p. (1 atm)/ ⁰ C = 80.05. ng |
| | REFERENCES : |

| COMPONENTS: | | | ORIGINAL MI | EASUREMENTS : | | |
|---|-----------------------|---|---|---|--|--|
| (1) Hydrogen chloride; HCl; | | | Tsiklis | , D. S.; Svet | tlova, G. M. | |
| [7647-01-0] (2) Cyclohexane; C ₆ H ₁₂ ; [110-82-7] | | | Zh. Hz. | . Khim. <u>1958</u> , | , <i>32</i> , 1476-1480. | |
| VARIABLES: | | | PREPARED BY | PREPARED BY: | | |
| | · | 93.15, 313.15 | | W. Gerrard | 1 | |
| | g: 100 - 800 |) | | | · · · · · · · · · · · · · · · · · · · | |
| EXPERIMENTAL VALUES: T/K 283.15 T/K 293.1 | | 3.15 | т/к 3 | 13.15 | | |
| | Mole | | Mole | | | |
| Pressure | Fraction | Pressure | Fraction | Pressure | Mole Fraction | |
| <i>P</i> ₁ | <i>x</i> ₁ | <i>p</i> ₁ | <i>x</i> ₁ | <i>p</i> ₁ | <i>x</i> ₁ | |
| 100 | 0.0028 | 100 | 0.0024 | 100 | 0.0018 | |
| 200 | 0.0055 | 200 | 0.0047 | 200 | 0.0035 | |
| 300 | 0.0083 | 300 | 0.0071 | 300 | 0.0053 | |
| 400 | 0.0111 | 400 | 0.0094 | 400 | 0.0071 | |
| 500 | 0.0131 | 500 | 0.0110 | 500 | 0.0088 | |
| 600 | 0.0166 | 600 | 0.0142 | 600 | 0.0105 | |
| 700 | 0.0194 | 700 | 0.0165 | 700 | 0.0123 | |
| 760 | 0.02091 | 760 | 0.01791 | 760 | 0.01331 | |
| 800 | 0.0122 ² | 800 | 0.0189 | 800 | 0.0141 | |
| The authors smoothing equation for He log $(H/mmHg) = 6.608 - 580.5/(T/K)$ wi | | | | | $(x_1, x_2) = x_1 + x_2 + x_2$ | |
| | | AUXILIARY | INFORMATION | 17. 1.1. | | |
| ETHOD/APPARAT | TUS/PROCEDURE: | | SOURCE AND PURITY OF MATERIALS: | | | |
| The cyclohexane was frozen in the absorption vessel, and the air was pumped out. The vapor pressure, p_{g}^{0} , of the cyclohexane was determined. | | (1) Hydrogen chloride. The HCl was freed from water by cooling to about 213 K. It was then cooled by liquid nitrogen and distilled. | | | | |
| The hydrogen chloride was admitted from a weighed vessel, and a second weighing gave (with certain adjust- ments) the amount of gas absorbed at the observed total pressure, p_t . The hydrogen chloride partial pressure, p_1 , appeared to be obtained from the difference $p_t - p_8^\circ$. The authors concluded that the mole fraction form of Henry's law was obeyed. | | adson twice | ohexane. Puri rption on sil e distilled. | | | |
| | | their dat square de data from lation of | y evaluated t ta by calcula eviation of t n those produ f the curves ed to fluctua | thors stated the error of ating the mean the experimental aced by interpo- . The deviation ate from 10 to | | |
| | | | | | | |

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|---|---|--|--|
| COMPONENTS: | ORIGINAL MEASUREMENTS: | | |
| <pre>(1) Hydrogen chloride; HCl; [7647-01-0]</pre> | Brown, H. C.; Brady, J. D. | | |
| <pre>(2) 2,4,4-trimethyl-l-pentene; C₈H₁₆; [107-39-1]</pre> | J. Am. Chem. Soc. <u>1952</u> , 74, 3570 - 3582. | | |
| VARIABLES: T/K: 194.64 P/kPa: 0.509 - 1.432 | PREPARED BY: W. Gerrard | | |
| (3.82 - 10.74 mmHg) | | | |
| EXPERIMENTAL VALUES: | | | |
| T/K Pressure Equilibrium Mixtu $p_1/mmHg = \frac{n_1/mmol}{n_1/mmol} \frac{n_2/mm}{n_2/mm}$ | $\frac{\text{Mol Fraction Henry's Constant}}{x_1} = \frac{x_1}{x_1}$ | | |
| 194.64 3.82 0.325 44.9 5.95 0.490 44.9 10.74 0.840 44.9 | 06 0.01078 552 | | |
| 10.74 0.840 44.9 | 6 0.01834 586 550 ¹ (0.724 atm) | | |
| | | | |
| AUXILIARY | INFORMATION | | |
| METHOD / APPARATUS / PROCEDURE : | SOURCE AND PURITY OF MATERIALS: | | |
| By means of high precision high vacuum equipment and procedure the change of the pressure of the gas phase due to absorption was accurately measured at 194.64 K. | <pre>(1) Hydrogen chloride. Not stated, but may be taken as of high quality.</pre> | | |
| | (2) 2,4,4-trimethyl-l-pentene. | | |
| chloride in the liquid phase was calculated. The solubility was finally expressed as the Henry's constant, K/mmHg = HCl pressure/mole | (2) 2,4,4-trimethyl-1-pentene. Thoroughly attested as of high quality. Values of the boiling point and refractive index are in the paper. | | |
| chloride in the liquid phase was calculated. The solubility was finally expressed as the Henry's constant, K/mmHg = HCl pressure/mole fraction. Henry's constant is the pressure | Thoroughly attested as of high quality. Values of the boiling point and refractive index are | | |
| chloride in the liquid phase was calculated. The solubility was finally expressed as the Henry's constant, K/mmHg = HCl pressure/mole fraction. Henry's constant is the pressure (numerically) at which $x_1 = 1$, and it may deviate widely from the | Thoroughly attested as of high quality. Values of the boiling point and refractive index are in the paper. | | |
| The mole fraction of hydrogen chloride in the liquid phase was calculated. The solubility was finally expressed as the Henry's constant, K/mmHg = HCl pressure/mole fraction. Henry's constant is the pressure (numerically) at which $x_1 = 1$, and it may deviate widely from the reported value of $p_1^\circ = 1.43$ atm (1087 mmHg), the vapor pressure of pure liquid hydrogen chloride at 194.64 K. | Thoroughly attested as of high quality. Values of the boiling point and refractive index are in the paper. | | |
| chloride in the liquid phase was calculated. The solubility was finally expressed as the Henry's constant, K/mmHg = HCl pressure/mole fraction. Henry's constant is the pressure (numerically) at which $x_1 = 1$, and it may deviate widely from the reported value of $p_1^\circ = 1.43$ atm (1087 mmHg), the vapor pressure of pure liquid hydrogen chloride at | Thoroughly attested as of high quality. Values of the boiling point and refractive index are in the paper. ESTIMATED ERROR: | | |

| COMPONENTS : | |
|--|--|
| (1) Hydrogen chloride; HCl; | ORIGINAL MEASUREMENTS: |
| [7647-01-0] | Brown, H. C.; Brady, J. D. J. Am. Chem. Soc. 1952, 74, |
| <pre>(2) 2,4,4-trimethyl-2-pentene; C₈H₁₆; [107-40-4]</pre> | 3570 - 3582. |
| VARIABLES: | PREPARED BY: |
| T/K: 194.64 P/kPa: 0.599 - 1.163 (4.49 - 8.72 mmHg) | W. Gerrard |
| EXPERIMENTAL VALUES: | |
| T/K Pressure Equilibrium Mixt | ure Mol Fraction Henry's Constant |
| p ₁ /mmHg n ₁ /mmol n ₂ /m | $\frac{1}{1} \qquad \frac{1}{1} \qquad \frac{1}$ |
| 194.64 4.49 0.483 44. | 96 0.01063 422 |
| | 96 0.01693 437 96 0.01984 440 |
| 0.72 0.910 44. | 430 ¹ (0.566 atm) |
| The authors estimated K/mmHg graph showed slight curvature, possibly more basic impurity in the olefin. | the result of a small quantity of a |
| AUXILIARY | INFORMATION |
| METHOD/APPARATUS/PROCEDURE: | SOURCE AND PURITY OF MATERIALS: |
| By means of high precision high vacuum equipment and procedure the change of the pressure of the gas phase due to absorption was accurately measured at 194.64 K. The mole fraction of hydrogen chloride in the liquid phase was calculated. The solubility was finally expressed as the Henry's constant, K/mmHg = HCl pressure/mole fraction. | (2) 2,4,4-trimethyl-2-pentene. Thoroughly attested as of high |
| Henry's constant is the pressure (numerically) at which $x_1 = 1$, and it | ESTIMATED ERROR: |
| may deviate widely from the reported value of $p_1^\circ = 1.43$ atm (1087 mmHg), | |
| the vapor pressure of pure liquid hydrogen chloride at 194.64 K. | REFERENCES: |
| | |

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| COMPONENTS: | ORIGINAL MEASUREMENTS: |
|---|---|
| <pre>(1) Hydrogen chloride; HCl; [7647-01-0]</pre> | Savich, T. O.; Dement'eva, V. Rajalo, G. |
| <pre>(2) 1,3-Pentadiene or piperylene; C₅H₈; [504-60-9]</pre> | Eesti NSV Tead. Akad. Toim. Keem. Geol. <u>1977</u> , 26, 83 - 88. |
| | Chem. Abstr. 1978, 88, 55542a |
| VARIABLES: | PREPARED BY: |
| | W. Gerrard |
| | |

EXPERIMENTAL VALUES:

The title of the paper is "Equilibrium Solubility of HCl in Piperylene and its Hydrochlorides." The authors used various mixtures of 1,3-pentadiene (piperylene), (E)-3-chloro-2-pentene (trans-2-chloro-3-pentene) [26423-61-0], and (Z)-3-chloro-2-pentene (cis-2-chloro-3-pentene) [26423-60-9]. There is a lack of definition in the quantities used. The pressure was not stated, presumably it was atmospheric. Numerical data were not given.

The solubility data were summarized by an equation which related Henry's constant, K/atm, to the temperature, T/K, and the 1,3-pentadiene mole fraction, x_2 :

 $\ln (K/atm) = 8.68 - 1760/(T/K) + 0.236 x_2.$

The low value of the term 0.236 x_2 was deemed to show the small difference in solubility of HCl in 1,3-pentadiene and the chloro-hydrocarbons.

The heat of solution can be approximated from the temperature dependence of Henry's constant as-14630 J mol⁻¹(-3495 cal mol⁻¹). There was deemed to be an insignificant difference in the heats of solution of HCl in 1,3-pentadiene and the chloro-hydrocarbons.

| AUXILIARY INFORMATION | | |
|---|--|--|
| METHOD/APPARATUS/PROCEDURE: | SOURCE AND PURITY OF MATERIALS: | |
| Dried HCl was passed via a flowmeter into a jacketed bubbler tube reactor fitted with a sampling device. When constant conditions were attained, a sample was removed for titration with standard alkali. From this result, and by gas-liquid chroma- tography, the amounts of piperylene and its hydrochloride were deter- mined. | (1) Hydrogen chloride was obtained by the action of concentrated sulfuric acid, and dried calcium chloride. (2) "All components for the prepara- tion of the initial mixtures were purified by rectification." Purity was stated to be greater than 99 per cent. ESTIMATED ERROR: | |
| | | |

| COMPONENTS: | ORIGINAL MEASUREMENTS: |
|--|---|
| <pre>(1) Hydrogen chloride; HCl; [7647-01-0]</pre> | Rajalo, G.; Savich, T. O.; Dement'eva, V. |
| <pre>(2) 2-Methy1-1,3-butadiene or iso- prene; C₅H₈; [78-79-5]</pre> | Eesti NSV Tead. Akad. Toim. Keem. Geol. <u>1979</u> , 28, 45 - 46. |
| | Chem. Abstr. <u>1979</u> , 90, 157793s |
| VARIABLES: | PREPARED BY: |
| | W. Gerrard |
| | |
| EXPERIMENTAL VALUES: | |
| The title of the paper is "The Equil | ibrium Solubility of Hydrogen chloride |

The title of the paper is "The Equilibrium Solubility of Hydrogen chloride in Systems Reacting with it and Consisting of Isoprene and Isopentenyl Chloride."

The authors stated that there is a negligible difference between the solubility of hydrogen chloride in isoprene and the isopentenyl chlorides. The authors conclude that there is absence of a statistical correlation between Henry's constant, K/atm, and the isoprene mole fraction, x_2 , and between ln (K/atm) and $x_2/T/K$. The authors obtained a correlation between Henry's constant, K/atm, and the temperature, T/K, which is given by the equation:

 $\ln (K/atm) = -6.12 - 996.6/(T/K)$.

The equation gives the approximate heat of solution of -8300 J mol^{-1} (-1980 cal mol⁻¹).

AUXILIARY INFORMATION

| METHOD/APPARATUS/PROCEDURE: Dried HCl was passed via a flowmeter into a jacketed bubbler tube reactor fitted with a sampling device. When constant conditions were attained, a sample was removed for titration with standard alkali. From this result, and by gas-liquid chroma- tography, the amounts of isoprene and the isopentenyl chlorides were determined. | SOURCE AND PURITY OF MATERIALS: (1) Hydrogen chloride was obtained by the action of concentrated sulfuric acid, and dried calcium chloride. (2) "All components for the prepara- tion of the initial mixtures were purified by rectification." Purity was stated to be greater than 99 per cent. |
|--|--|
| See the authors earlier paper (1). | ESTIMATED ERROR: |
| | REFERENCES: 1. Savich, T. O.; Dement'eva, V. Rajalo, G. Eesti NSV Tead. Akad. Toim. Keem. Geol. <u>1977</u> , 26, 83. |

| COMPONENTS : | ORIGINAL MEASUREMENTS: |
|---|---|
| <pre>(1) Hydrogen chloride; HCl; [7647-01-0]</pre> | Volens, T.; Rajalo, G. |
| (2) 2,3-Dimethyl-1,3-butadiene; C ₆ H ₁₀ ; [513-81-5] | Eesti NSV Tead. Akad. Toim. Keem. <u>1981</u> , 30 (2), 136 - 137. |
| VARIABLES: | PREPARED BY: |
| | H. L. Clever |
| EXPERIMENTAL VALUES: | |
| The title of the paper is "Equilibriu Systems reacting with it consisting o methylbutadiene hydrochlorides." | |
| The compiler assumes the title compound [513-81-5] however, 2-methyl -1,3-pen | nd is 2,3-dimethy1-1,3-butadiene tadiene [1118-58-7]is also possible. |
| Numerical data were not given. By usi related Henry's constant, K/atm, to t methyl-1,3-butadiene mole fraction, x | the temperature, T/K , and the 2.3-di- |
| ln (K/atm) = 8.26 - 1540 | $/(T/K) + 0.997 x_2.$ |
| The enthalpy of solution of hydrogen approximated from the temperature coe $-12.8 \text{ kJ mol}^{-1}$ (-3.06 kcal mol $^{-1}$). | chloride in the hydrocarbon can be fficient of the Henry's constant as |
| | |
| | |
| AUXILIARY | INFORMATION |
| METHOD/APPARATUS/PROCEDURE: | SOURCE AND PURITY OF MATERIALS: |
| Dried HCl was passed via a flowmeter into a jacketed bubbler tube reactor fitted with a sampling device. When Constant conditions were attained, a sample was removed for titration with standard alkali. From this result, and by gas-liquid chromoto- | Hydrogen chloride was obtained by the action of concentrated sulfuric acid and dry calcium chloride. "All components for the prepara- tion of the initial mixtures |
| graphy, the amounts of the butadiene and its hydrochlorides were determined. | were purified by rectification." Purity was stated to be greater than 99 per cent. |
| | ESTIMATED ERROR: |
| | |
| | REFERENCES: |
| | 1 |

| | | ORIGINAL MEASUREMENTS: | | | |
|--|---|---|----------------------|-------------------------------|------------------|
| | | Scher, M.; Gill, W. N.; Jelinek, R. V. | | | |
| (2) 1-Hexadecene; C ₁₆ H ₃₂ ; [629-73-2] | | Ind. Eng. 2, 107 - 1 | Chem., Fund 12. | am. <u>1963</u> , | |
| | | | | | |
| VARIABLES: | | | PREPARED BY: | | |
| | <pre>%: 298.15 - 328.15 ba: 23.33 - 99.99 (175 - 750 mmHg</pre> |) | | W. Gerrar | ď |
| EXPERIMENTAL | VALUES: | | | | |
| | | Number of Points | Percent Mean | Mol Fraction x_1 | |
| | K'/mmHg dm ³ mol ⁻¹ | K/mmHg | | Deviation | L : |
| 298.15 303.15 | 6000 6990 | 21,310 24,470 | 5 7 | ±1.0 ±1.4 | 0.0357 0.0311 |
| 313.15 | 7920 | 27,600 | 13 | ±1.6 | 0.0275 |
| 328.15 | 8680 | 29,820 | 4 | ±2.1 | 0.0255 |
| Henry's d | constants: | | | | |
| K'/mmHg ć | $im^3 mol^{-1} = (p_1/mmHg)$ |)/(c./mo] | L dm ⁻³) | | |
| 1 | - | ,, ,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,, | , | | |
| i | $(p_1/mmHg)/x_1$ | _ | | | |
| The compi kPa (760 | ler calculated the mmHg). | mole frac | ction solub | ility value | at 101.325 |
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| | | AUXILIARY | INFORMATION | | |
| | ATUS/PROCEDURE: | n on | | PURITY OF MATE en chloride | |
| apparatus | lity was measured in designed to determine | n an ne the | | ed at high | |
| | te of catalyzed hyd on of 1-hexadecene | | | air temper led into st | |
| presence c | of ferric chloride. | The | | system. | orage and |
| | gas absorbed by the increasing pressure | | (2) 1-Heya | decene. Pu | rified by |
| 175 - 750 | mmHg, was measured. | The | reflux | ing with po | tassium for |
| | solubility values a in a graph. The Her | | | rs, and the um, and sto | n distilled in |
| | were tabulated. | mry 5 | nitrog | • | |
| The heat of solution was stated to | | ESTIMATED EN | 202. | | |
| be -3.00 kcal mol ⁻¹ (-12.55 kJ mol ⁻¹) | | ESTIMATED EF | KKOK: | | |
| at 303 K and -0.20 kcal mol ⁻¹ (0.84 kJ mol ⁻¹) at 328 K. | | | | | |
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| | | | REFERENCES: | | |
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| COMPONENTS: | EVALUATOR: |
|---|--|
| <pre>1. Hydrogen Chloride; HCl; [7647-01-0]</pre> | Peter G. T. Fogg Department of Applied Chemistry and Life Sciences, |
| 2. Aromatic Hydrocarbons | Polytechnic of North London, Holloway, London, N7 8DB, U.K. January 1989 |

CRITICAL EVALUATION:

The Solubility of Hydrogen Chloride in Aromatic Hydrocarbons.

The solubility of hydrogen chloride in benzene was measured over a pressure range by Saylor (1) and by O'Brien *et al.*(2). Approximate values of the solubility at a partial pressure of 101.3 kPa were estimated by the evaluator by use of the Krichevskii-Il'inskaya equation. Measurements were made at a total pressure equal to barometric pressure by Knight & Hinshelwood (3), Bell (4), Parande *et al.*(5), Chesterman (6) and by Zetkin *et al.*(7). Data by Paranda *et al.* differ by a factor of about 100 from other data and should be rejected. The solubility reported by Chesterman is high compared with values given by other workers and should be rejected because the method used may be unreliable. Mole fraction solubilities at a partial pressure of 101.35 bar fit the equation: $\ln x_{\rm HCl} = -358.42 + 17853.6 / (T/K) + 51.818 \ln (T/K)$

The standard deviation in values of x_{HCl} is 0.00312. This equation is based upon measurements made from 283.15 K^{HCl} to 323.15 K.

The solubility in benzene saturated with water was measured over pressure ranges below 101.3 kPa by Wynne-Jones (8) at 298.15 K and by Saylor (1) at 303.15 K. Extrapolation to a partial pressure of 101.3 kPa and comparison with the mole fraction solubility in dry benzene given by the above equation indicate an apparent increase in the mole fraction solubility from addition of water in the first case and an apparent decrease in the second case. However the difference between solubilities in benzene saturated with water and those in dry benzene are less than those between different values for solubility in dry benzene.

The solubility in methylbenzene was measured by Bell (4), by Parande *et al.*(5) and by Mirsaidov *et al.*(9) at barometric pressure, by O'Brien & Bobalek (10) at pressures to 28 kPa and by Brown & Brady (11) at pressures to 0.8 kPa. Measurements by Parande *et al.* should again be rejected because they are grossly out of line with other data. Extrapolation of measurements by O'Brien to a partial pressure of 101.3 kPa by use of a Krichevskii-Il'inskaya equation indicates a mole fraction solubility at 298.15 K of 0.0428. This is in contrast to the lower value of 0.0334 from measurements by Mirsaidov *et al.* Four values of mole fraction solubilities at a partial pressure of 101.3 kPa estimated by the evaluator from measurements by Bell, by Mirsaidov *et al.* and by O'Brien & Bobalek in the temperature range 273.15 K to 298.15 K fit the equation : $\ln x_{\rm HCl} = -9.383 + 1837/(T/X)$

The standard deviation in values of x_{HC1} is 0.006.

Measurements by Brown and Brady at 194.64 K were at low pressures and reliable extrapolation to 101.3 kPa is not possible.

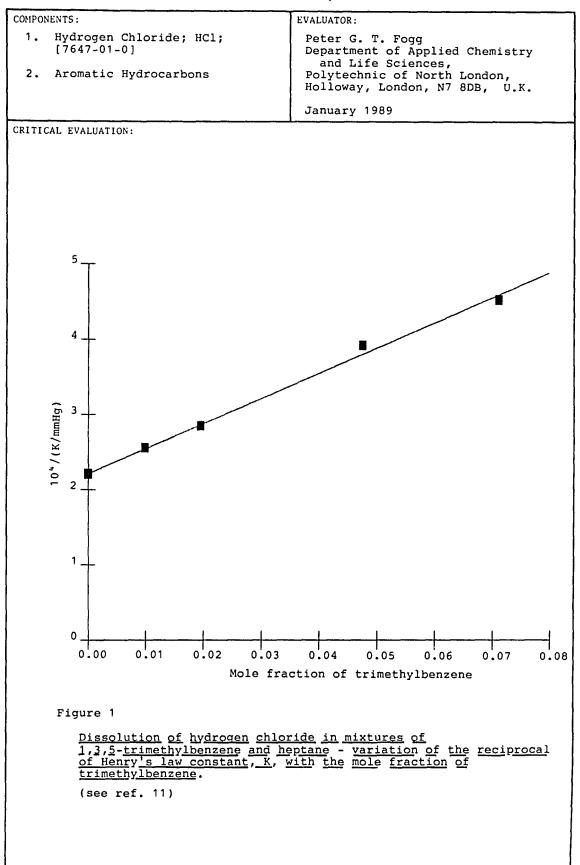
Solubilities in the three dimethylbenzenes at a total pressure equal to barometric pressure were measured over temperature ranges by Ahmed, Gerrard and Maladkar (12). These can be accepted on a tentative basis but no other measurements in pure dimethylbenzenes are available for comparison.

Mole fraction solubilities at 298.15 K and a partial pressure of gas of 101.3 kPa are, according to the data discussed above, in the order: benzene (0.0366) < methylbenzene (0.0399) < 1,2-dimethylbenzene (0.0515) < 1,4-dimethylbenzene (0.0529) < 1,3-dimethylbenzene (0.0570)</p>

This series is close to that found by Brown & Brady except that the order of 1,2- and 1.4-dimethylbenzene is reversed. These authors measured the solubility of hydrogen chloride at 194.64 K and pressures to 0.84 kPa (6.4 mmHg) in mixtures of organic compounds (mostly aromatic) and methylbenzene in the ratio 4.515 moles to 44.96 moles. Similar measurements at the same temperature were also made of the solubility in mixtures of organic compounds and heptane. In this case measurements were carried out up to a pressure of 9.6 kPa (72 mmHg). Henry's constants, K, based on measurements at low pressures, were defined as:

$K = P_{HC1}/x_{HC1}$

Values of K/mmHg are given in brackets. (The higher the value of K the lower is the mole fraction solubility at a fixed pressure.) COMPONENTS: EVALUATOR: Peter G. T. Fogg Hydrogen Chloride; HCl; 1. Department of Applied Chemistry [7647-01-0] and Life Sciences, Polytechnic of North London, 2. Aromatic Hydrocarbons Holloway, London, N7 8DB, U.K. January 1989 CRITICAL EVALUATION: Relative solubilities of HCl in mixtures containing methylbenzene and another solvent in the ratio 44.96 moles to 4.515 moles : heptane (335) < (trifluoromethyl)-benzene (332) = tetrachlorethene (332)</pre> < chlorobenzene (318) < thiophene (316) < benzene (308) < 1-octene (306)</pre> < [methyl benzene] (299) < 1,4-dimethylbenzene (294) < cyclohexene (290) < 2,4,4-trimethyl-2-pentene (288) = 2,4,4-trimethyl-1-pentene (288) < 1,2-dimethylbenzene (286) < 1,3-dimethylbenzene (278) < 1,2,4-trimethylbenzene (272) < 1,2,3-trimethylbenzene (265) < 1,3,5-trimethylbenzene (254) < 1,2,3,4-tetramethylbenzene (250)</pre> < 1,2,3,5-tetramethylbenzene (246) Relative solubilities in mixtures containing heptane and another solvent in the ratio 32.57 moles to 1.629 moles : [heptane] (4520) < trifluoromethylbenzene (4220) < chlorobenzene (4000) < benzene (3500) < fluorobenzene (3260) < methylbenzene (3170)</pre> < 1,3-dimethylbenzene (2980) < trimethylbenzene (2550) Relative solubilities in mixtures containing heptane and another solvent in the ratio 32.67 moles to 2.5 moles : [heptane] (4520) < iodobenzene (3750) < bromobenzene (3660) < chlorobenzene (3570) < fluorobenzene (3260) < methylbenzene (2790)
< ethylbenzene (2680) < (1-methylethyl)-benzene (2490)</pre> < 1,3-dimethylbenzene (2460) < (2-methylpropyl)-benzene (2380) < 1,3,5-trimethylbenzene (2210) The solubility of hydrogen chloride was also measured at two other concentrations of 1,3,5-trimethylbenzene in heptane. A plot of the reciprocal of the Henry's law constant against the mole fraction of 1,3,5-trimethylbenzene in the mixture lies close to a straight line (see fig. 1) The data presented by Brown and Brady are self-consistent and appear to be reliable and enable useful comparisons with measurements of solubilities in single solvents at higher temperatures. The two authors explained the orders for the aromatic compounds indicated above in terms of relative basicities of aromatic nuclei and showed that there was good correlation with other measures of relative basicities. REFERENCES 1. Saylor, J. H. J. Am. Chem. Soc. 1937, 59, 1712-1714. O'Brien, S. J.; Kenny, C. L.; Zeurcher, R. A. J. Am. Chem. Soc. 1939, 61, 2. 2504-2507.; O'Brien, S. J. J. Am. Chem. Soc. 1941, 63, 2709-2712. Knight, R. W.; Hinshelwood, C. N. J. Chem. Soc. 1927, 466-472. 3. 4. Bell, R. P. J. Chem. Soc. <u>1931</u>, 1371-1382. 5. Parande, M. G.; Kshirsagar, S. N.; Deshpande, A. B. Pet. Hydrocarbons 1969, 4, 17-18. 6. Chesterman, D. R. J. Chem. Soc. 1935, 906-910. Zetkin, V. I.; Kosorotov, V. I.; Stul, B. Ya.; Dzhagatspanyan, R. V. Khim. Prom. <u>1971</u>, 47, 102-103. 7. Wynne-Jones, W. F. K. J. Chem. Soc. 1930, 1064-1071. 8. Mirsaidov, U.; Dzhuraev, Kh. Sh.; Semenenko, K.N. Dokl. Akad. Nauk. 9. Tadzh. SSR 1975, 18, 30-31. O'Brien, S. J.; Bobalek, E. G. J. Am. Chem. Soc. 1940, 62, 3227-3230. 10. Brown, H. C.; Brady, J. D. J. Am. Chem. Soc. 1952, 74, 3570-3582. 11. 12. Ahmed W.; Gerrard W.; Maladkar, V. K. J. Appl. Chem. 1970, 20, 109-115.



| COMPONENTS: | ORIGINAL MEASUREMENTS: |
|--|---|
| <pre>(1) Hydrogen chloride; HCl; [7647-01-1]</pre> | Knight, R. W.; Hinshelwood, C. N. |
| (2) Benzene; C ₆ H ₆ ; [71-43-2] | J. Chem. Soc. <u>1927</u> , 466 - 472. |
| VARIABLES: T/K: 293.15 Total P/kPa: 101.325 | PREPARED BY: W. Gerrard |
| EXPERIMENTAL VALUES: | |
| T/K Total So Pressure p/mmHg | g dm ⁻³ |
| K. He estimates the pa above the solution to a linear change of mol chloride with change i (689 - 760 mmHg). The | 16.80 16.76 16.82 16.74 16.79 16.81 16.80 16.80 av. |
| | |
| AUXILIARY | INFORMATION |
| METHOD/APPARATUS/PROCEDURE: The apparatus was a straight tube fitted with a gas inlet tube, and a capillary syphon tube for the with- drawal of samples of solution for chemical analysis. After the gas had been passed for many hours at 293.15 K, a sample of solution was allowed to pass into alkali, and the excess of the latter was back titrated. The total pressure in the absorption vessel was atmospheric. | standard. Purified and fraction- ated through a 6-foot column. M.p. 278.63 K. |

| COMPONENTS: (1) Hydrogen chloride; HCl; [7647-01-0] | ORIGINAL MEASUREMENTS: Bell, R. P. |
|--|---|
| (2) Aromatic hydrocarbons; $C_6^{H_6}$ and $C_7^{H_8}$ | J. Chem. Soc. <u>1931</u> , 1371 - 1382. |
| VARIABLES: T/K: 293.15 P/kPa: 101.325 (1 atm) | PREPARED BY: W. Gerrard |
| EXPERIMENTAL VALUES: | |
| T/K Partitic Coefficie c1,2/c1 | ent r. |
| Benzene; C ₆ H ₆ ; | [71-43-2] |
| 293.15 11.05 | 0.0425 |
| Methyl benzene C ₇ H ₈ ; [108-88- | or toluene; 3] |
| 293.15 11.9 | 0.0507 |
| The ideal gas concen | tration at $p_1 = 1$ atm |
| is $c_{1,a}/mol dm^{-3} = n$ | - |
| | |
| AUXILIARY | INFORMATION |
| METHOD/APPARATUS/PROCEDURE: | SOURCE AND PURITY OF MATERIALS: |
| The apparatus consisted of a 50 cm ³ bulb extended at the top as a graduated tube, and sealed at the bottom to a capillary U-tube. The liquid was saturated with gas at | (1) Hydrogen chloride. Prepared by dropping pure concentrated hydrochloric acid into pure sulfuric acid. (2) Aromatic hydrocarbons. Good |
| displaced from the saturated solu- tion by a current of dry CO ₂ free | specimens were dried over calcium chloride, and distilled. Boiling points are given in |
| air, absorbed in water, and titrated with a solution of NaOH. | paper. |
| The solubility, $c/mol dm^{-3}$, was converted to a partition coefficient by dividing by the ideal gas con- | ESTIMATED ERROR: |
| centration of HCl in the gas phase. | $\delta T/K = 0.01$ $\delta c/c = 0.01$ |
| The mole fraction solubility was calculated on the assumption that the density of the solution obeys the ideal mixture law. | REFERENCES : |
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| COMPONENTS : | | ORIGINAL MEASUREMENTS: |
| <pre>(1) Hydrogen chloride; HCl; [7647-01-0]</pre> | | Chesterman, D. R. |
| (2) Benzene; C ₆ H ₆ ; [71-43-2] | | J. Chem. Soc. <u>1935</u> , 906 - 910. |
| (2) Benzene, C6n6, [/1-45-2] | | |
| | | |
| VARIABLES: T/K: 298.15 | | PREPARED BY: |
| Total P/kPa: 101 (~1 atm) | | W. Gerrard |
| EXPERIMENTAL VALUES: | | |
| | | |
| Pres | erved Solubil ssure g HCl g ⁻¹ mHg | ity Mol Fraction Solution x _l |
| 298.15 76 | 57 0.0 | 2 0.042 |
| The mole fraction solubility value was calculated by the compiler. | | |
| AUXILIARY INFORMATION | | |
| METHOD APPARATUS/PROCEDURE: | <u></u> | SOURCE AND PURITY OF MATERIALS: |
| The apparatus was that conductivity. A sample saturated solution was weighed, the hydrogen reacted with excess st which was back titrate standard acid solution | e of the s removed, chloride was candard base ed with a | (1) Hydrogen chloride. Prepared from conc. sulfuric acid and pure sodium chloride. Passed through sulfuric acid and over P205. (2) Benzene. Was stated to be the purest obtainable. Dried with sodium and distilled. B.p./°C (767 mmHg) = 79.5 - 80.0 |
| | | ESTIMATED ERROR: |
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| | | REFERENCES : |
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| COMPONENTS : | | | ORIGINAL MEASUR | EMENTS: | |
|--|--|---|--|---|--|
| (1) Hydrogen c | hloride. H | _ | | | |
| [7647-01-0 | | | Saylor, J. H. | | |
| (2) Benzene; C | C _{6^H6; [71-4} | 13-2] | J. Am. Chem 1712 - 1714 | . Soc. <u>1937</u> , 59, · | |
| VARIABLES: | | | PREPARED BY: | | |
| | (1.5 - 5 | 75.994 70 mmHg) | | W. Gerrard | |
| EXPERIMENTAL VALUES | 5: | | | | |
| T/K | Pressure | Molality | Mole Ratio | Mol Fraction | |
| | ₽1∕mmHg | m _l /mol kg ⁻¹ | n_1/n_2 | <i>x</i> 1 | |
| p1. | le ratio an | - | | 0.0000468 0.00172 0.00133 0.00304 0.00858 0.0132 0.0145 0.0210 0.0226 0.0230 0.027 - 0.029) ¹ Thin plot of $x_1 vs$. Here calculated by the | |
| | | | | | |
| | | AUXILIARY | INFORMATION | | |
| METHOD/APPARATUS/PI The apparatus of bulbs which an The lower bulb, contains the s space. The upped cm ³ capacity, of The solvent in saturated with dry gas through are then "part tap opened, and put in a thermo The tap is clos upper bulb is of and titrated. The sure is calcula volume and num A weighed solut moved for the t | consists of ce separate 200 cm ³ of solvent and er bulb, 29 contains t the lower HCl by but h the solve tially evac d the whole ostat for 5 sed. The HCl parated from to ber of mole tion sample lower bulb | ed by a tap. capacity, l some gas 92.6 ± 0.02 the gas. bulb is obling the ent. The bulb cuated", the e apparatus 5 to 7 days. Cl in the vely removed rtial pres- the bulb es of HC1. e is re- | <pre>(1) Hydrogen generate good gra (2) Benzene. Kahlbaum distilla sodium. B ESTIMATED ERRON REFERENCES:</pre> | <pre>ITY OF MATERIALS: h chloride. The HCl was ed from sulfuric acid and hde ammonium chloride. . Both Baker Analyzed and n. Purified by fractional ation, and stored over R:</pre> | |

| COMPONENTS: | | | IGINAL MEASUREN | | | |
|--|---|--|--|--|--|--|
| (1) Hydrogen chlor [7647-01-0] | ride; HCl; | | 'Brien, S. J eurcher, R. J | .; Kenny, C. L.; A. | | |
| (2) Benzene; C ₆ H ₆ | ; [71-43-2] | | J. Am. Chem. Soc. <u>1939</u> , 61, 2504 - 2507. | | | |
| | <u></u> | | | | | |
| VARIABLES: T/K: 298 | 15 | PR | EPARED BY: | | | |
| P/kPa: 2.6 | | .m) | ₩. | Gerrard | | |
| EXPERIMENTAL VALUES: | | | | | | |
| Т/К | Pressure Mc p ₁ /atm m ₁ / | lality mol kg ⁻¹ | | Mol Fraction $\frac{x_1}{2}$ | | |
| 298.15 | 0.026 0 | .014 | 0.00109 | 0.00109 | | |
| | | .040 | 0.00312 | 0.00311 | | |
| | | .047 | 0.00367 | 0.00365 | | |
| | | .048 | 0.00374 | 0.00373 | | |
| | |).096).112 | 0.00749 | 0.00743 0.00866 | | |
| | |).191 | 0.0149 | 0.0147 | | |
| | | .273 | 0.0213 | 0.0209 | | |
| | (1.00 | | | 0.0310)1 | | |
| | | | | | | |
| | AU | XILIARY IN | FORMATION | · · · · · · · · · · · · · · · · · · · | | |
| METHOD/APPARATUS/PROCE The method and ap identical to thos The main differen 1 to 2 day instea equilibration tim The apparatus con which are separat solvent is partia | paratus are al e of Saylor (] ce is the use d of a 5 to 7 e. sists of two h ed by a tap. lly saturated | Lmost (of a day oulbs The with | Hydrogen chemicall chloride Dried by | Y OF MATERIALS: chloride. Prepared from y pure potassium and sulfuric acid. phosphorus pentoxide. Eastman Kodak Co. eceived. | | |
| the gas, and the the lower bulb. partially evacuat and the whole app | The bulbs are ed, the tap op aratus put in | pened, | STIMATED ERROR: | ······································ | | |
| thermostat from 1 | το 2 days. | | | | | |
| The tap is closed upper bulb is qua and titrated with partial pressure the bulb volume a moles of HCl assu | ntitatively re NaOH. The HO is calculated nd the number | emoved Cl from R of | EFERENCES: 1. Saylor, J | К = 0.02 | | |
| behavior. A weig is removed from t titrated with NaO | hed solution s he lower bulb | sample | J. Am. Ch 1712. | .em. Soc. <u>1937</u> , 59, | | |

| COMPONENTS : | • • | | ORIGINAL ME | |
|---------------------------------------|---------------------|--------------------------------------|--------------------|---|
| (1) Hydrogen ch | | HCl; | O'Brien, | S. J. |
| [7647-01-0] | | | I Am Ch | em. Soc. 1941, 63, |
| (2) Benzene; C | .H.: [71- | 43-21 | 2709 - 27 | |
| | 56, | | 2703 - 27 | 12. |
| | | |] | |
| | | | | |
| | | | | |
| VARIABLES: T/K: 3 | 303.15, 3 | 12 15 | PREPARED BY | · · |
| |).77 - 61 | | | W. Gerrard |
| | (5.8 - 46) | | | |
| | | | l | |
| EXPERIMENTAL VALUE | | | | Mal Decalder |
| | Pressure | - | Mol Ratio | |
| | P1 ^{/mmHg} | m _l /mol kg ⁻¹ | n_{1}/n_{2} | x1 |
| | | · | 0.0000 | |
| 303.15 | 47 65 | 0.0255 0.0364 | 0.0020 0.0028 | 0.0020 0.0028 |
| | 72 | 0.0396 | 0.0031 | 0.0031 |
| | 246 | 0.145 | 0.0113 | 0.0112 |
| l | 438 | 0.252 | 0.0197 | 0.0193 |
| | 463 | 0.263 | 0.0205 | 0.0201 |
| | 1760 | | | 0.0306) |
| 1 | (760 | | | 0.0306)1 |
| 313.15 | 5.8 | 0.0026 | 0.000203 | 0.000203 |
| | 12.3 | 0.0061 | 0.00048 | 0.00048 |
| | 17.0 | 0.0074 | 0.00058 | 0.00058 |
| | 22.4 | 0.0110 | 0.00086 | 0.00086 |
| | 46.7 | 0.0204 | 0.00159 | 0.00159 |
| | 48.8 | 0.0221 | 0.00172 | 0.00172 0.00221 |
| | 56.2 108 | 0.0284 0.046 | 0.00222 0.00359 | 0.00358 |
| | 159 | 0.076 | 0.00593 | 0.00590 |
| | 247 | 0.107 | 0.00835 | 0.00827 |
| | | | | 0.0214) |
| | (760 | | | 0.0214)1 |
| | | | | the entry 1 w |
| · A graphi | ical extr | apolation of the | ne plot of | the actual x_1 |
| (760 mm) | | ves the stated | value ioi | 101.323 KFd |
| (700 1111 | | | | |
| | | | THEODULARTON | |
| | | AUXILIARY | INFORMATION | |
| METHOD/APPARATUS/P | ROCEDURE : | | SOURCE AND | PURITY OF MATERIALS: |
| | | | (1) Hydro | gen chloride. Prepared |
| Saylor (1) as r | | | | chemically pure potassium |
| al. (2) . The ruse of a 1 to 2 | | | | ide and sulfuric acid. |
| 7 day equilibra | ation tim | e. | DITEU | al husehusing bencoving. |
| | | | (2) Benze | ene. Stored over sodium. |
| The apparatus of | consists | of two bulbs | | lled before use; m.p. |
| which are separ | rated by | a tap. The | 278.6 | 3 K. |
| solvent is part | cially sa | turated with | 1 | |
| the gas, and the lower bulb. | | | | |
| partially evacu | | | 1 | |
| and the whole a | apparatus | put in a | | |
| thermostat from | | | ESTIMATED I | ERROR: |
| | ·· | 101 da 11 - | 1 | $\delta T/K = 0.02$ |
| The tap is close | | | | |
| upper bulb is of and titrated with | | | 1 | |
| partial pressu | | | REFERENCES | • |
| the bulb volume | e and the | number of | | - |
| moles of HCl as | ssuming i | deal gas | | or, J. H. A. Chem. Soc.1937, 59, 1712. |
| behavior. A we | eighed so | lution sample | | |
| is removed from titrated with N | | er buib and | | en, S. J.; Kenny, C. L. |
| LICIACEU WITH I | aun. | | | ther, R. A. |
| 1 | | | J. Am | n. Chem. Soc. <u>1939</u> , 61, 2504. |
| | | | 1 | |

| COMPONENTS : | | | ORIGI | NAL MEASURE | MENTS: | <u> </u> |
|--|---|--|--|---|------------------------------------|--|
| (1) Hydrogen c [7647-01-0 | | Cl; | Parande, M. G.; Kshirsagar, S. N.; Deshpande, A. B. | | | |
| (2) Benzene; C | 6 ^H 6; [71-4 | 3-2] | Pet. Hydrocarbons <u>1969</u> , 4, 17 - 18. | | | |
| | | | | · · · · · · · · · · · · · · · · · · · | | |
| VARIABLES: | K: 301.15 | - 328.15 | PREPA | RED BY: | | |
| HCl P/kP | a: 53.33 - (400 - | 80.53 604 mmHg) | | Г | . Gerrard | |
| EXPERIMENTAL VALUE | S: | | | | *,***** | |
| Т/К | Total Pressure p _t /mmHg | | 1 Se | g cm ⁻³ | Mol Frac Experiment Pressure | |
| 301.15 | 714 | 604 | 0 | .0001786 | 0.000439 | 0.000552 |
| 308.15 | 714 | 569 | 0 | .0001380 | 0.000342 | 0.000457 |
| 318.15 | 714 | 490 | 0 | .0001104 | 0.000278 | 0.000431 |
| 328.15 | 714 | 400 | 0 | .0000781 | 0.000199 | 0.000378 |
| The mol | e fraction | ity of pure s solubility a a linear cha | t on | e atm HCl | was obtained | - |
| | | AUXILIARY | INFOR | ATION | | |
| METHOD/APPARATUS/P | ROCEDURE : | | SOURC | E AND PURIT | Y OF MATERIALS: | |
| Dry hydrogen c into about 500 was in a three with a stirrer stated to be a The passage of stopped; the 1 "some more tim gas; a 5 cm ³ s removed for an | cm ³ of so -necked fl . The pres tmospheric gas appea iquid was e" to remo ample of s | <pre>lvent which ask fitted sure was . red to be stirred for ve excess olution was</pre> | | pure grad added dro sulfuric Benzene. ically pu | | ic acid was mically pure iven. Chem- |
| The liquid was m at the next controlled by another sample titration. | higher tem a thermost | perature, at, and | | ATED ERROR: | | |
| | | | | | | |

.

| Hydrogen Chloride in | Non-Aqueous Solvents 63 |
|--|--|
| COMPONENTS : | ORIGINAL MEASUREMENTS: |
| <pre>(1) Hydrogen chloride; HCl; [7647-01-0]</pre> | Zetkin, V. I.; Kosorotov, V. I.; Stul, B. Ya.; Dzhagatspanyan, R. V. |
| (2) Benzene; C ₆ H ₆ ; [71-43-2] | Khim. Prom. <u>1971</u> , 47, 102 - 103. |
| | Soviet Chem. Ind. <u>1971</u> , 3, 89 - 90. |
| VARIABLES: | PREPARED BY: |
| T/K = 283.15 - 323.15 p/kPa = 101.325 (1 atm) | W. Gerrard (smoothed data calculated by H.L. Clever) |
| EXPERIMENTAL VALUES: Temperature | Mol Fraction |
| t/°C T/K | |
| 10 283.15 | |
| 20 293.15 30 303.15 | |
| 40 313.15 | 5 0.0224 |
| 50 323.15 | 5 0.0162 |
| The measurements appear to have been one atm. | carried out at a total pressure of |
| Smoothed Data: For use between 283.] | L5 and 323.15 K |
| $\ln x_1 = 34.3060 - 39.2708/(T)$ | ′100 K) - 22.4004 ln (T/100 K) |
| The standard error about the | regression line is 2.53 x 10^{-4} . |
| <i>T/K</i> N | Nol Fraction |
| | x_1 |
| 283.15 | 0.0563 |
| 293.15 298.15 | 0.0415 0.0356 |
| 303.15 | 0.0305 |
| 313.15 323.15 | 0.0223 0.0162 |
| | |
| | |
| | INFORMATION |
| METHOD/APPARATUS/PROCEDURE: Gas absorbed at atmospheric pressure | SOURCE AND PURITY OF MATERIALS: |
| as described by Zetkin and Kosorotov (1). The amount of gas absorbed was determined by a chemical titration. | (1) Hydrogen chloride. Self prepared from sodium chloride and concen- trated sulfuric acid. Dried with sulfuric acid. |
| The author fitted the data to the linear equation | (2) Benzene. Purity stated to be |
| $\log x_1 = -5.71 + 1270/(T/K)$ | greater than 99 %. Dried with calcium chloride. |
| However, the three constant equation above fits the data much better. The author's equation gives an | |
| enthalpy of solution of -5.8 k cal mol-1. | ESTIMATED ERROR: |
| | DEFENSIVE. |
| | REFERENCES: 1. Zetkin, V. I.; Kosorotov, V. I. <i>Zh. Fiz. Khim.</i> <u>1970</u> , 44, 830. |
| | |
| 1 | |

| ORIGINAL MEAS | SUREMENTS : | |
|--|--|---|
| Wynne-Jon | les, W. F. K | |
| J. Chem. | Soc. <u>1930</u> , | 1064 - 1071. |
| | | |
| PREPARED BY: | ···· | · |
| | W. Gerrard | |
| | | |
| izene Phase | Henry's Constant | Mole Fraction ¹ |
| /mol kg ⁻¹ | | (Benzene) x ₁ |
| 0.00213 0.00340 0.00423 0.00768 0.0110 0.0216 | 1390 1370 1350 1400 1420 1300 | 0.000166 0.000265 0.000330 0.000599 0.000858 0.00168 |
| n, as given is only 28.1 | by Randall | and Young (1). |
| | | |
| (1) Hydrog obtain acid sulfut (2) Benzer (3) Water | gen chloride ned by dropp (analytical ric acid. ne. Not sta [.] | e. The gas was ping hydrochloric grade) into ted. |
| ESTIMATED ER | ROR: δT/K = | |
| REFERENCES : | 0T/K = | |
| | Wynne-Jon J. Chem. J. Chem. PREPARED BY: PREPARED BY: PREPARED BY: prepare Phase prepare Phase $prepare Phaseprepare $ | Wynne-Jones, W. F. K J. Chem. Soc. <u>1930</u> , PREPARED BY: W. Gerrard p_2 (Benzene) p_1/m_1 0.00213 1390 0.00340 1370 0.00423 1350 0.00768 1400 0.0110 1420 0.0216 1300 HCl in benzene was call $l = (p_1/mmHg)/(m_1/mol k)$ both liquid phases, ar n, as given by Randall is only 28.1 mmHg (0.03) FINFORMATION SOURCE AND PURITY OF MATER (1) Hydrogen chloride obtained by droppi acid (analytical sulfuric acid. (2) Benzene. Not stated (3) Water. Not stated |

| nyurogen chionu | e in Non-Aqueous Solvents 65 |
|---|---|
| COMPONENTS : | ORIGINAL MEASUREMENTS: |
| <pre>(1) Hydrogen chloride; HCl; [7647-01-0]</pre> | Saylor, J. H. |
| (2) Water; H ₂ O; [7732-18-5] | J. Am. Chem. Soc. <u>1937</u> , 59, |
| (3) Benzene; C ₆ H ₆ ; [71-43-2] | 1712 - 1714. |
| VARIABLES: T/K: 303.15 | PREPARED BY: |
| P/kPa: 14.49 - 77.21 (109 - 579 mmHg) | W. Gerrard |
| EXPERIMENTAL VALUES: | |
| T/K Pressure Molalit | y Mole Ratio Mol Fraction |
| p _l /mmHg m _l /mol | $\frac{kg^{-1} n_1/n_3}{2} \frac{x_1}{2}$ |
| 303.15 109 0.057 | |
| 244 0.132 395 0.205 | 0.0160 0.0157 |
| 579 0.282 | |
| (760 | 0.0266)1 |
| is distinctly curved cond the highest pressure to 7 The mole ratio and mole f by the compiler. Water-saturated benzene. bubbling HCl into a mixtu of the benzene layer was | The actual plot of x_1 vs. p_1 ave upward. Extrapolation from 60 mmHg gives the value for x_1 . Fraction values were calculated The solution was prepared by are of water and benzene. A sample transferred to the apparatus hine the equilibrium vapor pressure |
| AUXILI | ARY INFORMATION |
| METHOD/APPARATUS/PROCEDURE: | SOURCE AND PURITY OF MATERIALS: |
| The apparatus consists of two glass bulbs which are separated by a tap The lower bulb, 200 cm ³ capacity, contains the solvent and some gas space. The upper bulb, 292.6 \pm 0.0 cm ³ capacity, contains the gas. | generated from sulfuric acid and a good grade ammonium chloride. (2) Water. No information. |
| The solution is placed in the lowe bulb. The bulbs are then"partially evacuated", the tap opened, and th whole apparatus put in a thermosta for 5 to 7 days. | distillation, and stored over sodium. |
| The tap is closed. The HCl in the upper bulb is quantitatively remove and titrated with carbonate free sodium hydroxide. The HCl partial pressure is calculated from the bu- volume and the number of moles of HCl. A weighed solution sample is removed from the lower bulb and titrated with carbonate free sodiu hydroxide. | δT/K = 0.02 alb REFERENCES: |
| | |

| COMPONENTS: (1) Hydrogen chlori [7647-01-0] (2) Methylbenzene c [108-88-3] | | ORIGINAL MEASUREMENTS: O'Brien, S. J.; Bobalek, E. G. J. Am. Chem. Soc. <u>1940</u> , 62, 3227 - 3230. |
|--|--|--|
| | 15 - 28.53 L - 214 mmHg) | PREPARED BY: W. Gerrard |
| | | |
| EXPERIMENTAL VALUES: T/K Press P1/m | | Henry's Mol Ratio Mol Fraction Constant $\frac{n_1}{2}$ $\frac{x_1}{1}$ |
| 21 | 0 0.119 4 0.137 | 2.16 0.00141 0.00141 2.02 0.00154 0.00153 2.09 0.00428 0.00426 2.06 0.0043 0.00429 2.07 0.0070 0.00696 2.11 0.0109 0.0108 2.05 0.0126 0.0124 2.09 av. 0.0444 $0.0425)^2$ |
| | | |
| | AUXILIARY | INFORMATION |
| METHOD/APPARATUS/PROCED | MIDE . | SOURCE AND PURITY OF MATERIALS: |
| The method and app Saylor (1) as modi al. (2). The main | aratus are those of fied by O'Brien <i>et</i> difference is the y instead of a 5 to n time. ists of two bulbs | f (1) Hydrogen chloride. Prepared from chemically pure potassium chloride and sulfuric acid. |
| solvent is partial the gas, and the s the lower bulb. T partially evacuate and the whole appa thermostat from 1 | ly saturated with olution added to he bulbs are | |
| The tap is closed. upper bulb is quan | ratus put in a | ESTIMATED ERROR: |

| P | |
|--|---|
| COMPONENTS: | ORIGINAL MEASUREMENTS: |
| <pre>(1) Hydrogen chloride; HCl; [7647-01-0]</pre> | Brown, H. C.; Brady, J. D. |
| <pre>(2) Methylbenzene or toluene; C₆H₅CH₃; [108-88-3]</pre> | J. Am. Chem. Soc. <u>1952</u> , 74, 3570 - 3582. |
| | |
| VARIABLES: T/K: 194.64 P/kPa: 0.504 - 0.836 (3.78 - 6.27 mmHg) | PREPARED BY: W. Gerrard |
| EXPERIMENTAL VALUES: | |
| T/K Pressure Equilibrium Mixtu | are Mol Fraction Henry's Constant |
| $\frac{p_1/mmHg}{n_1/mmOl} = \frac{1}{n_2/mmOl} \frac{1}{n_2/mmOl}$ | |
| 194.64 3.78 0.640 49.4 | |
| 4.84 0.824 49.4 6.27 1.061 49.4 | |
| | |
| | 299 ¹ (0.393 atm) |
| | alue should not be used indiscrimi- fraction for pressures greater than |
| | |
| | |
| AUXILIARY | INFORMATION |
| METHOD/APPARATUS/PROCEDURE: | SOURCE AND PURITY OF MATERIALS: |
| By means of high precision high vacuum equipment and procedure the change of the pressure of the gas phase due to absorption was accu- rately measured at 194.64 K. The mole fraction of hydrogen | (1) Hydrogen chloride. Not stated, but may be taken as of high quality. (2) Methylbenzene. Thoroughly attested as of high quality. Values of the boiling point |
| chloride in the liquid phase was calculated. The solubility was finally expressed as the Henry's constant, K/mmHg = HCl pressure/mole fraction. | and refractive index are in the paper. |
| Henry's constant is the pressure (numerically) at which $x_1 = 1$, and | ESTIMATED ERROR: |
| it may deviate widely from the reported value of $p_1^2 = 1.43$ atm | |
| (1087 mmHg), the vapor pressure of pure liquid hydrogen chloride at 194.64 K. | REFERENCES : |
| | |

| COMPONENTS: | ORIGINAL MEASUREMENTS: |
|--|--|
| <pre>(1) Hydrogen chloride; HCl; [7647-01-0]</pre> | Parande, M. G.; Kshirsagar, S. N.; Deshpande, A. B. |
| (2) Methylbenzene or toluene; C _{7^H8} ; [108-88-3] | Pet. Hydrocarbons <u>1969</u> , 4, 17 - 18. |
| VARIABLES: | PREPARED BY: |
| T/K: 300.15 - 328.15 HCl P/kPa: 78.93 - 90.66 (592 - 680 mmHg) | W. Gerrard |
| EXPERIMENTAL VALUES: | |
| T/K Total Approximate S Pressure HCl Pressure ¹ p _t /mmHg p ₁ /mmHg | olubility Mol Fraction x_1^2 g cm ⁻³ Experiment At One Pressure Atm |
| 300.15 712 680 0 | .0002759 0.000809 0.000904 |
| 308.15 712 665 0 | .0001980 0.000586 0.000669 |
| | .0001677 0.000502 0.000601 |
| 328.14 712 592 0 | .0001380 0.000423 0.000543 |
| ¹ The compiler calculated the approx subtracting the pure toluene vapor at the specified temperature. | imate HCl partial pressure by pressure from the total pressure |
| ² The mole fraction solubility value assuming the solubility represente solvent. The density of pure solv The mole fraction solubility at on compiler assuming a linear change | d g HCl with 1 cm ³ of pure ent was used at each temperature. e atm HCl was obtained by the |
| | |
| AUXILIARY | INFORMATION |
| METHOD/APPARATUS/PROCEDURE: | SOURCE AND PURITY OF MATERIALS; |
| Dry hydrogen chloride was bubbled into about 500 cm ³ of solvent which was in a three-necked flask fitted with a stirrer. The pressure was stated to be atmospheric. The passage of gas appeared to be | Hydrogen chloride. Chemically pure grade hydrochloric acid was added dropwise to chemically pure sulfuric acid. Methylbenzene. Chemically pure sample was distilled, and stored |
| stopped; the liquid was stirred for "some more time" to remove excess gas; a 5 cm ³ sample of solution was removed for an acid-alkali titration. | over sodium. |
| The liquid was then stirred 30 to 40 m at the next higher temperature, controlled by a thermostat, and another sample was removed for titration. | ESTIMATED ERROR: |
| | REFERENCES : |
| | |
| | |
| | |
| | 1 |

| nyarogen emonae m | Non-Addeods Solvents 09 |
|---|---|
| COMPONENTS: (1) Hydrogen chloride; HCl; [7647-01-0] | ORIGINAL MEASUREMENTS: Mirsaidov, U.; Dzhuraev, Kh. Sh.; Semenenko, K. N. |
| (2) Methylbenzene or toluene; C ₇ H ₈ ; [108-88-3] | Dokl. Akad. Nauk Tadzh. SSR <u>1975</u> , 18, 30 - 31. |
| VARIABLES: T/K = 273.15, 298.15 $p_1/kPa = 101.325 (1 atm)$ | PREPARED BY: W. Gerrard |
| EXPERIMENTAL VALUES: | |
| T/K Hydrogen Chloride Ma | ol Ratio Mol Fraction |
| w ₁ /wt% | n_1/n_2 x_1 |
| 273.15 2.8 298.15 1.3 | 0.0729 0.0679 0.0332 0.0322 |
| | |
| AUXILIARY | INFORMATION |
| METHOD /APPARATUS / PROCEDURE : | SOURCE AND PURITY OF MATERIALS: |
| Hydrogen chloride was passed into the liquid until the concentration remained constant. The amount dis- solved was determined by an alkali titration. The final pressure was presumably a total pressure equal to the atmospheric pressure. | |
| | ESTIMATED ERROR: |
| | REFERENCES : |
| | |

| [7647-01-0] (2) Various orga | | ounds | Brown J. Am | | EMENTS: rady, J. D. c. <u>1952</u> , 74 | |
|--|--|---|---|--|---|--|
| <pre>(3) Methylbenzen C7H8; [108-8</pre> | e, (tolue 8-3] | ene); | | | | |
| VARIABLES: T/K: 194.64 | | | PREPAI | RED BY: | | |
| p1/kPa: 0.1 | | 55 | | W. Gerrard | đ | |
| EXPERIMENTAL VALU Temperature = 194 | | | | | | |
| Component (2) | P/mmHg | - | ibrium mı: | | Mole Fraction | Henry's Constant |
| ····· | , <u> </u> | n ₁ /mmol | ⁿ 2 ^{/mmol} | n ₃ /mmol | ×1 | K/mmHg |
| Cyclohexene; | 1 74 | 0.303 | 4.515 | 44.96 | 0.00609 | 286 |
| C ₆ H ₁₀ ; [110-82-7] | 3.38 | 0.588 | | 44.96 | 0.01174 | 288 |
| | 5.70 | 0.995 | 4.515 | 44.96 | 0.01971 | 289 290 ¹ |
| | | | | | (0 | .382 atm) |
| Heptane; C ₇ H ₁₆ ; [142-82-5] | 2.25 | 0.334 | 4.515 | 44.96 | 0.00671 | 335 |
| -7.16/ (1.2.02.0) | 3.50 | 0.526 | 4.515 | 44.96 | 0.01052 | 333 |
| | 5.90 | 0.888 | 4.515 | 44.96 | 0.01763 | 335 3351 |
| 2 2 4 7 1 1 4 | | • | | | (0 | .441 atm) |
| 2,2,4-Trimethyl-1 C ₈ H ₁₆ ; [107-39-1] | -pentene; | 0.156 | 4.515 | 44.96 | 0.00314 | 287 |
| -8-167 (107 01 11 | 3.33 | 0.574 | 4.515 | 44.96 | 0.01147 | 290 |
| | 4.75 | 0.810 | 4.515 | 44.96 | 0.01611 | 295 2881 |
| | | | | | | |
| ¹ The authors' va linear. The He | nry's con | stant val | ue should | not be use | ed indiscrı | minately |
| | nry's con lues of m | stant val | ue should | not be use | ed indiscrı | minately |
| linear. The He to calculate va | nry's con lues of m d above. | istant val Nole fract | ue should ion for pi | not be use ressures gi | ed indiscrı reater than | minately the |
| linear. The He to calculate va maximum recorde | nry's con lues of m d above. | estant val hole fract the value | ue should ion for pi | not be use ressures g y's constan | ed indiscrı reater than | minately the |
| linear. The He to calculate va maximum recorde The compiler ca | nry's cor lues of m d above. lculated | AUXILIAR | ue should ion for pi s of Henry Y INFORMAT | not be use ressures g y's constan TION | ed indiscrı reater than | minately the mixtures. |
| <pre>linear. The He to calculate va maximum recorde The compiler ca METHOD/APPARATUS/ By means of high vacuum equipment change of the pre</pre> | nry's cor lues of m d above. lculated PROCEDURE precision and proce ssure of | AUXILIAR AUXILIAR | ue should ion for pr s of Henry Y INFORMA SOURCI (1) I | not be use ressures g y's constan FION E AND PURI Hydrogen cl | ed indiscri reater than nt for the TY OF MATER | minately the mixtures. IALS: |
| <pre>linear. The He to calculate va maximum recorde The compiler ca METHOD/APPARATUS/ By means of high vacuum equipment change of the pre phase due to abso</pre> | nry's con lues of m d above. lculated PROCEDURE precision and proce ssure of rption wa | AUXILIAR AUXILIAR | ve should ion for pr s of Henry Y INFORMAT (1) H (2,3) | not be use ressures g: y's constan FION E AND PURI Hydrogen cl but may be guality. Thorough | ed indiscri reater than nt for the TY OF MATER hloride. N taken as o ly attested | minately the mixtures. IALS: ot stated f high |
| <pre>linear. The He to calculate va maximum recorde The compiler ca METHOD/APPARATUS/ By means of high vacuum equipment change of the pre phase due to abso accurately measur The mole fraction chloride in the 1</pre> | nry's con lues of m d above. lculated PROCEDURE precision and proce ssure of rption wa ed at 194 of hydrc iquid pha | AUXILIAR AUXILIAR AUXILIAR the gas the gas the function the function | ue should ion for pr s of Henry Y INFORMAT (1) H (2,3) | not be use ressures gr y's constant FION E AND PURI Hydrogen ch but may be quality. Thorough high quality poiling poi | ed indiscri reater than nt for the TY OF MATER hloride. N taken as o | minately the mixtures. IALS: of stated of high as of of the fractive |
| <pre>linear. The He to calculate va maximum recorde The compiler ca METHOD/APPARATUS/ By means of high vacuum equipment change of the pre phase due to abso accurately measur The mole fraction chloride in the l calculated. The finally expressed</pre> | nry's con lues of m d above. lculated PROCEDURE precision and proce ssure of rption wa ed at 194 of hydrc iquid pha solubilit as the H | AUXILIAR AUXILIAR AUXILIAR c: high dure the the gas s. 64 K. ogen see was cy was lenry's | ve should ion for pr s of Henry Y INFORMAT (1) H (2,3) | not be use ressures gr y's constant FION E AND PURI Hydrogen ch but may be quality. Thorough high quality onling position | ed indiscri reater than nt for the TY OF MATER hloride. N taken as o ly attested ty. Values ints and re e given in | minately the mixtures. IALS: of stated of high as of of the fractive |
| <pre>linear. The He to calculate va maximum recorde The compiler ca METHOD/APPARATUS/ By means of high vacuum equipment change of the pre phase due to abso accurately measur The mole fraction chloride in the l calculated. The</pre> | nry's con lues of m d above. lculated PROCEDURE precision and proce ssure of rption wa ed at 194 of hydrc iquid pha solubilit as the H | AUXILIAR AUXILIAR AUXILIAR c: high dure the the gas s. 64 K. ogen see was cy was lenry's | ve should ion for pr s of Henry Y INFORMAT (1) H (2,3) | not be use ressures gr y's constant FION E AND PURI Hydrogen ch but may be quality. Thorough high quality poiling poi | ed indiscri reater than nt for the TY OF MATER hloride. N taken as o ly attested ty. Values ints and re e given in | minately the mixtures. IALS: of stated of high as of of the fractive |
| <pre>linear. The He to calculate va maximum recorde The compiler ca METHOD/APPARATUS/ By means of high vacuum equipment change of the pre phase due to abso accurately measur The mole fraction chloride in the 1 calculated. The finally expressed constant, K/mmHg fraction, p1/x1.</pre> | nry's con lues of m d above. lculated PROCEDURE precision and proce ssure of rption wa ed at 194 of hydrc iquid pha solubilit as the H = HCl pre | AUXILIAR AUX | ve should ion for pr s of Henry Y INFORMAT (1) H (2,3) | not be use ressures gr y's constant FION E AND PURI Hydrogen ch but may be quality. Thorough high quality onling position | ed indiscri reater than nt for the TY OF MATER hloride. N taken as o ly attested ty. Values ints and re e given in | minately the mixtures. IALS: of stated of high as of of the fractive |
| <pre>linear. The He to calculate va maximum recorde The compiler ca METHOD/APPARATUS/ By means of high vacuum equipment change of the pre phase due to abso accurately measur The mole fraction chloride in the 1 calculated. The finally expressed constant, K/mmHg fraction, p₁/x₁. Henry's constant (numerically) at</pre> | nry's con lues of m d above. lculated PROCEDURE precision and proce ssure of rption wa ed at 194 of hydro iguid pha solubilit as the H = HCl pre is the pr which x ₁ | AUXILIAR AUX | e ESTIMA | not be use ressures gr y's constant FION E AND PURI Hydrogen ch but may be quality. Thorough high quality onling position | ed indiscri reater than nt for the TY OF MATER hloride. N taken as o ly attested ty. Values ints and re e given in | minately the mixtures. IALS: of stated of high as of of the fractive |
| <pre>linear. The He to calculate va maximum recorde The compiler ca METHOD/APPARATUS/ By means of high vacuum equipment change of the pre phase due to abso accurately measur The mole fraction chloride in the l calculated. The finally expressed constant, K/mmHg fraction, p₁/x₁. Henry's constant (numerically) at it may deviate</pre> | nry's con lues of m d above. lculated PROCEDURE precision and proce ssure of rption wa ed at 194 of hydro iquid pha solubilit as the F = HCl pre is the pr which x1 widely | AUXILIAR AUX | e ESTIMA | not be use ressures g: y's constant FION E AND PURI Hydrogen cl but may be guality. Thorough high quality. Thorough high quality boiling poindices are ATED ERROR | ed indiscri reater than nt for the TY OF MATER hloride. N taken as o ly attested ty. Values ints and re e given in | minately the mixtures. IALS: of stated of high as of of the fractive |
| <pre>linear. The He to calculate va maximum recorde The compiler ca METHOD/APPARATUS/ By means of high vacuum equipment change of the pre phase due to abso accurately measur The mole fraction chloride in the 1 calculated. The finally expressed constant, K/mmHg fraction, p₁/x₁. Henry's constant (numerically) at</pre> | nry's con lues of m d above. lculated PROCEDURE precision and proce ssure of rption wa ed at 194 of hydro iquid pha solubilit as the F = HCl pre is the pr which x1 widely pi = 1.4 vapor | AUXILIAR AUXILIAR AUXILIAR AUXILIAR AUXILIAR AUXILIAR AUXILIAR AUXILIAR AUXILIAR AUXILIAR AUXILIAR AUXILIAR AUXILIAR AUXILIAR AUXILIAR AUXILIAR AUXILIAR AUXILIAR Composition | e ESTIMA | not be use ressures g: y's constant FION E AND PURI Hydrogen cl but may be guality. Thorough high quality. Thorough high quality boiling poindices are ATED ERROR | ed indiscri reater than nt for the TY OF MATER hloride. N taken as o ly attested ty. Values ints and re e given in | minately the mixtures. IALS: of stated of high as of of the fractive |

| <pre>COMPONENTS: (1) Hydrogen Chloride; HCl; [7647-01-0] (2) Various organic compounds (3) Methylbenzene, (toluene); C₇H₈; [108-88-3]</pre> | | ORIGINAL MEASUREMENTS: Brown, H. C.; Brady, J. D. J. Am. Chem. Soc. <u>1952</u> , 74, | | | | |
|---|----------------------|---|--------------|----------------------|--------------------|-------------------------------|
| | | ne); | 3570 - 3582. | | | |
| EXPERIMENTAL VALUE Temperature = 194. | | | | | <u> </u> | |
| Component (2) | P/mmHg | Equilibr | | | Mole Fraction | Henry's Constant |
| | | n ₁ /mmol n ₂ | 2/mmo1 | n ₃ /mmol | [×] 1 | K/mmHg |
| 2,4,4-Trimethy1-2- | pentene; | | | | | |
| C ₈ H ₁₆ ; [107-40-4] | 1.30 | 0.228 4. | 515 | 44.96 | 0.00459 | 283 |
| | 2.75 4.58 | | .515 .515 | 44.96 44.96 | 0.00953 0.01537 | 289 298 |
| | 4.50 | 01772 4 | . 51 5 | 41.00 | | 288 ¹ |
| 1-Octene; | | | | | (0 | .379 atm) |
| C ₈ H ₁₆ ; [111-66-0] | 1.95 | | 515 | 44.96 | 0.00637 | 306 |
| | 3.00 4.11 | | .515 .515 | 44.96 44.96 | 0.00975 0.01320 | 308 311 |
| | | | | | | 306¹ |
| Benzene; | | | | | (0 | .403 atm) |
| C ₆ H ₆ ; [71-43-2] | 1.90 | | 515 | 44.96 | 0.00629 | 302 |
| 0 0 | 3.67 | | .515 .515 | 44.96 | 0.01200 | 306 |
| | 5.80 | 0.947 4. | . 515 | 44.96 | 0.01880 | 309 3081 |
| | | | | | (0 | .405 atm) |
| 1,2-Dimethylbenzen C ₈ H ₁₀ ; [95-47-6] | 1.40 | 0.245 4. | .515 | 44.96 | 0.00493 | 284 |
| 8 107 1 | 3.65 | 0.636 4. | .515 | 44.96 | 0.01269 | 288 |
| | 5.15 | 0.902 4. | .515 | 44.96 | 0.01791 | 288 286 ¹ |
| | | | | | (0 | .376 atm) |
| 1,3-Dimethylbenzen C ₈ H ₁₀ ; [108-38-3] | le; (m-xy 1.99 | lene); 0.359 4. | 515 | 44.96 | 0.00720 | 276 |
| 8.10' [100 50 5] | 2.98 | 0.542 4. | .515 | 44.96 | 0.01084 | 275 |
| | 3.92 | 0.701 4. | .515 | 44.96 | 0.01397 | 281 2781 |
| | | | | | (0 | .366 atm) |
| 1,4-Dimethylbenzen | e; (p-xy | lene); | | | | |
| C ₈ H ₁₀ ; [106-42-3] | 2.34 | 0.402 4. 0.885 4. | .515 .515 | 44.96 44.96 | 0.00806 0.01757 | 290 295 |
| | 6.41 | 1.093 4. | 515 | 44.96 | 0.02161 | 297 |
| | | | | | (0 | 294 ¹ .387 atm) |
| 1,2,3-Trimethylben | zene, (h | emimellitene | e); | | (0 | .507 acm; |
| C ₉ H ₁₂ ; [526-73-8] | 2.88 | 0.545 4. | .515 | 44.96 | 0.01090 | 264 |
| | 4.45 5.61 | | .515 .515 | 44.96 44.96 | 0.01666 0.02107 | 267 266 |
| | | | - | | | 265 ¹ |
| 1,2,4-Trimethylber | zene (n | seudocumene | • | | (0 | .349 atm) |
| C ₉ H ₁₂ ; [95-63-6] | 3.36 | 0.623 4. | .515 | 44.96 | 0.01244 | 270 |
| 5 12 | 4.24 | | .515 | 44.96 | 0.01558 | 272 |
| | 5.49 | 1.011 4. | .515 | 44.96 | 0.02003 | 274 272 ¹ |
| | | | | | (0 | .358 atm) |
| ¹ The authors' val linear. The Hen to calculate val maximum recorded | ry's con ues of m | | should | not be use | d indiscri | minately |

The compiler calculated the values of Henry's constant for the mixtures.

| COMPONENTS: (1) Hydrogen Chlo | oride; HC | :1; | | AL MEASURE H. C.; Br | EMENTS: ady, J. D. | |
|--|--------------|----------------------|---------------------------------|---|-----------------------|--------------------------------|
| [7647-01-0] (2) Various organ | | | | J. Am. Chem. Soc. <u>1952</u> , 74, 3570 - 3582. | | |
| (3) Methylbenzene C ₇ H ₈ ; [108-88 | | ne); | 3570 - | 3582. | | |
| EXPERIMENTAL VALUE Temperature = 194. | | | I | | | |
| Component (2) | P/mmHg | Equili | ibrium mix | | Mole Fraction | Henry's Constant |
| | | n ₁ /mmol | ⁿ 2 ^{/mmol} | n ₃ /mmol | ^x 1 | K/mmHg |
| 1,3,5-Trimethylber | izene, (m | esitylene) |); | | | |
| C ₉ H ₁₂ ; [108-67-8] | 1.84 | 0.375 | 4.515 | 44.96 | 0.00752 | 245 |
| | 2.78 4.40 | 0.547 0.852 | 4.515 4.515 | 44.96 44.96 | 0.01094 0.01693 | 254 260 254 ¹ |
| | | | | | (0 | .334 atm) |
| 1,2,3,4-Tetramethy C ₁₀ H ₁₄ ; [488-23-3] | lbenzene | •, (prehnit 0.276 | tene); 4.515 | 44.96 | 0.00555 | 241 |
| 10 ⁿ 14 ⁱ [400-23-3] | 3.05 | 0.600 | 4.515 | 44.96 | 0.01198 | 255 |
| | 3.85 | 0.777 | 4.515 | 44.96 | 0.01553 | 248 |
| | | | | | (0 | 250 ¹ .329 atm) |
| 1,2,3,5-Tetramethy | lbenzene | . (isodure | ene): | | (0 | .329 atm) |
| C ₁₀ H ₁₄ ; [527-53-7] | 2.50 | 0.514 | 4.515 | 44.96 | 0.01028 | 243 |
| 10 14 | 3.61 | 0.733 | 4.515 | 44.96 | 0.01460 | 247 |
| | | | | | (0 | 246 ¹ .324 atm) |
| (Trifluoromethyl)b | enzene, | (benzotrif | fluoride): | | (0 | • JZ- ACIII) |
| C ₇ H ₅ F ₃ ; [98-08-8] | 2.24 | 0.335 | 4.515 | 44.96 | 0.00673 | 333 |
| , , , , | 3.50 | 0.530 | 4.515 | 44.96 | 0.01060 | 330 |
| | 5.43 | 0.824 | 4.515 | 44.96 | 0.01638 | 332 3321 |
| | | | | | (0 | .437 atm) |
| Chlorobenzene; | | | | | 0.00001 | 212 |
| C ₆ H ₅ Cl; [108-90-7] | 1.88 | 0.299 0.555 | 4.515 4.515 | 44.96 44.96 | 0.00601 0.01109 | 313 320 |
| | 5.53 | 0.861 | 4.515 | 44.96 | 0.01711 | 323 |
| | | | | | | 318 ¹ |
| Matriaghlanasthanas | | | | | (0 | .418 atm) |
| Tetrachloroethene; C ₂ Cl ₄ ; [127-18-4] | 1.54 | 0.233 | 4.515 | 44.96 | 0.00469 | 328 |
| 2214, [12,110 1] | 2.63 | 0.403 | 4.515 | 44.96 | 0.00808 | 325 |
| | 5.15 | 0.785 | 4.515 | 44.96 | 0.01571 | 328 |
| | | | | | (0 | 332 ¹ .437 atm) |
| Thiophene, (thiofu | ran); | | | | (0 | •457 atill) |
| C ₄ H ₄ S; [110-02-1] | 3.80 | 0.602 | 4.515 | 44.96 | 0.01202 | 316 |
| 7 7 | 4.92 | 0.783 | 4.515 | 44.96 | 0.01202 | 316 |
| | 5.89 | 0.939 | 4.515 | 44.96 | 0.01863 | 316 316 ¹ |
| (0.416 atm) | | | | | | |
| (100% Methylbenzen | | 0.640 | | 40 475 | 0 01070 | 207 |
| | 3.78 4.84 | 0.640 0.824 | - | 49.475 49.475 | 0.01278 0.01639 | 296 295 |
| | 6.27 | 1.061 | - | 49.475 | 0.02099 | 295 |
| | , | | | | | 2991 |
| | | | | | (0 | .392 atm) |
| | | | | | | |
| ¹ The authors' val | ue The | nlot of r | | a mala fr | action was | road ac |

¹ The authors' value. The plot of pressure *vs*. mole fraction was read as linear. The Henry's constant value should not be used indiscriminately to calculate values of mole fraction for pressures greater than the maximum recorded above.

The compiler calculated the values of Henry's constant for the mixtures.

| , , | |
|---|--|
| COMPONENTS: (1) Hydrogen chloride; HCl; [7647-01-0] (2) 1,1'-Oxybisethane or diethyl ether; $C_4H_{10}O$; [60-29-7] (3) Methylbenzene or toluene; C_7H_8 ; [108-88-3] VARIABLES: T/K = 273.15, 298.15 $p_1/kPa = 101.325$ (1 atm) | ORIGINAL MEASUREMENTS: Mirsaidov, U.; Dzhuraev, Kh. Sh.; Semenenko, K. N. Dokl. Akad. Nauk Tadzh. SSR <u>1975</u> , 18, 30 - 31. PREPARED BY: W. Gerrard |
| | |
| EXPERIMENTAL VALUES: | |
| T/K Ether Methylbenz | ene Ratio Hydrogen Chloride ² |
| n ₂ :n ₃ | $10^2 w_{\gamma}$ /wt% |
| | |
| 273.15 1:0 1:1 | 26.5 20.1 |
| 3:7 | 12.7 |
| 1:3 | 11.04 |
| 0:1 | 2.8 |
| 298.15 1:0 | 17.0 |
| 3:1 | 19.0 ¹ |
| 1:1 | 13.5 8 ¹ |
| 1:3 0:1 | 1.3 |
| compiler assumed this wa | s wergnt per cent. |
| AUXILIARY | INFORMATION |
| METHOD/APPARATUS/PROCEDURE: | SOURCE AND PURITY OF MATERIALS: |
| Hydrogen chloride was passed into the liquid until the concentration remained constant. The amount dis- solved was determined by an alkali titration. The final pressure was | (1) Hydrogen chloride. Obtained from its concentrated aqueous solution by treatment with concentrated sulfuric acid. |
| presumably a total pressure equal to the atmospheric pressure. | (2) 1,1'-Oxybisethane. Not stated. |
| | (3) Methyl benzene. Not stated. |
| | ESTIMATED ERROR: |
| | DEPENDING |
| | REFERENCES: |
| | |

| COMPONENTS : | ORIGINAL MEASUREMENTS: |
|---|--|
| 1. Hydrogen chloride; HCl; [7647-01-0] | Ahmed, W.; Gerrard, W.; Maladkar, V. K. |
| 2. 1,2-Dimethylbenzene; C ₈ H ₁₀ ; | J. Appl. Chem. 1970, 20, 109 - 115. |
| [95-47-6] | |
| | |
| VARIABLES: T/K: 253.15 - 293.15 | PREPARED BY: |
| Total P/kPa: 101.325 (1 atm) | W. Gerrard (smoothed data calculated by H.L. Clever) |
| EXPERIMENTAL VALUES: | |
| T/K Mol Ra | |
| | |
| 253.15 0.18 263.15 0.13 | |
| 273.15 0.10 | 3 0.0934 |
| 283.15 0.07 293.15 0.06 | |
| The mole fraction solubilities were ca | alculated from the mole ratio by the |
| compiler. | |
| Smoothed Data: $\ln x_{HC1} = -9.359 + 19$ | - |
| Standard error about | the regression line = 1.03×10^{-3} |
| T/K | Mol Fraction |
| | × _{HC1} |
| 253.15 263.15 | 0.159 0.119 |
| 273.15 283.15 | 0.0917 0.0717 |
| 293.15 | 0.0570 |
| | |
| | |
| | |
| | INFORMATION |
| METHOD /APPARATUS / PROCEDURE : | SOURCE AND PURITY OF MATERIALS: |
| Hydrogen chloride was passed into a known weight of liquid in a bubbler | Hydrogen chloride. Obtained from a cylinder containing a good com- |
| tube at a total pressure measured by | mercial specimen. Was dried by |
| a manometer assembly. The absorbed gas was weighed by re-weighing the | passage through concentrated sulfuric acid. |
| bubbler tube. The temperature was manually controlled to within 0.2 K. | 2. 1,2-Dimethylbenzene. Best |
| The procedure and apparatus are | obtainable specimen was suitably purified, dried, and fractionally |
| described by Gerrard (1,2). For temperatures below 268 K a | distilled, and attested. |
| chemical titration was conducted. | |
| | ESTIMATED ERROR: |
| | $\begin{array}{rcl} \delta T/K &= & 0.2 \\ \delta X/X &= & 0.015 \end{array}$ |
| | |
| | REFERENCES: |
| | <pre>1. Gerrard, W. J. Appl. Chem. Biotechnol. 1972, 22, 623 - 650.</pre> |
| | 2. Gerrard, W. "Solubility of Gases and Liquids" Plenum Press, New York, 1976 |
| | |

| COMPONENTS: | ORIGINAL MEASUREMENTS: | |
|--|--|--|
| <pre>1. Hydrogen chloride; HCl; [7647-01-0]</pre> | Ahmed, W.; Gerrard, W.; Maladkar, V. K. | |
| 2. 1,3-Dimethylbenzene; C ₈ H ₁₀ ; [108-38-3] | J. Appl. Chem. <u>1970</u> , 20, 109 - 115. | |
| | | |
| VARIABLES: | PREPARED BY: | |
| T/K: 203.15 - 293.15 | W. Gerrard | |
| Total P/kPa: 101.325 (1 atm) | (smoothed data calculated by H.L. Clever) | |
| | | |
| EXPERIMENTAL VALUES: T/K Mol R | | |
| ⁿ HC1/ ⁿ C | 8 ^H 10 XHC1 | |
| 203.15 1.45 | | |
| 213.15 0.95 | | |
| 223.15 0.60 233.15 0.38 | | |
| 243.15 0.27 | | |
| 253.15 0.19 | 5 0.163 | |
| 263.15 0.14 | | |
| 273.15 0.11 283.15 0.08 | | |
| 293.15 0.07 | | |
| The mole fraction solubilities were c compiler. | | |
| Smoothed Data: $\ln X_{ucl} = 9.261 - 6.7$ | 86/(T/100) - 9.026 ln (T/100) | |
| Standard error about | regression line = 1.42×10^{-2} | |
| | Mol Fraction | |
| _, | X _{HC1} | |
| 203.15 | 0.621 | |
| 213.15 | 0.471 | |
| 223.15 | 0.359 | |
| 233.15 243.15 | 0.275 0.212 | |
| 253.15 | 0.165 | |
| 263.15 | 0.129 | |
| 273.15 | 0.101 | |
| 283.15 293.15 | 0.0797 C.0632 | |
| | INFORMATION | |
| METHOD/APPARATUS/PROCEDURE: | SOURCE AND PURITY OF MATERIALS: | |
| Hydrogen chloride was passed into a | 1. Hydrogen chloride. Obtained from | |
| known weight of liquid in a bubbler | a cylinder containing a good com- | |
| tube at a total pressure measured by | mercial specimen. Was dried by | |
| a manometer assembly. The absorbed | passage through concentrated | |
| gas was weighed by re-weighing the bubbler tube. The temperature was | sulfuric acid. | |
| manually controlled to within 0.2 K. | 2. 1,3-Dimethylbenzene. Best | |
| The procedure and apparatus are | obtainable specimen was suitably | |
| described by Gerrard (1,2). | purified, dried, and fractionally distilled, and attested. | |
| For temperatures below 268 K a chem- | distilled, and attested. | |
| ical titration was conducted. | | |
| | ESTIMATED ERROR: | |
| | $\delta T/K = 0.2$ | |
| | $\delta X/X = 0.04$ | |
| | | |
| | PEEDENCUS . | |
| | REFERENCES: | |
| | 1. Gerrard, W. J. Appl. Chem. Biotechnol. <u>1972</u> , | |
| 1 | 22, 623 - 650. | |
| | 2. Gerrard, W. | |
| | "Solubility of Gases and Liquids" | |
| | Plenum Press, New York, 1976 | |
| | 1 | |

| COMPONENTS: | ORIGINAL MEASUREMENTS: |
|---|--|
| <pre>1. Hydrogen chloride; HCl; [7647-01-0]</pre> | Ahmed, W.; Gerrard, W.; Maladkar, V. K. |
| <pre>2. 1,4-Dimethylbenzene; C₈H₁₀; [106-42-3]</pre> | J. Appl. Chem. <u>1970</u> , 20, 109 - 115. |
| | |
| VARIABLES: T/K: 273.15 - 293.15 | PREPARED BY: |
| Total P/kPa: 101.325 (1 atm) | W. Gerrard (smoothed data calculated by H.L. Clever) |
| | (smoothed data calculated by H.L. Clever) |
| EXPERIMENTAL VALUES: T/K Mol Ra | |
| ⁿ HCl/ ⁿ C | 8 ^H 10 ^X HC1 |
| 273.15 0.11 | |
| 283.15 0.08 293.15 0.06 | |
| | |
| The mole fraction solubilities were ca compiler. | arcutated from the more fatio by the |
| Smoothed Data: $\ln X_{HC1} = -9.752 + 20$ | .313/(T/100) |
| Standard error about | regression line = 2.30×10^{-3} |
| | Mol Fraction |
| -, • | × _{HC1} |
| 273.15 | 0.0987 |
| 283.15 | 0.0759 |
| 293.15 | 0.0594 |
| | |
| AUXILIARY | INFORMATION |
| METHOD /APPARATUS / PROCEDURE : | SOURCE AND PURITY OF MATERIALS; |
| Hydrogen chloride was passed into a known weight of liquid in a bubbler tube at a total pressure measured by a manometer assembly. The absorbed gas was weighed by re-weighing the bubbler tube. The temperature was | Hydrogen chloride. Obtained from a cylinder containing a good com- mercial specimen. Was dried by passage through concentrated sulfuric acid. 1,4-Dimethylbenzene. Best |
| manually controlled to within 0.2 K. The procedure and apparatus are described by Gerrard (1,2). | obtainable specimen was suitably purified, dried, and fractionally distilled, and attested. |
| | ESTIMATED ERROR: $\delta T/K = 0.2$ $\delta X/X = 0.015$ |
| | REFERENCES: 1. Gerrard, W. J. Appl. Chem. Biotechnol. <u>1972</u> , 22, 623 - 650. |
| | 2. Gerrard, W. "Solubility of Gases and Liquids" Plenum Press, New York, 1976 |

| nydrogen chionde in r | von-Aqueous Solvents // | |
|--|---|--|
| COMPONENTS : | ORIGINAL MEASUREMENTS: | |
| <pre>(1) Hydrogen chloride; HCl; [7647-01-0]</pre> | Parande, M. G.; Kshirsagar, S. N.; Deshpande, A. B. | |
| <pre>(2) Dimethylbenzene (mixture of isomers); C₈H₁₀; [1330-20-7]</pre> | Pet.Hydrocarbons <u>1969</u> , 4, 17 - 18. | |
| VARIABLES: | PREPARED BY: | |
| T/K: 300.15 - 328.15 HCl P/kPa: 93.33 (700 mmHg) | W. Gerrard | |
| EXPERIMENTAL VALUES: | | |
| T/K Total Approximate S | Solubility Mol Fraction x_1^2 | |
| $\frac{p_t/mmHg}{p_1/mmHg} = \frac{p_t/mmHg}{p_1/mmHg}$ | g cm ⁻³ Experiment At One Pressure Atm | |
| 300.15 711 700 | 0.0005520 0.00187 0.00203 | |
| 308.15 | 0.0004629 | |
| 318.15 | 0.0003750 | |
| 328.15 | 0.0003220 | |
| ¹ The compiler calculated the approx subtracting the pure solvent vapor at the specified temperature. ² The mole fraction solubility value | r pressure from the total pressure | |
| | | |
| AUXILIARY | INFORMATION | |
| METHOD/APPARATUS/PROCEDURE: Dry hydrogen chloride was bubbled into about 500 cm ³ of solvent which was in a three-necked flask fitted with a stirrer. The pressure was | SOURCE AND PURITY OF MATERIALS: (1) Hydrogen chloride. Chemically pure grade hydrochloric acid was added dropwise to chemically pure sulfuric acid. | |
| stated to be atmospheric. The passage of gas appeared to be stopped; the liquid was stirred for "some more time" to remove excess gas; a 5 cm ³ sample of solution was removed for an acid-alkali titration. | (2) Dimethylbenzene. Commercial grade sample was distilled, and stored over sodium. | |
| The liquid was then stirred 30 to 40 m at the next higher temperature, controlled by a thermostat, and another sample was removed for titration. | ESTIMATED ERROR: | |
| | REFERENCES : | |

| COMPONENTS : | EVALUATOR: |
|--|---|
| <pre>(1) Hydrogen chloride; HCl; [7647-01-0]</pre> | H. Lawrence Clever Department of Chemistry Emory University |
| (2) Alcohols | Atlanta, GA 30322 USA 1984, March; revised 1987, February |
| | |

An Evaluation of the Solubility of Hydrogen Chloride in Alcohols.

Fifteen papers (ref 1 - 15) report the solubility of hydrogen chloride gas in fourteen linear primary alcohols, four branched primary alcohols, five linear secondary alcohols, and one branched secondary alcohol. Most of the measurements were carried out at a hydrogen chloride partial pressure of 101.3 kPa at several temperatures. Measurements at hydrogen chloride partial pressures less than atmospheric pressure (101.3 kPa) are reported for only methanol, ethanol, and 1-butanol. Seventy per cent of the data are in six papers (ref 5, 7, 8, 9, 13, 14) from the laboratory of Professor W. Gerrard, who has published extensively on the solubility of gases in liquids (ref 16, 17, and references therein).

The solutions saturated at 101.3 kPa partial pressure of hydrogen chloride are concentrated and non-ideal. A number of conductivity studies have been carried out on dilute hydrogen chloride-alcohol solutions, but few experiments have been carried out to characterize the departure from ideal behavior of the concentrated solutions. The nature of the interaction between hydrogen chloride and the alcohol lone pair electrons is still a matter of some controversy as to whether these are strong, moderate, or weak electrolyte interactions.

Table 1 compares the solubilities of hydrogen chloride in the various alcohol solutions liquid at 273.15 and 298.15 K and 101.3 kPa partial pressure hydrogen chloride in units of mole fraction (x_1) , molality $(m_1/mol kg^{-1})$, and concentration $(c_1/mol dm^{-3})$. The solubility of hydrogen chloride in water is included for comparison (ref 18). Table 2 contains a more extensive comparison of mole fraction solubilities for 24 alcohols at ten degree intervals over the experimental range reported.

The experimental data were treated by linear regressions to obtain equations of ln (mole fraction) as a function of temperature. The mole fraction values in Table 1 and 2 are from these equations. Several of the 273.15 K values were extrapolated from values at higher temperature. The mole fraction values in Table 1 are believed to be reliable to 0.5 percent or better. The molality values, calculated directly from the mole fraction values, should be equally reliable. However, the concentration values may be uncertain by several percent. They were approximated by estimating the solution volume to be the sum of the pure hydrogen chloride and alcohol volumes at 273.15 and 298.15 K. The density of liquid hydrogen chloride was taken from (ref 18).

The solubility data in Table 1 show several trends of interest. (*i*) The mole fraction solubility of hydrogen chloride is smaller in water than in any of the alcohols at 273.15 K, but larger in water than in the primary alcohols at 298.15. The secondary alcohols show a larger mole fraction solubility than in water at both temperatures. (*ii*) The mole fraction solubility of hydrogen chloride in the primary alcohols increases with increasing alcohol carbon number from methanol to 1-pentanol at 273.15 K, and from methanol to 1-heptanol at 298.15 K. The largest increase is between methanol and ethanol (5 - 7 %); at higher carbon number alcohols the increase is about the magnitude of the uncertainty in the measurement. (*iii*) The mole fraction solubility is about four percent greater in the secondary alcohol than in the corresponding carbon number primary alcohol at these temperatures.

Individual hydrogen chloride + alcohol systems are discussed below under sections on the effect of hydrogen chloride partial pressure and temperature on the solubility.

I. The solubility of hydrogen chloride in alcohols as a function of partial pressure.

The solubility of hydrogen chloride as a function of pressure

| COMPONENTS : | EVALUATOR: |
|---|--|
| (1) Hydrogen chloride; HCl; [7647-01-0] (2) Alcohols | H. Lawrence Clever Department of Chemistry Emory University Atlanta, GA 30322 USA |
| | 1984, March, revised 1987, February |

Table 1. Solubility of hydrogen chloride in alcohols. Tentative values of the mole fraction (x_1) , molality $(m_1/\text{mol kg}^{-1})$, and concentration $(c_1/\text{mol dm}^{-3})$ solubilities at 273.15 and 298.15 K at a hydrogen chloride partial pressure of 101.3 kPa.

| Alcohol | <i>T</i> /K | <i>x</i> ₁ | $m_1/mol kg^{-1}$ | $c_1/\text{mol dm}^{-3}$ |
|---------------------------------------|----------------------------|-------------------------|----------------------|--------------------------|
| Water ^a | 273.15 | 0.487 | 52.8 | 22.5 |
| | 298.15 | 0.463 | 47.9 | 21.4 |
| Lınear (Normal) Primary | | 0.100 | | |
| Methanol | 273.15 | 0.490 | 30.0 | 12.4 |
| | 298.15 | 0.419 | 22.5 | 9.85 |
| Ethanol | 273.15 | 0.513 | 22.9 | 10.7 |
| | 298.15 | 0.448 | 17.6 | 8.5 |
| l-Propanol | 273.15 | 0.513 | 17.5 | 9.2 |
| | 298.15 | 0.449 | 13.6 | 7.3 |
| 1-Butanol | 273.15 | 0.520 | 14.6 | 8.2 |
| | 298.15 | 0.451 | 11.1 | 6.4 |
| l-Pentanol | 273.15 | 0.523 | 12.4 | 7.3 |
| | 298.15 | 0.450 | 9.28 | 5.6 |
| l-Hexanol | 273.15 | 0.518 | 10.5 | 6.5 |
| | 298.15 | 0.454 | 8.14 | 5.1 |
| l-Heptanol | 273.15 | 0.516 | 9.17 | 5.9 |
| | 298.15 | 0.456 | 7.21 | 4.7 |
| l-Octanol | 273.15 | 0.511 | 8.02 | 5.3 |
| | 298.15 | 0.452 | 6.33 | 4.2 |
| l-Nonanol | 273.15 298.15 | - 0.449 | 5.65 | - 3.85 |
| l-Decanol | 273.15 | 0.513 | 6.68 | 4.6 |
| | 298.15 | 0.460 | 5.38 | 3.7 |
| 1-Dodecanol | 273.15 298.15 | _ 0.424 | 3.95 | 2.9 |
| Branched Primary Alcoho | ls | | | |
| 2-Methyl-l-propanol | 273.15 | 0.514 | 14.3 | 8.0 |
| | 298.15 | 0.455 | 11.3 | 6.4 |
| 2-Methyl-l-butanol | 273.15 | 0.526 | 12.6 | 7.4 |
| | 298.15 | 0.471 | 10.1 | 6.0 |
| 3-Methyl-l-butanol | 273.15 298.15 | 0.521 | 12.3 | 7.15 |
| 2,5,5-Trimethyl-l-hexan | 298.15 | 0.517 0.457 | 7.42 5.83 | 5.0 3.95 |
| Linear and Branched Sec 2-Propanol | ondary Alco 273.15 | hols 0.530 | 18.8 | 9.4 |
| 2-Butanol | 298.15 | 0.472 | 14.9 | 7.6 |
| | 273.15 | 0.539 | 15.8 | 8.6 |
| 3-Pentanol | 298.15 273.15 | 0.473 | 12.1 13.2 | 6.8 7.6 |
| 4-Heptanol | 298.15 | 0.479 | 10.4 | 6.1 |
| | 273.15 | 0.535 | 9.90 | 6.2 |
| | 298.15 | 0.478 | 7.88 | 5.0 |
| 2-Octanol 4-Methyl-2-pentanol | 273.15 273.15 298.15 | 0.535 0.547 0.476 | 8.83 11.8 8.89 | 5.7 7.0 5.4 |
| ^a Ref 18 | | | | J • 7 |

was studied in methanol at 298.15 K, in ethanol at 298.15 K, and in 1-butanol at a number of temperatures between 235 and 326 K. One study estimated the hydrogen chloride solubility at a single small partial pressure from electrochemical measurements in methanol and ethanol at a temperature of 298.15 K. The temperatures, pressure intervals, and number of measurements are summarized below and in Figures 1, 2, and 3.

| System | T/K | Pressure Interval | Number | Reference |
|-----------------|--------|-------------------------------|--------|-----------|
| HCl + Methanol | 298.15 | 5.19-1.116x10 ⁴ Pa | 56 | 11 |
| | 298.15 | 0.11 Pa | 1 | 6 |
| HCl + Ethanol | 298.15 | 14.4 - 625 Pa | 5 | 2 |
| | 298.15 | 62 Pa | 1 | 6 |
| HCl + 1-Butanol | 273.15 | 22.8 - 101.3 kPa | 6 | 9 |
| | 278.15 | 28.3 - 116.9 kPa | 6 | 9 |
| | 283.15 | 34.3 - 136.4 kPa | 6 | 9 |
| | 288.15 | 41.2 - 157.7 kPa | 6 | 9 |

1. Hydrogen chloride + 1-Butanol [71-36-3]

Gerrard, Mincer and Wyvill (ref 9) report the partial pressure of hydrogen chloride over six solutions as a function of temperature and pressure. There are over 60 measurements that range in temperature from 235.15 to 326.85 K and in hydrogen chloride partial pressure from 22.7 to 170.7 kPa (170 to 1281 mmHg). From these measurements data sets of the solubility of hydrogen chloride as a function of partial pressure were prepared at temperatures of 273.15, 278.15, 283.15, and 288.15. The data are displayed in Figure 1 as a plot of ln $(p_1/kPa)vs$. ln (x_1) . The plots were assumed to be linear, and the data were treated by a linear regression to obtain the intercepts and slopes below:

| T/K | Intercept | Slope |
|--------|-----------|--------|
| 273.15 | 8.6572 | 6.153 |
| 278.15 | 8.7605 | 6.044 |
| 283.15 | 8.7876 | 5.8575 |
| 288.15 | 8.8432 | 5.7146 |

The slopes are very near six. They show that the hydrogen chloride mole fraction solubility increases as about the (1/6) power of the partial pressure.

Professor Gerrard has long criticized both the concept and the application of Henry's law. He is correct in that Henry's law does not apply to the HCl + 1-butanol system at these temperatures and pressures. The partial pressure to the (1/6) power is quite different than the limiting first power dependence expected of Henry's law in the limit of low pressure and dilute solution.

At present we have no explanation of the linear $\ln (p_1) vs$. $\ln (x_1)$ relationship of slope near six. As an empirical relationship it appears to be useful. From a single measurement of the solubility at atmospheric pressure one can assume the slope of six and estimate the hydrogen chloride mole fraction solubility down to an HCl partial pressure of near 20 kPa. Figure 1 data do show a slight upward curvature. Thus, it is not advisable to use the relationship at either higher or lower pressures until the relationship is studied over greater pressure intervals.

The hydrogen chloride + 1-butanol data are classed as tentative. The equation $\ln (p_1/kPa) = \text{Intercept} + \text{Slope } \ln (x_1)$ reproduces the data with an average deviation of less than 0.5 percent.

2. Hydrogen chloride + Ethanol [64-17-5]

Jones, Lapworth, and Lingford (ref 2) measured the solubility of hydrogen chloride in ethanol and in a number of ethanol + water mixtures. Only the results for pure ethanol are presented and discussed in this volume. They measured the equilibrium pressure of HCl over solutions of known composition rather than measure directly the solubility. There are five duplicate measurements at hydrogen chloride partial pressures between 14 and 625 Pa. These values are presented in Figure 2 on a $\ln (p_1/kPa)$ vs. $\ln (x_1)$ plot. Also on Figure 2 is a point for the accepted solubility at one atm (101.3 kPa) with a line of slope six drawn through it. The experimental data at

| COMPONENTS : | EVALUATOR: |
|---|--|
| (1) Hydrogen Chloride; HCl; [7647-01-0] (2) Alcohols | H. Lawrence Clever Department of Chemistry Emory University Atlanta, GA 30322 USA |
| | 1984, March; revised 1987, February |

pressures less than 1 kPa deviate from the line of slope six, but do appear to be approaching the line as the partial pressure increases.

The results are classed as tentative. The experimental values at 298.15 K are given below: HCl partial pressure, p_1 /Pa 14.4 55.6 108. 351 625

Mole Fraction HCl, x_1 0.0159 0.0425 0.0651 0.1267 0.1642

The authors applied the Gibbs-Duhem relation to obtain an equation for the HCl partial pressure as a function of the solution mole ratio. It is interesting that the equation, when extrapolated to atmospheric pressure, gives a solution composition that is within 2 percent of the accepted HCl solubility in ethanol at that pressure.

Fritz (ref 6) estimated an HCl solubility of 0.0461 mole fraction at a partial pressure of 62 Pa. The value is classed tentative. It agrees well with the values of Jones $et \ al$. (ref 2).

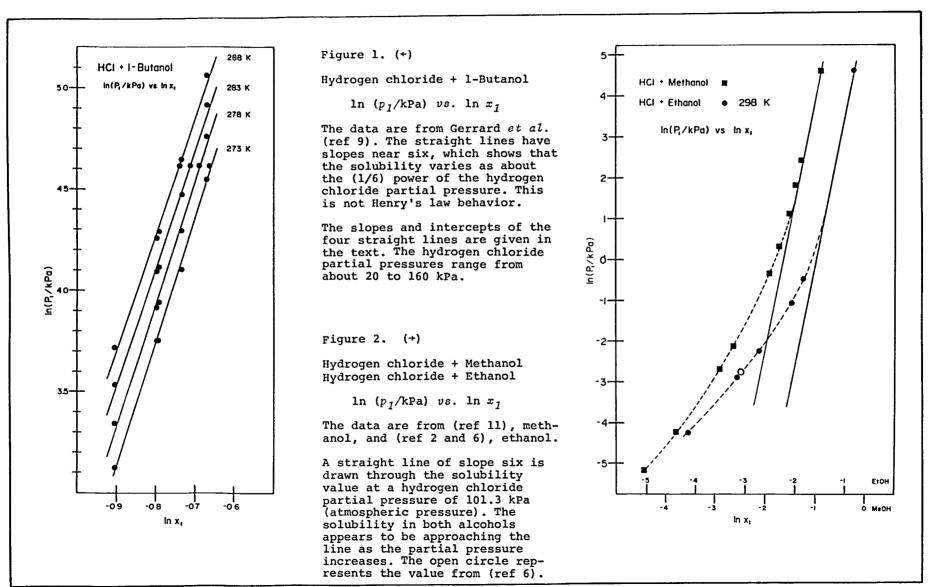
3. Hydrogen chloride + Methanol [67-56-1]

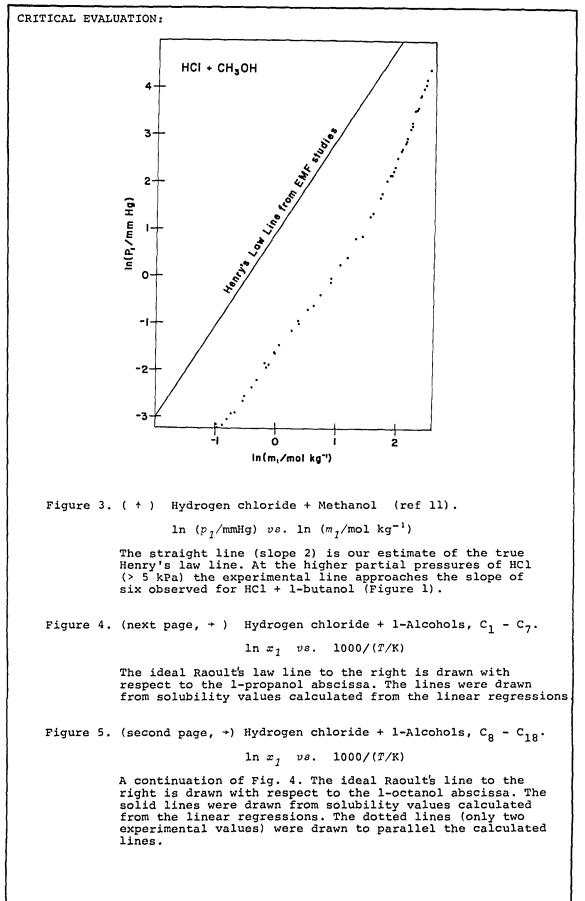
Fritz (ref 6) estimated one solubility value at a partial pressure of 0.11 Pa from his analysis of emf results. Schmid, Maschka, and Sofer (ref 11) made 56 measurements of the HCl vapor pressure over HCl + methanol solutions of known composition. The partial pressures ranged from 5.19 to 11160 Pa at 298.15 K. The single value of Fritz does not agree well with the results of Schmid *et al*. The value was not considered further, but the lack of agreement is disturbing since Fritz's solubility value in ethanol appears to be reliable.

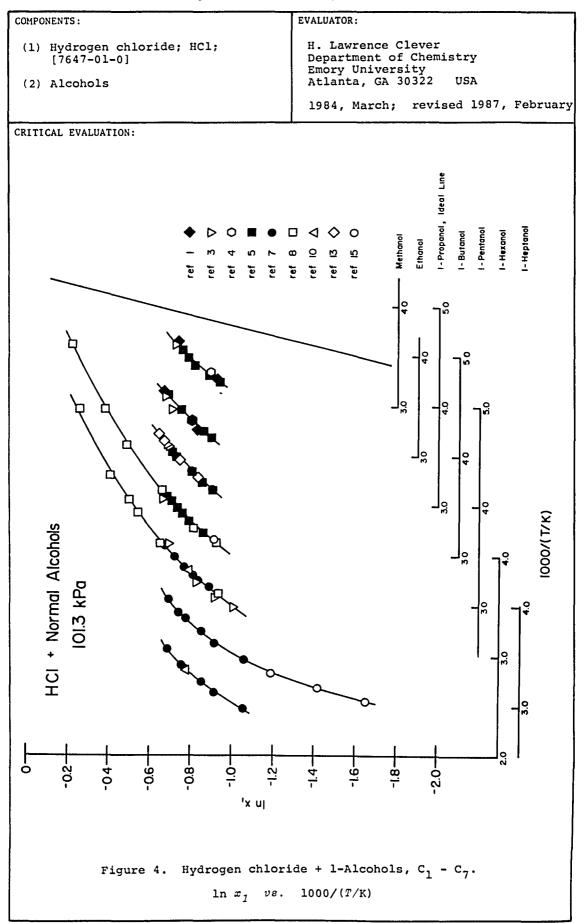
Nine of the Schmid *et al.* values are plotted on the $\ln (p_1/kPa) vs$. $\ln (x_1)$ scale of Figure 2. Also on the Figure is a point for the solubility of HCl in methanol at atmospheric pressure with a line of slope six through it. The solubility values at the lower pressures deviates greatly from the line, but the values at partial pressures of 3.08, 6.11, and 11.16 kPa fall almost on the line of slope six. This indicates the empirical observation of the slope six line for the HCl + 1-butanol system may be useful for other systems. For the HCl + methanol system it may allow a reasonable estimation of the solubility down to a partial pressure of 3 kPa.

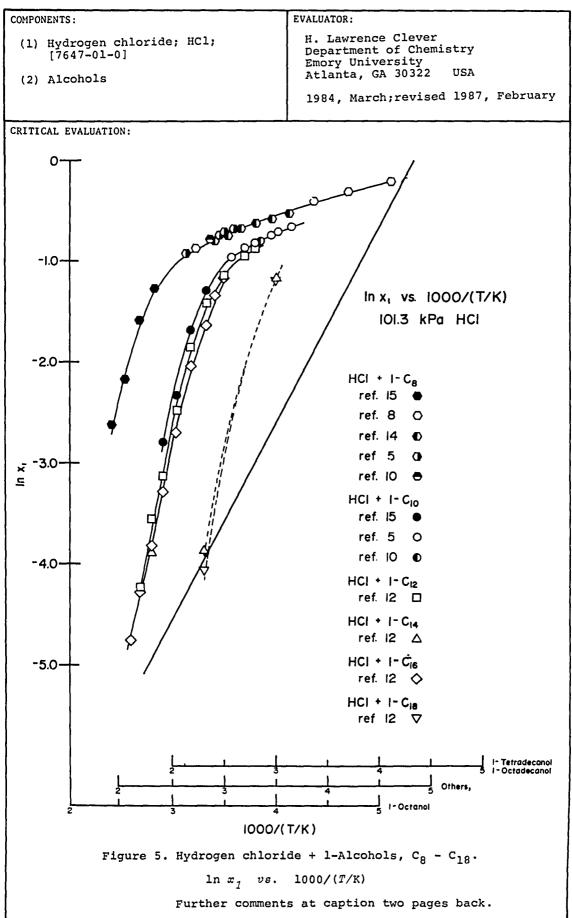
A further test for Henry's law behavior is shown in Figure 3. All 56 measurements of Schmid *et al.* (ref 11) were used to prepare the Figure of ln (p_1/mmHg) vs. ln $(m_1/\text{mol kg}^{-1})$. The experimental values are compared with a Henry's law line of slope 2 (strong electrolyte assumption) estimated from literature emf measurements in ultradilute solutions. If our estimate is correct, the HCl + methanol system is not in agreement with Henry's law at the pressure of 5.19 Pa (0.0389 mmHg). For the HCl + methanol solutions the relationship for the HCl activity was taken to be $a_1 = a_1^2 = m_1^2 \ \gamma_1^2$.

The data of Schmid, Mashka, and Sofer (ref 11) are classed as tentative. The single value of Frizt (ref 6) is classed as doubtful. The behavior of HCl + methanol solutions at low HCl partial pressures needs further study.









| COMPONENTS : | EVALUATOR: |
|---|--|
| (1) Hydrogen chloride; HCl; [7647-01-0) (2) Alcohols | H. Lawrence Clever Department of Chemistry Emory University Atlanta, GA 30322 USA |
| | 1984, March, revised 1987, February |

II. The solubility of hydrogen chloride in alcohols as a function of temperature at a hydrogen partial pressure of 101.3 kPa.

There are solubility data on 24 alcohols at a hydrogen chloride partial pressure of 101.3 kPa. Three systems have data at only one temperature, two systems at two temperatures, and for the other nineteen systems the data range from five to over twenty five temperatures. The temperature intervals studied range from 35 degrees for methanol to 220 degrees for l-octanol.

Few of the papers give details of the HCl partial pressure measurement. In many of the experiments the gas is bubbled through the liquid and escapes against'atmospheric'pressure. The depth of the liquid (hydrostatic pressure contribution) and the actual atmospheric (barometer) pressure are not given. There could be an uncertainty in the pressure of several percent. If all of the HCl + alcohol systems show the same (1/6) power of partial pressure dependence of mole fraction as does the HCl + 1-butanol system discussed in section I the effect of pressure would result in only a 0.5 percent uncertainty in the mole fraction solubility.

Most of the papers state the alcohol was dried and protected from water vapor during the experiment. However, none of the papers give a quantitative analysis of the alcohol water content. Jones $et \ al$. (ref 2) studied the effect of water on the solubility of HCl in ethanol. Small amounts of water decrease the HCl solubility in ethanol. This effect is an unknown factor in the other alcohols.

The temperature dependent data have been fitted by the method of least squares to an equation of the type:

 $\ln x_{1} = A_{1} + A_{2}/(T/100 \text{ K}) + A_{3}\ln (T/100 \text{ K}) + A_{4}(T/100 \text{ K}) + A_{5}(T/100 \text{ K})^{2} + \cdots$

Most of the systems were well fitted by a three constant equation, but five systems required four constants (1-butanol, 1-hexanol, 1-decanol, 1-hexadecanol, and 2-butanol), and the 1-octanol systems required five constants. The linear regression equation, its standard error about the regression line in mole fraction, and the experimental temperature range are given for each system in Table 3. Table 2 contains smoothed values of the mole fraction solubility at ten degree intervals within the experimental temperature interval. A few values were extrapolated beyond the experimental temperature range. They are enclosed in ().

Figures 4 and 5 display the experimental data for the linear primary alcohols. The lines were drawn from values calculated from the linear regression equations. The straight line to the right is the Raoult's law ideal solubility line. The maximum deviation from Raoult's law behavior occurs near 335 K for all systems. It appears as if the experimental behavior will approach the Raoult's law line at very high temperatures. The normal boiling point of hydrogen chloride is 188.2 K. At this temperature the ideal mole fraction solubility reaches its limit of unit mole fraction hydrogen chloride.

It is reassuring to see the parallel nature of the $\ln x_1$ vs. 1000/(T/K) plots of Figures 4 and 5. It implies a consistency among the various workers in their measurement of the HCl solubility in alcohols. The data are classed tentative with a few exceptions noted in the following section on the individual systems. The values in the 273 to 313 K interval are believed to be reliable to within one-half or one percent. At the temperature extremes the uncertainty is probably greater, but probably no worse than three to five percent.

Starting at alcohol of carbon number 12 there appears to be a change in the solubility pattern. At 333 K the mole fraction solubility is about four percent less than in the lower molecular weight alcohols. All of the solubility values for alcohols of carbon number 12, 14, 16, and 18 are from the paper of Fernandes and Sharma (ref 12). Whether the change indicates a systematic error in their measurement or a change in the solution property because of increasing fraction of hydrocarbon residue in the alcohol can not be determined. However, there is a possibility that the solubility data for these alcohols is less reliable than the values for the smaller carbon number alcohols.

The individual systems are discussed briefly below. There is additional information on the systems in Tables 2 and 3. Table 2 is arranged to make comparison of the smoothed solubility values for linear primary, branched primary, linear secondary, and branched secondary alcohols easy. The same arrangement is used in the discussion below and in Table 3. There are no HCl solubility data in tertiary alcohols. The tertiary alcohols normally react readily with HCl to form the chloride.

1. HCl + Methanol; [67-56-1]

Lobry de Bruyn (ref 1) reports two, Gerrard and Macklen (ref 5) six, Kohn (ref 3) one, and Chesterman (ref 4) one measurement. The 273.15 K measurement from (ref 1) and the single measurement from (ref 4) were not used in the linear regression. All other values were classed tentative.

2. HCl + Ethanol; [64-17-5]

Lobry de Bruyn (ref 1) reports two, Kohn (ref 3) one, Chesterman (ref 4) two, and Gerrard and Macklen (ref 5) five measurements. The 305.15 K value from (ref 1) and the 288.15 K value from (ref 3) were not used in the linear regression. All other values were classed tentative.

3. HCl + 1-Propanol; [71-23-8]

Kohn (ref 3) reports two, Gerrard and Macklen (ref 5) six, and Cook (ref 13) five measurements. All values were classed as tentative and used in the linear regression.

4. HCl + 1-Butanol; [71-36-3]

Kohn (ref 3) reports three, Gerrard and Macklen (ref 5) seven, Gerrard $et \ al.$ (ref 8) six, Ionin $et \ al.$ (ref 10) one, and Fernandes (ref 15) one measurement. No values from (ref 3) were used. The 273.15 K value of (ref 8) and the 315.15 K value of (ref 15) were not used in the linear regression. All of the values used were classed as tentative.

5. HCl + 1-Pentanol; [71-41-0]

Kohn (ref 3) reports six, Gerrard and Macklen (ref 7) six, Gerrard *et al.* (ref 8) thirteen, and Ionin *et al.* (ref 10) one measurement. The 334.15 K value from (ref 3) and all of the values from the other references were classed as tentative and used in the linear regression.

6. HCl + 1-Hexanol; [111-27-3]

Gerrard and Macklen (ref 7) report six, and Fernandes (ref 15) three measurements. All were classed as tentative and used in the linear regression.

7. HCl + 1-Heptanol; [111-70-6]

Gerrard and Macklen (ref 7) report six, and Ionin $et \ al.$ (ref 10) one measurement. All values were classed as tentative and used in the linear regression.

8. HCl + 1-Octanol; [111-87-5]

Gerrard and Macklen (ref 5) report seven, Gerrard *et al.* (ref 8) four, Ionin *et al.* (ref 10) one, Ahmed *et al.* (ref 14), and Fernandes (ref 15) four measurements. The values at 196.15 and 229.15 K from (ref 8), at 273.15 and 283.15 from (ref 14), and at 353.15 and 373.15 K from (ref 15) were omitted from the linear regression. All other values were classed as tentative.

9. HCl + 1-Nonanol; [143-08-8]

The single measurement of Ionin et al. (ref 10) was classed as tentative.

10. HCl + 1-Decanol; [112-30-1]

Gerrard and Macklen (ref 7) report six, Ionin *et al.* (ref 10) one, and Fernandes (ref 15) four measurments. All values were classed as tentative and used in the linear regression. 1-Decanol melts at 280.1 K, however, the saturated solutions are liquid well below the alcohol's normal m. p. COMPONENTS : EVALUATOR: (1) Hydrogen chloride; HCl; H. Lawrence Clever [7647-01-0] Department of Chemistry Emory University (2) Alcohols Atlanta, GA 30322 USA 1984, March; revised 1987, February CRITICAL EVALUATION: 11. HCl + 1-Dodecanol; [112-53-8] Fernandes and Sharma (ref 12) report the nine measurements on the system. They are classed as tentative and all were used in the linear regression. The authors report the solution at 453.15 K turned brown, however, the solubility value appears consistent with the other values. The 1-dodecanol melts at 297.0 K, but its solutions saturated with HCl are liquid to lower temperatures. Note the comment about these data at the top of the previous page. HC1 + 1-Tetradecano1; [112-72-1]12. Fernandes and Sharma (ref 12) report the two measurements on the system. The values were classed as tentative. HCl + 1-Hexadecanol; [36653-82-4] 13. Fernandes and Sharma (ref 12) report nine measurements. All values were classed tentative and used in the linear regression. HC1 + 1-Octadecano1; [112-92-5]Fernandes and Sharma (ref 12) report two measurements. The values were classed as tentative. HC1 + 2-Methyl-1-propanol; [78-83-1] 15. Gerrard and Macklen (ref 5) report seven measurements. All values were classed as tentative and used in the linear regression. HC1 + 2-Methyl-l-butanol; [137-32-6] 16. Gerrard and Macklen (ref 5) report seven measurements. All values were classed as tentative and used in the linear regression. 17. HC1 + 3-Methyl-1-butanol; [123-51-3] Kohn (ref 3) reports two measurements at 278.15 K. The values were classed tentative, but may be less reliable than values from most other workers. HCl + 2,5,5-Trimethyl-1-hexanol; [3452-97-9] 18. Gerrard and Macklen (ref 5) report five measurements. All values were classed as tentative and used in the linear regression. HC1 + 2-Propano1; [67-63-0]Chesterman (ref 4) reports one, and Gerrard and Macklen (ref 5) five measurements. The single value from (ref 4) appears to be about four percent too small and was not used. The other values were classed as tentative and were used in the linear regression. 20. HCl + 2-Butanol; [78-92-2] Gerrard and Macklen (ref 5) report six measurements from 281.25 to 312.95 K, and Gerrard *et al.* (ref 8) report seven measurements from 198.15 to 319.15 K. All values were classed as tentative and were used in the linear regression. 21. HCl + 3-Pentanol; [584-02-1] 22. HCl + 4-Heptanol; [589-55-9] Gerrard and Macklen (ref 5) report five measurements for each system. All values were classed as tentative and used in the linear regressions. HC1 + 2-Octano1; [123-96-6]Kohn(ref 3) reports one measurement at 279.15 K. The value was classed as tentative, but may be less reliable by 2 - 3 percent than values from other workers. 24. HCl + 4-Methyl-2-pentanol; [108-11-2] Gerrard and Macklen (ref 7) report six measurements from 274.75 to 319.45 K, and Gerrard et al. (ref 8) report nine measurements from 201.15 and 311.15 K. The 307.45 K value from (ref 7) was not used. All other values were classed as tentative and used in the linear regression.

| COMPONENT | S: | | | | EVAI | UATOR: | | | |
|---|-----------------|---------------------|---------------------|---------------------------|---------------------------|--|-----------------|---------------------------|----------------------------------|
| (1) Hydrogen chloride; HCl; [7647-01-0] (2) Alcohols | | | | | Dep Emo | H. Lawrence Clever Department of Chemistry Emory University Atlanta, GA 30322 USA | | | |
| | | | | | 198 | 4, Marc | h, revi | sed 198 | 7, February |
| CRITICAL | EVALUATI | ON: | ······ | | | | | | |
| Table 2 | val | ues of | the mol | | on sol | ubility | at a h | ydrogen | Tentative chloride rature. |
| | Primar | y Norma | l Alcoh | nols | | | | | |
| | Methanol | Ethanol | l-Propanol | 1-Butanol | 1-Pentanol | 1-Hexanol | l-Heptanol | 1-Octanol | l-Nonanol |
| T/K | | | | | | | | | |
| 193.15 203.15 213.15 | | | | (0.816) 0.767 0.724 | (0.799) 0.765 0.729 | | | (0.828) 0.776 0.724 | |
| 223.15 233.15 243.15 | | | | | 0.693 0.657 0.622 | | | 0.675 0.632 0.595 | |
| 253.15 263.15 273.15 | - - 0.490 | _ 0.513 | - 0.513 | 0.581 0.550 0.520 | 0.587 0.554 0.523 | - - (0.518) | (0.516) | 0.564 0.536 0.511 | |
| 283.15 293.15 | 0.463 0.434 | 0.488 0.462 | 0.488 0.463 | | 0.493 0.464 | 0.493 0.467 | | 0.488 0.464 | |
| 298.15 | 0.419 | 0.448 | 0.449 | 0.451 | 0.450 | 0.454 | 0.456 | 0.452 | 0.449 ^a |
| 303.15 313.15 323.15 | 0.404 | 0.434 0.407 - | 0.436 0.410 - | 0.437 0.412 | 0.437 0.412 0.388 | 0.414 | 0.415 | 0.439 0.412 0.383 | - |
| 333.15 343.15 353.15 | | | | | 0.366 | 0.359 0.330 0.301 | 0.360 - - | 0.350 0.314 0.276 | |
| 363.15 373.15 383.15 | | | | | | 0.272 0.244 0.217 | | 0.237 0.198 0.160 | |
| 393.15 403.15 413.15 | | | | | | 0.190 | | 0.126 0.095 0.070 | |
| 423.15 433.15 443.15 | | | | | | | | - | |
| 453.15 463.15 | | | | | | | | | |

Values in () were extrapolated outside the range of experimental measurement.

| COMPONENTS | S: | | | | EVALUAT | OR: | | ····· | | |
|--|-------------------------|-------------------------|--------------------|-------------------------|--------------------|---|------------------------|--|--|--|
| <pre>(1) Hydrogen chloride; HCl; [7647-01-0]</pre> | | | | | Depar | H. Lawrence Clever Department of Chemistry | | | | |
| (2) Alcohols | | | | | | Emory University Atlanta, GA 30322 USA | | | | |
| | | | | | | 1984, March, revised 1987, February | | | | |
| CRITICAL E | | | | <u> </u> | | | | | | |
| Table 2 | value | es of th | e mole | fractio | n solubil | chloride in Lity of hydro function of | ogen ch | ls. Tentative loride at a ature. | | |
| Primary Normal Alcohols | | | | | | Branched | l Prim | ary Alcohols | | |
| | l-Decanol | 1-Dodecanol | l-Tetradecanol | 1-Hexadecanol | 1-Octadecanol | 2-Methyl-l- propanol | 2-Methyl-1- butanol | 3-Methyl-l- butanol | | |
| T/K | | | | | | | | | | |
| 193.15 203.15 213.15 | | | | | | | | | | |
| 223.15 233.15 243.15 | | | | | | | | | | |
| 253.15 263.15 273.15 | - 0.513 | | | | | - (0.514) | _ _ (0.526) | - 0.521 ^C | | |
| 283.15 293.15 | 0.492 0.471 | - | | | | 0.492 0.468 | 0.505 0.482 | - | | |
| 298.15 | 0.460 | (0.424) | | - | | 0.455 | 0.471 | | | |
| 303.15 313.15 323.15 | 0.448 0.420 0.388 | 0.421 0.399 0.364 | - | (0.398) (0.365) | - | 0.442 0.415 - | 0.459 0.435 - | | | |
| 333.15 343.15 353.15 | 0.350 0.309 0.266 | | 0.313 ^b | 0.315 0.260 0.207 | 0.309 ^b | | | | | |
| 363.15 373.15 383.15 | 0.223 0.181 0.143 | 0.186 0.148 0.115 | | 0.160 0.122 0.092 | | | | | | |
| 393.15 403.15 413.15 | 0.109 0.081 0.058 | 0.089 0.067 0.050 | | 0.069 0.051 0.039 | | | | | | |
| 423.15 433.15 443.15 | - - - | 0.037 0.027 0.020 | 0.021 | 0.029 0.022 0.017 | 0.018 ^b | | | | | |
| 453.15 463.15 473.15 | | 0.014 | | 0.014 0.011 0.009 | | | | | | |
| b experimental values. c estimated from two experimental values at a higher temperature. | | | | | | | | | | |

| COMPONEN | | | | 1 | | | | 9 |
|----------------------------|--|-------------------------|--------------------|---|---|--------------------|-------------------------|-----------|
| | | ide. HCl. | | 1 | UATOR: | re Cleve |)r | |
| | <pre>(1) Hydrogen chloride; HCl; [7647-01-0]</pre> | | | De | H. Lawrence Clever Department of Chemistry | | | |
| (2) Alcohols | | | | Emory University Atlanta, GA 30322 USA | | | | |
| 8 | | | | 19 | 84, Mar¢ | ch, rev | ised 1987, | February |
| | | | | | <u> </u> | | | |
| | EVALUATION: 2 (continued | l). Solubil | ity of h | vdrog | en chlo | ride in | alcohols. | Tentative |
| | values of | the mole pressure of | fraction | solu | bility d | of hydro | ogen chlor | ide at a |
| | Parciar P | | | | | | | |
| (| cont.) | Linea | ar and Br | anche | d Second | lary Alo | CONOIS | |
| i i | L L | | | | | | | |
| | ,5-Trimethyl -hexanol | | | | | | | |
| | ime nol | 01 | d. | 01 | 01 | н | 4-Methyl- 2-pentanol | |
| | -Tr exa | pan | ano | itan | tan | ano | thy l enta | |
| | 1-72 | 2-Propanol | 2-Butanol | 3-Pentanol | -Heptanol | 2-Octanol | -Met 2-pe | |
| | 7 | 5- | 5 | 'n | 4 | 2- | 4 | |
| T/K | | | | | | | | |
| 193.15 203.15 | | | 0.779 | | | | (0.831) 0.793 | |
| 213.15 | | | 0.732 | | | | 0.755 | |
| 223.15 233.15 | | | 0.691 0.656 | | | | 0.717 0.680 | |
| 243.15 | | | 0.624 | | | | 0.645 | |
| 253.15 | - | - | 0.594 | - | - | - | 0.610 | |
| 263.15 273.15 | (0.517) | (0.530) | 0.566 0.539 (0 | - .535) | (0.535) | 0.535 ^d | 0.578 0.547 | |
| 283.15 293.15 | 0.495 0.470 | 0.508 0.484 | | .514 | | | 0.517 0.489 | |
| 298.15 | 0.457 | 0.472 | 0.473 0 | .479 | 0.478 | | 0.476 | |
| 303.15 | 0.444 | 0.460 | | .467 | 0.466 | | 0.463 | |
| 313.15 323.15 | 0.418 | 0.435 | 0.435 0 (0.410) | | | | 0.438 | |
| 333.15 | - | - | - | | | | | |
| 343.15 353.15 | - | - | - | | | | | |
| 363.15 | | | | | | | | |
| 373.15 | | | | | | | | |
| | | | | | | | | |
| 293.15 403.15 | | | | | | | | |
| 413.15 | | | | | | | | |
| 423.15 433.15 443.15 | | | | | | | | |
| 453.15 463.15 473.15 | | | | | | | | |
| d esti | mated from a | a single va | lue at a | high | er temp | erature | • | |
| | es in () ar rimental mea | | | ues f | rom out: | side the | e range of | the the |
| | | | | | | | | |

Table 3. Hydrogen chloride in alcohols. Smoothing equation from linear regression, standard error about regression line (mole fraction), temperature range of experimental measurements. 1-Hexadecanol Methanol $\ln x_7 = (387.1453 \pm 113.6435)$ $\ln x_1 = (18.1997 \pm 7.0628)$ -(543.9591 ± 163.0653)/(T/100K) -(275.4782 ± 82.3463)ln(T/100K) -(23.8284 ± 9.9260)/(T/100K) $-(10.1400 \pm 3.4162) \ln(T/100K)$ +(31.9656 ± 10.3266)(T/100K) $\sigma = 0.0025$ $\sigma = 0.0063$ 273.15 - 307.35 K 333.15 - 473.15 K Ethanol $\ln x_1 = (13.6149 \pm 3.5862)$ 1-Octadecanol $-(17.7142 \pm 5.0459)/(T/100K)$ No equation, only two values. 2-Methyl-1-propanol $-(7.7589 \pm 1.7323) \ln(T/100K)$ $\ln x_1 = (15.2839 \pm 1.1420)$ $\sigma = 0.0021$ -(20.2632 ± 1.6281)/(T/100K) -(8.4901 ± 0.5451)ln(T/100K) 273.15 - 313.25 K 1-Propanol $\ln x_1 = (12.4129 \pm 0.5637)$ $\sigma = 0.0006$ -(16.0956 ± 0.7919)/(T/100K) 279.15 - 319.55 K 2-Methyl-l-butanol $-(7.1532 \pm 0.2727) \ln(T/100K)$ $\ln x_1 = (10.1079 \pm 1.7033)$ = 0.0005 -(13.1798 ± 2.4235)/(T/100K) 267.65 -315.15 K $-(5.8961 \pm 0.8149) \ln(T/100K)$ 1-Butanol $\sigma = 0.0009$ $\ln x_1 = -(5.3500 \pm 1.800)$ 277.85 - 318.35 K $+(8.4593 \pm 2.4336)/(T/100K)$ 3-Methyl-l-butanol $+(6.9795 \pm 1.9422) \ln(T/100K)$ No equation, only two values. $-(1.9819 \pm 0.3824)(T/100K)$ 2,5,5-Trimethyl-l-hexanol $\sigma = 0.0015$ $\ln x_1 = (13.2973 \pm 0.4197)$ 195.15 - 318.15 К -(17.4507 ± 0.5958)/(T/100K) 1-Pentanol $-(7.5306 \pm 0.2012) \ln(T/100K)$ $\ln x_1 = (4.9597 \pm 0.3413)$ -(5.4332 ± 0.4510)/(T/100K) $\sigma = 0.0001$ 280.05 - 313.65 K $-3.6021 \pm 0.1737) \ln(T/100K)$ $\sigma = 0.0033$ 2-Propanol $\ln x_1 = (11.5269 \pm 1.2174)$ 201.15 = 334.15 K $-(15.0957 \pm 1.7321)/(T/100K)$ 1-Hexanol $-(6.6035 \pm 0.5822) \ln(T/100K)$ $\ln x_1 = -(45.5683 \pm 12.2455)$ $\sigma = 0.0005$ $\overline{+}(62.9042 \pm 16.8788)/(T/100K)$ 280.55 - 316.45 K $+(46.3840 \pm 10.2143) \ln(T/100K)$ 2-Butanol $-(9.0526 \pm 1.5359)(T/100K)$ $\ln x_1 = -(12.3518 \pm 7.7459)$ $\sigma = 0.0014$ +(17.7961 ± 10.4797)/(T/100K) 279.85 - 393.15 $+(13.9946 \pm 8.2996) \ln(T/100K)$ 1-Heptanol $-(3.2378 \pm 1.6256)(T/100K)$ $\ln x_{1} = (16.6621 \pm 1.3802)$ -(22.1457 ± 1.9973)/(T/100K) $\sigma = 0.0057$ 198.15 - 319.15 K $-(9.1718 \pm 0.6496) \ln(T/100K)$ 3-Pentanol $\sigma = 0.0013$ $\ln x_1 = (10.6744 \pm 1.3536) \\ -(13.9682 \pm 1.9251) / (T/100K)$ 279.15 - 337.35 K 1-Octanol $\ln x_1 = (75.6012 \pm 28.4597)$ $-(6.1562 \pm 0.6476) \ln(T/100K)$ -(158.4921 ± 48.8758)/(T/100K) $\sigma = 0.0005$ $-(200.3029 \pm 52.1084) \ln(T/100K)$ 280.35 - 316.55 K +(82.3919 ± 18.1865)(T/100K) 4-Heptanol $\ln x_1 = (9.9919 \pm 0.5128)$ -5.6328 ± 1.0389) (T/100K) $-(12.9965 \pm 0.7326)/(T/100K)$ $\sigma = 0.0087$ $-(5.8317 \pm 0.2443) \ln(T/100K)$ 196.15 - 413.15 K $\sigma = 0.0002$ 1-Nonanol 283.05 -318.45 K No equation, only one experimental value. 2-Octanol 1-Decanol $\ln x_1 = -(175.8767 \pm 68.5805)$ No equation, only a single value. $+(239.8244 \pm 94.5801)/(T/100K)$ 4-Methyl-2-pentanol $\ln x_1 = (4.0718 \pm 0.6401) \\ -(4.2973 \pm 0.8340)/(T/100K)$ $+(170.1297 \pm 56.6925) \ln(T/100K)$ $-(30.5853 \pm 8.4252)(T/100K)$ $-(3.0877 \pm 0.3305) \ln(T/100K)$ $\sigma = 0.0088$ 273.15 - 413.15 K $\sigma = 0.0065$ 201.15 - 319.45 K 1-Dodecanol $\ln x_1 = (89.8907 \pm 7.6611)$ $-(129.0024 \pm 12.1823)/(T/100K)$ $-(43.4629 \pm 3.3184) \ln(T/100K)$ $\sigma = 0.0093$ 303.15 - 453.15 K 1-Tetradecanol No equation, only two values.

| COMPO | NENTS: | EVALUATOR: | | | | | | |
|-------|--|---|--|--|--|--|--|--|
| (1) | Hydrogen Chloride; HCl; [7647-01-0] | H. Lawrence Clever Department of Chemistry Emory University | | | | | | |
| (2) | Alcohols | Atlanta, GA 30322 USA | | | | | | |
| | | 1984, March, revised 1987, February | | | | | | |
| CRITI | CAL EVALUATION: | | | | | | | |
| REFI | ERENCES: | | | | | | | |
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| COMPONENTS : | 6 | ORIGINAL MEASUREMENTS: | | | | |
|--|---------------|--|----------------------------|--------------------------------------|--|--|
| <pre>(1) Hydrogen chloride; HCl [7647-01-0]</pre> | ; | Lobr | y de Bruyn, | С. А. | | |
| (2) Methanol; CH ₄ O; [67-56 | -11 | 2. P | hys. Chem. | <u>1892</u> , <i>10</i> , 782 - 789. | | |
| (2) Methanor, cn_4 0, co_{-30} | | Recl. Trav. Chim. Pays-Bas <u>1892</u> , 11, 112 - 157. | | | | |
| VARIABLES: T/K = 273.15, p = "baromet | 304.85 | PREPARED BY: W. Gerrard | | | | |
| EXPERIMENTAL VALUES: | | | | <u> </u> | | |
| Temperature P | arts HCl by | | Mol Ratio | Mol Fraction | | |
| | weight for 10 | | | <i>x</i> ₁ | | |
| 0 273.15 | 105 | | 0.922 | 0.480 | | |
| 31.7 304.85 | 75.1 | | 0.659 | 0.397 | | |
| The compiler calcu | lated the mo | ole ra | tio and mol | e fraction values. | | |
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| | AUXILIARY | INFORMA | TION | | | |
| METHOD/APPARATUS/PROCEDURE: | | SOURCE AND PURITY OF MATERIALS: | | | | |
| The gas was passed into a | weighed | (1) 1 | lydrogen ch | loride. Definite | | |
| amount of methanol in a b 3 cm ³ capacity until equi | librium was | | | not given. | | |
| reached at the observed t and at a total pressure o | | (2) 1 | Methanol. S oure alcoho | imply stated that l was used. | | |
| 760 - 770 mmHg (barometri bulb was sealed "à la lam | c). The | | | | | |
| weighed. A titration was | also | | | | | |
| mentioned, but the statem vague. | ent is | | | | | |
| - | | | | | | |
| | 1 | ESTIMA | TED FROMP. | | | |
| | | ESTIMA | TED ERROR: | | | |
| | | ESTIMA | TED ERROR: | | | |
| | | | | | | |
| | | ESTIMA | | | | |
| | | | | | | |
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| COMPONENTS: | ORIGINAL MEASUREMENTS: |
|--|---|
| <pre>(1) Hydrogen chloride; HCl; [7647-01-0]</pre> | Kohn, G. |
| (2) Methanol | Ber. Dtschn. Chem. Ges. B. <u>1932</u> , 65, 589 - 595. |
| or Ethanol | |
| | |
| VARIABLES: T/K: 275.15 - 334.15 | PREPARED BY: |
| P/kPa: 101 (atmospheric) | W. Gerrard |
| EXPERIMENTAL VALUES: | |
| T/K Alcohol Hydroge | n Mol Ratio Mol Fraction |
| Chlorid wt/g wt/g | $n_{1/n_{2}}^{e}$ |
| Methanol; CH ₄ O; [67 | -56-1] |
| 276.15 19.9 21.4 | 0.944 0.486 |
| Ethanol; C ₂ H ₆ O; [64 | -17-5] |
| 277.15 20.6 16.8 | 1.029 0.507 |
| 288.15 31.7 24.5 | 0.975 0.494 |
| | |
| | INFORMATION |
| | |
| METHOD/APPARATUS/PROCEDURE: The hydrogen chloride was passed to the alcohol in a measuring cylinder in an ice-salt mixture. The temperature, "end temperature" was recorded, and the absorbed gas was weighed. The pressure was presumably atmospheric. | SOURCE AND PURITY OF MATERIALS: (1) Hydrogen chloride. Prepared from sodium chloride and sulfuric acid, and dried by sulfuric acid. (2) Alcohols. Kahlbaum specimens. |
| | ESTIMATED ERROR: |
| | ówt∕g = 0.1 |
| 1 | REFERENCES : |
| | |

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| COMPONENTS : | | ORIGINAL MEASUREMENTS: |
|---|--|--|
| (1) Hydrogen cl [7647-01-0] | | Chesterman, D. R. |
| (2) Alcohols | - | J. Chem. Soc. <u>1935</u> , 906 - 910. |
| | | |
| | | |
| VARIABLES: | | PREPARED BY: |
| T/K: Total P/kPa: | | W. Gerrard |
| EXPERIMENTAL VALUE | S: | |
| | T/K Observed Sol Pressure g HCl o p/mmHg | Lubility Mol Fraction y^{-1} Solution x_1 |
| Me | ethanol; CH ₄ O; [67-56-1] | |
| 29 | 98.15 750 | 0.44 0.41 |
| Et | hanol; C ₂ H ₆ 0; [64-17-5] | |
| | 98.15 752 | 0.39 0.45 |
| 2- | -Propanol; C ₃ H ₈ O; [67-63 | 3-0] |
| | 98.15 771 | 0.17 0.25 |
| | ······································ | y values were calculated by |
| | | |
| | AUXILIARY | INFORMATION |
| METHOD APPARATUS / | PROCEDURE : | SOURCE AND PURITY OF MATERIALS: |
| METHOD APPARATUS / PROCEDURE: The apparatus was that used for the conductivity. A sample of the saturated solution was removed, weighed, the hydrogen chloride was reacted with excess base which was back titrated with a standard acid solution. | | Hydrogen chloride. Prepared from conc. sulfuric acid and pure sodium chloride. Passed through sulfuric acid and over P₂O₅. |
| | | <pre>(2) Methanol. Was stated to be the purest obtainable. Freed from acetone, dried with sodium, b.p./°C (759 mmHg) = 66.0.</pre> |
| | | Ethanol. Was stated to be the purest obtainable. Dried with calcium oxide, b.p./°C (752 mmHg) = 77.7. |
| | | 2-Propanol. Was stated to be the purest obtainable. Dried over calcium, b.p./°C (745 mmHg) = 80.5. |
| | | |

| COMPONENTS: | ORIGINAL M | EASUREMENTS: | |
|---|--|-------------------------------------|----------------------------|
| (1) Hydrogen chloride; HCl; | | .; Macklen, E.D. | |
| [7647-01-0] | | hem. <u>1956</u> , 6, 24 | |
| (2) Alcohols | | <i>new.</i> <u>1990</u> , 0, 24 | 1-244 |
| VARIABLES: | PREPARED B | | |
| T/K: See below Total P/kPa : 101.325 (1 atm) | W. G | errard | |
| EXPERIMENTAL VALUES: | K Mole ratio | Mole* Sm | oothed** |
| · | ⁿ HCl ^{/n} alcohol | fraction mole | fraction |
| | ····· | *нсі | *нсі |
| Methanol; CH ₄ O; [67-56-1] 273 | 3.15 | | 0.487 |
| 275 | 5.25 0.933).35 0.883 | 0.483 0.469 | |
| | 8.15 | 0.409 | 0.462 |
| | 5.55 0.835 | 0.455 | |
| | 1.85 0.785 3.15 | 0.440 | 0.435 |
| | 0.75 0.700 | 0.412 | |
| | 3.15 7.35 0.645 | 0.392 | 0.405 |
| | 3.15 | | 0.374 |
| Smoothing equation: $\ln x_{HC1} = 21.1$ Standard error in x_{HC1} about | 83 - 28.125/(T/ the regression | 100) - 11.550 lr line = 1.27 × 1 | (T/100) 0 ⁻³ |
| Ethanol; C ₂ H ₆ O; [64-17-5] 273 | 3.15 | | 0.513 |
| - 276 | 5.15 1.021 | 0.505 | 0 407 |
| | 3.15 3.75 0.895 | 0.472 | 0.487 |
| | 8.15 | 0.440 | 0.461 |
| | 7.55 0.816 3.15 | 0.449 | 0.434 |
| | 7.15 0.732 | 0.423 | |
| | 8.25 0.686 8.15 | 0.407 | 0,408 |
| Smoothing equation: ln x _{HCl} = 11.6 Standard error in x _{HCl} about | 531 - 14.943/(T/ the regression | 100) - 6.795 ln(line = 2.46 × 1 | T/100) 0 ⁻³ |
| * calculated by the compiler ** smoothing equation and smoothe | ed values were c | alculated by H.I | . Clever |
| AUXILIA | ARY INFORMATION | | |
| METHOD/APPARATUS/PROCEDURE: | SOURCE AND | PURITY OF MATER | IALS: |
| Hydrogen chloride was generated in an all-glass apparatus. | | gen chloride: se red and dried. | lf- |
| The all-glass absroption vessel (50 cm^3) comprised an inlet bubble tube, an outlet tube, and the part holding a weighed amount of liquid | er were | ols: high grade distilled and at | |
| Each tube was fitted with a tap, a | | ERROR: $\delta T/K = \pm 0.1$ | |
| either a B-19 cone, or a B-19 sock Entrained liquid was collected and | $\delta x_{max}/\delta$ | $x_{HC1} = \pm 0.005 \text{ to}$ | 0.01 |
| allowed for. Temperature control | | | |
| was within 0.1 K. The amount of c absorbed was determined by weighin | | : | |
| | | | |

97

Hydrogen Chloride in Non-Aqueous Solvents

| | OPICINAL NEACOPROPERTY |
|--|--|
| COMPONENTS: (1) Hydrogen chloride; HCl; [7647-01-0] | ORIGINAL MEASUREMENTS: Gerrard, W.; Macklen, E.D. |
| (2) Alcohols | J. Appl. Chem. <u>1956</u> , 6, 241-244 |
| EXPERIMENTAL VALUES: T/K | Mole ratio Mole* Smoothed** HCl ^{/n} alcohol fraction mole fraction ^x HCl ^x HCl |
| 1-Propanol; C ₃ H ₈ O; [71-23-8] 273.1 275.6 281.6 | 5 1.028 0.507 |
| 283.1 285.5 | 5 0.488 5 0.932 0.482 |
| 293.1 298.7 303.1 | 5 0 . 811 0 . 448 |
| 307.3 313.1 | 0.740 0.425 |
| 315.1 323.1 | |
| Smoothing equation: $\ln x_{HC1} = 12.983$ Standard error in x_{HC1} about the | - 16.900/(T/100) - 7.428 ln(T/100) e regression line = 2.67 × 10 ⁻⁴ |
| 2-Propanol; C ₃ H ₈ O; [67-63-0] 273.11 280.5 | |
| 283.1 289.7 | 0.508 0.970 0.492 |
| 293.1 300.4 303.1 | 0.877 0.467 |
| 306.4 313.1 | 5 0.824 0.452 5 0.435 |
| 316.4 323.1 | |
| Smoothing equation: ln x _{HCl} = 13.166 Standard error in x _{HCl} about the | - 17.405/(T/100) - 7.395 ln(T/100) e regression line = 6.64 × 10 ⁻⁴ |
| 1-Butanol; C ₄ H ₁₀ O; [71-36-3] 273.1 277.1 281.9 | 5 1.023 0.506 |
| 283.1 286.8 291.0 | 5 0.925 0.481 5 0.887 0.470 |
| 293.1 298.1 | 0.827 0.453 |
| 303.11 308.9 313.11 | 0.732 0.423 |
| 318.1 323.1 | o 0.660 0.398 |
| Smoothing equation: $\ln x_{HC1} = 13.723$ Standard error in x_{HC1} about the | - 17.945/(T/100) - 7.779 ln(T/100) e regression line = 7.31 × 10 ⁻⁴ |
| 2-Butanol; C ₄ H ₁₀ O; [78-92-2] 273.15 281.25 | 0.533 |
| 283.1 283.3 | 0.512 5 1.046 0.511 |
| 291.4! 293.1! 298.6! | o.489 |
| 303.1 304.0 | 0.465 |
| 312.99 | o.793 0.442 |
| Smoothing equation: ln x _{HCl} = 10.431 Standard error in x _{HCl} about the * calculated by the compiler | - 13.623/(T/100) - 6.043 ln(T/100) e regression line = 2.12 × 10 ⁻³ |
| ** smoothing equation and smoothed v | values were calculated by H.L. Clever |

98

| COMPONENTS: (1) Hydrogen chloride; HCl; [7647-01-0] (2) Alcohols | G | errard, W. | ASUREMENTS: ; Macklen, em. <u>1956</u> , 6 | E.D. |
|---|----------------------------------|------------------------------------|--|---|
| EXPERIMENTAL VALUES: | | | | |
| | • | ele ratio /n _{alcohol} | | Smoothed** mole fraction ^x HCl |
| [78-83-1] 21 | 73.15 79.05 83.15 85.55 | 1.008 | 0.502 | 0.514 0.492 |
| 2 2 2 2 | 88.05 92.25 93.15 | 0.922 0.886 0.840 | 0.480 0.470 0.457 | 0.468 |
| 3 | 03.15 06.45 13.15 | 0.766 | 0.434 | 0.442 0.416 |
| 3 | | 0.661 | 0.398 | 0.389 |
| Smoothing equation: ln x _{HCl} = 15 Standard error in x _{HCl} abou | .284 - 2 t the re | 0.263/(T/1 gression l | 00) - 8.490 ine = 5.92 |) ln(T/100) × 10 ⁻³ |
| [584-02-1] 5 12 2 | | 1.083 | 0.520 | 0.535 0.514 |
| 2 | 93.15 | 0.979 | 0.495 | 0.491 |
| 3 | 03.05 03.15 06.15 | 0.878 | 0.468 0.460 | 0.467 |
| 3 | 13.15 16.55 | 0.771 | 0.435 | 0.443 |
| | 23.15 .674 - 1 | 3.968/(T/1 | 00) - 6.156 | 0.419 5 ln(T/100) |
| Smoothing equation: $\ln x_{HC1} = 10$ Standard error in x_{HC1} abou | | gression 1 | ine = 5.39 | |
| [137-32-6] 2 | 73.15 77.85 83.15 | 1.068 | 0.516 | 0.526 |
| 2 | 84.95 91.55 93.15 | 1.004 0.948 | 0.501 0.487 | 0.482 |
| 2 | | 0.899 | 0.473 | 0.459 |
| 3 | 03.55 12.95 13.15 | 0.844 0.771 | 0.458 0.435 | 0.436 |
| 3 | 18.35 | 0.736 | 0.424 | 0.412 |
| Smoothing equation: ln x _{HCl} = 10 Standard error in x _{HCl} abou | .108 - 1 t the re | 3.180/(T/1 egression l | 00) - 5.896 ine = 9.03 | $\frac{1}{10} \ln(T/100) \times 10^{-3}$ |
| <pre>* calculated by the compiler ** smoothing equation and smoot</pre> | hed valu | aes were ca | lculated by | 'H.L. Clever |
| | | | | |

99

| COMPONENTS: (1) Hydrogen chloride; HCl; [7647-01-0] (2) Alcohols | ORIGINAL ME Gerrard, W. J. Appl. Ch | ; Macklen, | E.D. |
|---|---|---------------------------------------|-------------------------------------|
| , | Mole ratio Cl ^{/n} alcohol | Mole* fraction ^x HCl | |
| 4-Heptanol; C ₇ H ₁₆ O; 283.05 [589-55-9] 283.15 286.65 | 1.054 | 0.513 | 0.513 |
| 293.15 294.45 | 0.950 | 0.487 | 0.490 |
| 303.15 306.15 313.15 | 0.850 | 0.459 | 0.466 0.442 |
| 318.45 323.15 | 0.753 | 0.430 | 0.419 |
| Smoothing equation: $\ln x_{HC1} = 9.992 - Standard error in x_{HC1}^{HC1}$ about the | 12.996/(T/10 regression 1 | 00) - 5.832 Line = 1.80 | 2 ln(T/100)) × 10 ⁻⁴ |
| 1-Octanol; C ₈ H ₁₈ O; [111-87-5] 273.15 278.45 | 1.021 | 0.505 | 0.516 |
| 283.15 285.65 289.65 | 0.951 0.912 | 0.487 0.477 | 0.494 |
| - 293.15 299.15 303.15 | 0.827 | 0.453 | 0.469 0.443 |
| 304.05 311.15 | 0.788 0.728 | 0.441 0.421 | 0.113 |
| 313.15 319.75 323.15 | 0.661 | 0.398 | 0.416 0.389 |
| Smoothing equation: $\ln x_{HC1} = 14.392$ - Standard error in x_{HC1} about the | 18.962/(T/1 regression 1 | 100) - 8.07 Line = 6.23 | 2 ln(T/100) 3 × 10 ⁻³ |
| 3,5,5-Trimethyl-1-hexanol; 273.15 C ₉ H ₂₀ O; [3452-97-9] 280.05 | 1.009 | 0.502 | 0.517 |
| 283.15 290.45 293.15 | 0.912 | 0.477 | 0.494 0.470 |
| 300.45 303.15 308.25 | 0.820 0.759 | 0.451 0.431 | 0.444 |
| 313.15 313.65 | 0.739 | 0.431 | 0.418 |
| 323.15 Smoothing equation: $\ln x_{HC1} = 13.297$ - | 17.451/(T/1 | 00) - 7.53 | 0.392 1 ln(T/100) |
| Standard error in x _{HCl} about the | regression 1 | line = 1.35 | 5 × 10 ⁻⁴ |
| <pre>** calculated by the compiler ** smoothing equation and smoothed va</pre> | lues were ca | alculated b | by H.L. Clever |

| | NENTS: | | | | ORIGINAL MEASUREM | ENTS : | |
|--|---|--|--|---|---|--------------------------------|----------------------------|
| (1) | | gen chlori | de; HCl; | | · · · · · · · · · · · · · · · · · · · | | |
| / | | -01-0] | | | Fritz, J. J. | | |
| (2) | Metha | nol; CH ₄ O; | l67 - 56-1 | 1 | J. Phys. Chem | 1956, 60 | 0, 1461. |
| | Ethan | ol; C ₂ H ₆ O; | [64-17-5 | 1 | | | |
| VARIA | BLES: | | | | PREPARED BY: | | |
| | Р | T/K = 298 1/Pa = 0.1 | | | H | I. L. Clever | r |
| EXPER | IMENTAL | VALUES: | | | | | |
| _ | Temp | erature | | | Molality | Mol Ratio | |
| | t∕°C | <i>Т/</i> К | | ssure p ₁ /atm | m ₁ /mol kg ⁻¹ | n ₁ /n ₂ | Fraction ^x 1 |
| | 1 | Methanol | | | | | |
| | 25 | 298.15 Ethanol | 8x10 ⁻⁴ | 1.1×10 ⁻⁶ | 0.56 | 0.0179 | 0.017 ₆ |
| | 25 | | 0.46 | 6.1x10 ⁻⁴ | 1.00 | 0.0461 | 0.0440 |
| | | | | | | | |
| | | | | | ب العرب و الم | | |
| METHO | | | | AUXILIARY | INFORMATION | | |
| ጥ | D/APPAR | ATUS / PROCEDU | RE: | AUXILIARY | INFORMATION SOURCE AND PURITY | OF MATERIALS | : |
| | he vap | ATUS/PROCEDU or pressur d from | | | · · · · · · · · · · · · · · · · · · · | OF MATERIALS | : |
| cal | he vap culate | or pressur | e of HCl | | · · · · · · · · · · · · · · · · · · · | | : |
| cal 1 | he vap culate n $f_1 =$ | or pressur d from | e of HCl - E) | was | SOURCE AND PURITY | | : |
| cale li whe: ^H 2, | he vap culate n f_1 = re E i Pt/HC | or pressur d from $(F/RT) (E_g^0)$ s the volt l(alcohol) | e of HCl - E) age of th /AgCl, Ag | was e cell | SOURCE AND PURITY | | : |
| cale li whe: H ₂ , and | he vap culate n $f_1 =$ re E i Pt/HC E_q^0 i | or pressur d from (F/RT)(E ⁰ g s the volt | e of HCl - E) age of th /AgCl, Ag dard pote | was e cell | SOURCE AND PURITY | | :: |
| cald li whe: H ₂ , and the T Har: value | he vap culate n $f_1 =$ re E i Pt/HC $E_{\mathcal{G}}^{0}$ i cell he E v ned an ue was | or pressur d from $(F/RT) (E_g^0)$ s the volt l(alcohol) s the stan | e of HCl - E) age of th /AgCl, Ag dard pote ugacity. taken fr f l), and | was e cell , ntial of om the E_q^0 | SOURCE AND PURITY NO informa ESTIMATED ERROR: | | |

| COMPONENTS: | ORIGINAL MEASUREMENTS: | | | |
|--|---|--|--|--|
| <pre>(1) Hydrogen chloride; HCl; [7647-01-0]</pre> | Schmid, H.; Maschka, A.; Sofer, H. | | | |
| (2) Methanol; CH ₄ O; [67-56-1] | Monatshefte <u>1964</u> , 95, 348 - 358. | | | |
| | | | | |
| VARIABLES: | PREPARED BY: | | | |
| T/K = 298.15 | | | | |
| $p_1/kPa = 5.19 - 11.159$ (0.0389 - 83.7 mmHg) | | | | |
| METHOD/APPARATUS/PROCEDURE: | · · · · · · · · · · · · · · · · · · · | | | |
| METHOD/APPARATUS/PROCEDURE: The solution of HCl in methanol was prepared freshly each day, because of the slow conversion into chloromethane as reported by Carter and Butler (1). The molality of the solution for use in the vapor pressure measurements was determined by acid-akkali titration. Dry nitrogen was passed through the solution of the stated molality at 298.15 K slowly enough to give an effluent gas "saturated" with HCl and methanol. The effluent gas was passed into the first of two U-tubes to absorb the HCl in 0.5 N-NaOH, and most of the methanol, the increase in weight and a potentiometric titration (AgNO ₃) giving the contents. The remaining methanol and entrained water vapor was collected in the second U-tube containing water-free magnesium chloride. The nitrogen was collected in a gasometer. The partial pressures, p_1 and p_2 were calculated by assuming the validity of Dalton's law. | | | | |
| - | | | | |
| The authors used the data of Oiwa (ref 2) to establish that Henry's constant in $f_1 = ka_1$ is 2.58 mmHg. | | | | |
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| AUXILIARY | INFORMATION | | | |
| METHOD/APPARATUS/PROCEDURE: | SOURCE AND PURITY OF MATERIALS: | | | |
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| | ESTIMATED ERROR: | | | |
| | | | | |
| | | | | |
| | DEEEDENCIA | | | |
| | REFERENCES: | | | |
| | l. Carter, S. R.; Butler, J. A. V. J. Chem. Soc. <u>1924</u> , 125, 963. | | | |
| | Oiwa, I. T. J. Phys. Chem. <u>1956</u>, 60, 754. | | | |
| | | | | |

| COMPONENTS. | | | | | | | |
|--|--|---|---|--------------------------------|------------------------|--|--|
| COMPONENTS: | | | | | ORIGINAL MEASUREMENTS: | | |
| | <pre>(1) Hydrogen chloride; HCl; [7647-01-0]</pre> | | | I.; Maschka, | A.; Sofer, H. | | |
| (2) Methanol; CH ₄ O; [67-56-1] | | | Monatshej | fte <u>1964</u> , 95 | 5, 348 - 358. | | |
| EXPERIMENTAL VA | LUES: | | | | | | |
| <i>T/</i> K | Partial | Pressures | | Mol Ratio | Mol Fraction | | |
| | HCl p ₁ /mmHg | CH3OH p2/mmHg | | n ₁ /n ₂ | <i>x</i> ₁ | | |
| 298.15 | 0.0417 0.0389 0.0417 0.0473 0.0531 0.0538 0.0705 0.0772 0.0932 | 124.6 125.1 125.1 124.0 123.2 124.3 126.6 124.6 122.6 | 0.375 0.379 0.416 0.446 0.478 0.507 0.580 0.598 0.67 | 0.0120 | 0.0119 | | |
| | $\begin{array}{c} 0.110\\ 0.154\\ 0.141\\ 0.152\\ 0.201\\ 0.194\\ 0.231\\ 0.310\\ 0.386\\ 0.365\\ 0.492 \end{array}$ | 119.8 123.2 122.7 122.0 121.0 120.3 120.3 119.6 119.3 119.1 116.6 | 0.73 0.825 0.85 0.885 0.975 0.98 1.04 1.28 1.43 1.45 1.67 | 0.0234 | 0.0228 | | |
| | 0.516 0.671 0.961 | 115.6 113.2 111.8 | 1.84 2.06 2.45 | 0.0589 | 0.0556 | | |
| | 0.903 1.27 1.49 2.21 2.34 3.63 4.01 | 110.7 107.8 105.4 102.7 101.2 97.2 94.4 | 2.46 2.85 3.23 3.67 4.12 4.6 4.85 | 0.0787 | 0.0730 | | |
| | 5.32 5.77 7.94 8.63 8.61 9.37 | 91.7 90.4 90.8 84.7 87.5 79.2 | 5.45 5.6 6.05 6.45 6.6 6.8 | 0.174 | 0.149 | | |
| | 10.2 12.4 14.8 15.2 17.4 17.8 19.1 | 79.6 82.9 78.5 77.2 77.5 73.4 70.4 | 6.9 7.25 7.75 7.85 8.25 8.3 8.4 | 0.221 | 0.181 | | |
| | 23.1 26.4 24.7 33.4 33.8 34.8 36.1 | 69.1 70.9 68.6 66.1 68.0 65.1 65.6 | 8.9 9.15 9.55 9.55 9.55 9.9 10.1 | 0.285 | 0.222 | | |
| | 45.8 47.6 54.5 58.9 65.4 | 55.1 60.9 55.4 51.3 51.2 | 10.5 10.55 11.15 11.45 11.7 | 0.336 | 0.251 | | |

83.7

44.9

12.4

0.397

0.284

| COMPONENTS : | ORIGINAL MEASUREMENTS: |
|--|--|
| (1) Hydrogen chloride; HCl; [7647-01-0] (2) Ethanol; C₂H₆O; [64-17-5] | Lobry de Bruyn, C. A. <i>Z. Phys. Chem.</i> <u>1892</u> , <i>10</i> , 782 - 789. <i>Recl. Trav. Chim. Pays-Bas</i> <u>1892</u> , <i>11</i> , 112 - 157. |
| VARIABLES: T/K = 273.15, 305.15 p = "barometric" | PREPARED BY: W. Gerrard |

EXPERIMENTAL VALUES:

| Tempe | rature | Parts HCl by | | Mol Fraction |
|-------|-------------|---|--------------------------------|-----------------------|
| t∕°C | <i>Т/</i> К | weight for 100 parts of ethanol ¹ | ⁿ 1 ^{/n} 2 | <i>x</i> ₁ |
| 0 | 273.15 | 83 | 1.047 | 0.512 |
| 32 | 305.15 | 61.6 | 0.777 | 0.437 |

¹ Equivalent to g of gas per 100 g of solvent.

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The mole ratio and mole fraction values were calculated by the compiler.

| AUXILIARY INFORMATION | | | | |
|---|---|--|--|--|
| ME THOD /APPARATUS / PROCEDURE : | SOURCE AND PURITY OF MATERIALS: | | | |
| The gas was passed into a weighed amount of ethanol in a bulb of 2 - 3 cm ³ capacity until equilibrium was reached at the observed temperature and at a total pressure of about 760 - 770 mmHg (barometric). The bulb was sealed "à la lampe," and weighed. A titration was also mentioned, but the statement is vague. | (1) Hydrogen chloride. Definite information not given. (2) Ethanol. Simply stated that pure alcohol was used. ESTIMATED ERROR: REFERENCES: | | | |

| COMPONENTS : | | | ORIGIN | AT. MEASUR | FMENTS . | |
|---|--|---|--|--|--|---|
| | | | ORIGINAL MEASUREMENTS: | | | |
| <pre>(1) Hydrogen chloride; HCl; [7647-01-0]</pre> | | | Jones, W. J.; Lapworth, A.; Lingford, H. M. | | | |
| (2) Ethanol; C ₂ H ₆ O; [64-17-5] | | | J. Ci | hem. Soc | e. <u>1913</u> , <i>103</i> , 252-263. | |
| VARIABLES: T/K = 298.15 $p_1/Pa = 14.4 - 625$ (0.108 - 4.69 mmHg) | | | PREPAR | ED BY: | H. L. Clever | |
| EXPERIMENTAL VAL | LUES: | <u> </u> | <u> </u> | | | |
| <i>Т/</i> К | T/K Hydrogen Hydrogen Chloride Chloride Pressure Concentration | | Mole Ratio Mol Fraction | | | |
| | p ₁ /mmHg | | n ₁ , | /n ₂ | <i>x</i> ₁ | |
| 298.15 | 0.108 0.417 0.811 2.63 4.69 | 0.275 0.751 1.168 2.390 3.188 | 0.0 | 0162 0444 0696 1451 1965 | 0.0159 0.0425 0.0651 0.1267 0.1642 | |
| ſ | 760. | 10.45 | 0.1 | 82 | 0.45] ¹ | |
| | ta for the | aqueous ethano | l solu | itions a | s of water per dm ³ . are not included in | |
| | | AUXILIARY | | | | |
| METHOD/APPARATUS/PROCEDURE: A solution of dry ethanol + hydrogen chloride was prepared and placed in the middle of a three bubbler train. The first bubbler contained pure ethanol, the second the solutio of known composition, and the third contained water. | | (1) H (2) H (2) H | Hydrogen given. S Iried. Ethanol. alcohol calcium | ITY OF MATERIALS: a chloride. Source not Stated to be carefully Commercial absolute was distilled from turnings. The ethanol was $\rho_4^{2.5}/g$ cm ⁻³ = 0.784 | 93. | |
| Hydrogen gas, prepared from zinc and dilute hydrochloric acid, suitably purified and dried, was passed through the system. The volume of hydrogen gas was measured. The HCl transferred from the alcohol solution to the water was titrated against standard barium hydroxide. | | | | $\delta p_1/mm$ | R: $T/K = \pm 0.05$ $Hg = \pm 0.03$ $x_1 = \pm 0.025$ (Compiler |) |
| The HCl pressure over the ethanol + hydrogen chloride solution of known concentration was calculate from the hydrogen volume, amount of hydrogen chloride, and the vapor pressure of pure ethanol. | | | đ | | | |

105

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|---|---------------------------------------|--------------------------------------|-----------------------------------|--|---------------|
| COMPONENTS: | | | ORIGINAL MEASUREMENTS: | | |
| (1) Hydrogen ch [7647-01-0] | loride; HCl; | | Kohn, G. | | |
| | | | <i>Ber. Dtschn</i> 65, 589 - 5 | . Chem. Ges. B. <u>193</u> 95. | <u>2</u> , |
| or | | | | | |
| 1-Butanol | | | | | |
| | 75.15 - 334.1 | 5 | PREPARED BY: | | |
| P/kPa: 1 | 01 atmospheric) | | | W. Gerrard | |
| EXPERIMENTAL VALUES | : | | | ······································ | |
| T | /K Alcohol | Hydrogen | Mol Ratio | Mol Fraction | |
| | wt/g | Chloride wt/g | ⁿ 1 ^{/n} 2 | <i>x</i> 1 | ſ |
| | 1-Propanol; | с ₃ н ₈ 0; [7 | 71-23-8] | | |
| 276 277 | .15 31.2 .15 25.2 | 19.3 15.5 | 1.018 1.012 | 0.505 0.503 | : |
| | 1-Butanol; | C ₄ H ₁₀ 0; [7 | 71-36-3] | | |
| 278 | .15 30.2 | 14.3 | 0.961 | 0.490 | |
| 279 | .15 30.0 .15 30.9 | 15.6 16.1 | 1.056 1.058 | 0.513 0.514 | |
| | | | | | |
| | ···· | AUXILIARY | INFORMATION | · · · · · · · · · · · · · · · · · · · | |
| METHOD/APPARATUS/PROCEDURE: The hydrogen chloride was passed to the alcohol in a measuring cylinder in an ice-salt mixture. The temperature, "end temperature", was recorded, and the absorbed gas was weighed. The pressure was presumably atmospheric. | | | (1) Hydroge sodium acid, a | RITY OF MATERIALS: n chloride. Prepar chloride and sulfur nd dried by sulfuri s. Kahlbaum specim | ic c acid. |
| | | | ESTIMATED ERF | OR: δwt/g = 0.1 | |
| | | | | | |

| | • | |
|--|---|--|
| Components : | ORIGINAL MEASUREMENTS: | |
| <pre>1. Hydrogen Chloride; HCl; [7647-01-0]</pre> | Cook, T. M. | |
| 2. 1-Propanol; C ₃ H ₈ O; [71-23-8] | Thesis, <u>1966</u> University of London | |
| 3 0 | | |
| | | |
| VARIABLES: | PREPARED BY: | |
| T/K: 267.65 - 304.15 Total P/kPa: 101.325 (1 atm) | W. Gerrard | |
| 10tal F/KFa: 101.525 (1 atm) | (smoothed data calculated by H.L. Clever) | |
| EXPERIMENTAL VALUES: | | |
| T/K Mol Ratio | Mol Fraction | |
| ⁿ HC1/ ⁿ C ₃ H ₈ C | | |
| | | |
| 267.65 1.110 273.15 1.052 | 0.526 0.513 | |
| | 0.493 | |
| 288.55 0.901 | 0.474 | |
| 304.15 0.767 | 0.434 | |
| The mole fraction values were calculat | ed by the compiler. | |
| | | |
| | 066/(T/100) - 6.790 ln (T/100) | |
| Standard Error About F | Regression Line = 7.11 x 10^{-4} | |
| | Nol Fraction | |
| | x _{HC1} | |
| | | |
| | | |
| 263.15 273.15 | 0.536 0.513 | |
| 283.15 | 0.489 | |
| 293.15 | 0.463 | |
| 303.15 313.15 | 0.434 0.411 | |
| | | |
| | | |
| AUXILIARY | INFORMATION | |
| METHOD/APPARATUS/PROCEDURE: | SOURCE AND PURITY OF MATERIALS: | |
| The data were cited by Gerrard (1). | 1. Hydrogen chloride. Sample of best guality was self prepared, and was | |
| Hydrogen chloride was passed into a | passed through concentrated sul- | |
| bubbler tube containing a weighed | furic acid and calcium chloride. | |
| amount of solvent at the specified | 2. 1-Propanol. Purified and attested | |
| temperature until the increase in | | |
| weight was constant at the barometric pressure (2). | | |
| | | |
| For temperatures below 273 K a weighed amount (excess) of pyridine | | |
| was quantitatively injected into the | | |
| absorption vessel at the temperature | ESTIMATED ERROR: | |
| of the thermostat. The tube was then weighed at room temperature. | $\delta x_1 / x_1 = 0.005$ | |
| Chen werghen at room temperature. | | |
| | | |
| | REFERENCES: 1. Gerrard, W. | |
| | J. Chim. Phys. 1964, 61, 73; | |
| | Solubility of Gases in Liquids, | |
| | Plenum Press, New York, <u>1976</u> . | |
| | 2. Ahmed, W.; Gerrard, W.; Maladkar, V. K. J. Appl. Chem. | |
| | <u>1970</u> , 20, 109. | |
| | | |

| COMPONENTS: | ORIGINAL MEASUREMENTS: | | |
|--|---|--|--|
| | | | |
| <pre>(1) Hydrogen chloride; HCl; [7647-01-0]</pre> | Gerrard, W.; Mincer, A. M. A.; Wyvill, P. L. | | |
| (2) Alkanols | J. Appl. Chem. <u>1959</u> , 9, 89-93. | | |
| VARIABLES: | PREPARED BY: | | |
| T/K: See below Total P/kPa : 101.325 (1 atm) | W. Gerrard | | |
| EXPERIMENTAL VALUES: T/K | Mole ratio Mole* Smoothed** HCl ^{/n} alkanol fraction mole fraction | | |
| | *HCl [*] HCl | | |
| 1-Butanol; C ₄ H ₁₀ O; [71-36-3] 193.15 195.15 | 0.812 4.127 0.805 | | |
| 203.15 | 0.769 | | |
| 213.15 223.15 | | | |
| 223.15 | | | |
| 243.15 | | | |
| 253.15 | 0.579 | | |
| 263.15 | | | |
| 273.15 | | | |
| 283.15 293.15 | 0.487 0.460 | | |
| 303.15 | 0.435 | | |
| 304.15 | 0.740 0.436 | | |
| * 313.15 | 0.412 | | |
| 318.15 323.15 | 0.660 0.398 0.390 | | |
| <pre>Smoothing equation: ln x_{HCl} = 3.548 - Standard error in x_{HCl} about the * calculated by the compiler ** smoothing equation and smoothed va</pre> | regression line = 3.04 × 10 | | |
| AUXILIARY | INFORMATION | | |
| METHOD/APPARATUS/PROCEDURE: | SOURCE AND PURITY OF MATERIALS: | | |
| The liquid component was weighed in a bubbler tube. The amount of gas absorbed was determined by reweighing to constant weight. The total pressure was barometric, very nearly 1 atm (101.325 kPa). | Hydrogen chloride: good specimen from a commercial cylinder was dried. Alkanols : carefully purified, and purity rigourously attested. | | |
| For determination at temperatures | ESTIMATED ERROR: $\delta T/K = \pm 2$ below 273 K $\delta x_{HCl}/x_{HCl} = \pm 0.005$ to 0.015 | | |
| below 273 K, a chemical titration was carried out. After the maximum | | | |
| absorption at the stated temperature, the bubbler was attached to a flask | | | |
| containing one dm ³ of water, and allowed to warm slowly to room temperature (12 hours). The contents of the bubbler tube were then added to the water, and the total chloride ion was determined by the Volhard method. A low temperature, Teddington-type YM | REFERENCES: | | |
| thermostat was used for temperatures below 273 K, the control being to ±2 K. | | | |

| r | | | |
|---|------------------------------|-------------------------|-----------------------------------|
| COMPONENTS: | ORIGINAL ME | ASUREMENTS | 5: |
| <pre>(1) Hydrogen chloride; HCl; [7647-01-0]</pre> | Gerrard, W. Wyvill, P. | | A. M. A.; |
| (2) Alkanols | J. Appl. Ch | em. <u>1959</u> , | 9, 89-93. |
| EXPERIMENTAL VALUES: T/K | Mole ratio | Mole* | Smoothed** mole fraction |
| | HCl ^{/n} alkanol | ^x HC1 | ^x HC1 |
| | | | |
| 2-Butanol; C ₄ H ₁₀ O; [78-92-2] 193.15 198.15 203.15 | | 0.805 | 0.824 |
| 213.15 | | 0.731 | 0.736 |
| 223.15 | | 0.694 | 0.696 |
| 233.15 243.15 | | 0 6 2 4 | 0.659 |
| 243.15 | 1.000 | 0.624 | 0.624 0.592 |
| 263.15 | | | 0.562 |
| 273.15 | | 0.534 | 0.534 |
| 283.15 | | | 0.508 |
| 293.15 303.15 | 0.955 | 0.488 | 0.484 0.461 |
| 313.15 | | | 0.440 |
| 319.15 | 0.738 | 0.425 | |
| 323.15 | | | 0.420 |
| Smoothing equation: $\ln x_{HC1} = 2.062 - Standard error in x_{HC1}$ about the | 1.776/(T/100 regression 1 |) - 2.029 ine = 4.10 | ln(T/100)) × 10 ⁻³ |
| 1-Pentanol; C ₅ H ₁₂ O; [71-41-0] 193.15 | | | 0.798 |
| 201.15 | 3.424 | 0.774 | |
| 203.15 | | | 0.765 |
| 213.15 | | | 0.730 0.694 |
| 231.15 | 1.985 | 0.665 | 0.004 |
| 233.15 | | | 0.658 |
| 243.15 | | 0 607 | 0.622 |
| 245.65 253.15 | 1.545 | 0.607 | 0.588 |
| 253.65 | 1.397 | 0.583 | 0.500 |
| 263.15 | | | 0.554 |
| 273.15 | | | 0.522 |
| 275.15 | 1.091 | 0.522 | 0.492 |
| 293.15 | | | 0.463 |
| 294.15 | | 0.464 | |
| 298.05 | 0.816 | 0.449 | |
| 300.15 303.15 | 0.803 | 0.445 | 0.436 |
| 305.55 | 0.761 | 0.432 | 0.430 |
| 306.55 | 0.742 | 0.426 | |
| 310.25 | 0.716 | 0.417 | A 44- |
| 313.15 314.05 | 0.695 | 0.410 | 0.410 |
| 314.03 | 0.641 | 0.391 | |
| 323.15 | | | 0.386 |
| Smoothing equation: $\ln x_{HC1} = 5.154 - Standard error in x_{HC1}$ about the | 5.677/(T/100 regression l |) - 3.707 ine = 3.72 | ln(T/100) 2 × 10 ⁻³ |
| * calculated by the compiler | | | |
| ** smoothing equation and smoothed va | alues were ca | lculated b | y H.L. Clever |
| | | | - |
| | | | |
| | | | |
| | | | |

| Gerrard, W Wyvill, P. | Chem. <u>1959</u> , Mole* | A. M. A.; 9, 89-93. |
|--|---|--|
| Wyvill, P. J. Appl. (Iole ratio 1 ^{/n} alkano) 4.232 3.060 2.486 1.852 1.576 | . L. Chem. <u>1959</u> , Mole* fraction ^x HCl 0.809 0.754 0.713 0.649 0.612 | 9, 89-93. Smoothed** mole fraction ^x HCl 0.791 0.756 0.719 0.683 0.683 0.648 0.614 0.581 |
| lole ratio 21 ^{/n} alkano 4.232 3.060 2.486 1.852 1.576 | Mole* fraction *HC1 0.809 0.754 0.713 0.649 0.612 | Smoothed** mole fraction ^x HCl 0.791 0.756 0.719 0.683 0.648 0.614 0.581 |
| 4.232 3.060 2.486 1.852 1.576 | 1 fraction *HC1 0.809 0.754 0.713 0.649 0.612 | mole fraction ^x HCl 0.791 0.756 0.719 0.683 0.648 0.614 0.581 |
| 4.232 3.060 2.486 1.852 1.576 | 1 fraction *HC1 0.809 0.754 0.713 0.649 0.612 | mole fraction ^x HCl 0.791 0.756 0.719 0.683 0.648 0.614 0.581 |
| 4.232 3.060 2.486 1.852 1.576 | [×] HC1 0.809 0.754 0.713 0.649 0.612 | 0.791 0.756 0.719 0.683 0.648 0.614 0.581 |
| 3.060 2.486 1.852 1.576 | 0.754 0.713 0.649 0.612 | 0.756 0.719 0.683 0.648 0.614 0.581 |
| 3.060 2.486 1.852 1.576 | 0.754 0.713 0.649 0.612 | 0.756 0.719 0.683 0.648 0.614 0.581 |
| 2.486 1.852 1.576 | 0.713 0.649 0.612 | 0.719 0.683 0.648 0.614 0.581 |
| 1.852 1.576 | 0.649 0.612 | 0.719 0.683 0.648 0.614 0.581 |
| 1.852 1.576 | 0.649 0.612 | 0.683 0.648 0.614 0.581 |
| 1.576 | 0.612 | 0.648 0.614 0.581 |
| 1.576 | 0.612 | 0.614 0.581 |
| 1.576 | 0.612 | 0.581 |
| 1.576 | | 0.581 |
| | | 0.581 |
| 1.249 | 0.555 | |
| | 0.555 | 0.347 |
| | | 0.519 |
| | | 0.491 |
| 0 055 | 0 400 | 0.491 |
| 0.955 | 0.488 | |
| | | 0.464 |
| | | |
| 0.802 | 0.445 | |
| | | 0.438 |
| .964/(T/10 egression | 00) - 3.350 line = 7.66 | × 10 ⁻³ |
| | | 0.821 |
| 4.184 | 0.807 | |
| | | 0.774 |
| 2.681 | 0.728 | 0.729 |
| | | 0.687 |
| 1 972 | 0 664 | |
| 1.772 | 0.004 | 0.648 |
| | | |
| | | 0.612 |
| | | 0.577 |
| | | 0.545 |
| | | 0.516 |
| | | 0.488 |
| | | 0.462 |
| | | 0.438 |
| 0.731 | 0.422 | - |
| | | 0.416 |
| | | |
| | 0.826 0.802 .964/(T/1/ egression 4.184 2.681 1.972 0.731 .476/(T/1) egression | 0.826 0.452 0.802 0.445 .964/(T/100) - 3.350 egression line = 7.66 4.184 0.807 2.681 0.728 1.972 0.664 |

| COMPONENTS : | | | ORIGINAL | MEASUREMEN | ITS: | |
|--|---|---------------------------------|--|--|---|--|
| | | | | Gerrard, W.; Mincer, A. M. A.; Wyvill, P. L. | | |
| (2) l-But | (2) 1-Butanol; C ₄ H ₁₀ O; [71-36-3] | | J. Appl. | Chem. <u>1960</u> | <u>)</u> , <i>10</i> , 115 - 121. | |
| Variation | | ature and pres- le fraction. | | | ature and pres- ble fraction (cont.) | |
| Т/К | Pressure P1 ^{/mmHg} | Mol Fraction | T/K | Pressure P1 ^{/mmHg} | Mol Fraction | |
| 273.65 279.75 284.35 293.15 298.55 303.65 308.15 312.15 315.95 319.15 322.95 326.85 | 174 230 263 307 371 448 531 617 687 754 821 884 973 | 0.405 | 235.15 240.65 246.85 254.65 261.45 266.95 267.45 277.15 281.05 281.05 282.55 284.75 286.55 288.15 | 170 211 252 338 438 542 546 709 847 962 1008 1077 1131 1182 | 0.512 | |
| 273.15 277.35 283.05 286.55 290.55 | 321 366 453 504 575 | 0.451 | Variation fraction | of pressu at constan | re and mole t temperature. | |
| 291.95 295.15 300.75 306.15 309.15 311.65 315.35 | 608 673 805 945 1031 1124 1249 | | T/K | Pressure <u>p₁/mmHg</u> 171 321 321 456 710 | x1 0.405 0.451 0.454 0.480 0.512 | |
| 272.15 279.75 283.55 290.35 293.35 298.55 305.65 | 309 408 466 593 652 779 972 | 0.454 | 278.15 | 760 212 377 387 552 760 877 | 0.516 0.405 0.451 0.454 0.480 0.503 0.512 | |
| 310.95 257.15 259.15 262.75 267.45 273.15 277.35 | 1116 261 281 305 368 456 533 | 0.480 | 283.15 | 257 451 461 659 760 1023 309 | 0.405 0.451 0.454 0.480 0.491 0.512 0.405 | |
| 277.35 278.25 285.15 290.15 293.35 297.95 299.15 303.75 | 555 708 841 928 1079 1115 1281 | | | 531 548 759 783 1183 | 0.401 0.451 0.454 0.478 0.480 0.512 | |
| | | | | | | |
| | | | See nex informa | | additional | |

| <u></u> | |
|---|--|
| COMPONENTS: | ORIGINAL MEASUREMENTS: |
| <pre>(1) Hydrogen chloride; HCl; [7647-01-0]</pre> | Gerrard, W.; Mincer, A. M. A.; Wyvill, P. L. |
| (2) 1-Butanol; C ₄ H ₁₀ O; [71-36-3] | J. Appl. Chem. <u>1960</u> , 10, 115 - 121. |
| | |
| VARIABLES: T/K : 235.15 - 326.85 p_1/kPa : 22.66 - 170.79 (170 - 1281 mmHg) | PREPARED BY: W. Gerrard |
| EXPERIMENTAL VALUES: | |
| See preceding pag | ge. |
| | |
| | INFORMATION |
| | |
| METHOD/APPARATUS/PROCEDURE: To measure the total pressure, taken to be p_1 , a weighed amount of 1-but- anol was put into a flask fitted with a capillary bubbler tube through which the gas was passed into the liquid at approximately room temper- ature. By suitable adjustments of taps the flask was attached to the tapped end of a U-tube manometer containing mercury, the other limb being open to the atmosphere; the pressure, p_1 , was measured to within | (2) 1-Butanol. The sample was purified by a standard technique, and the purity was rigorously attested. |
| 1 mmHg for the condition of equilibriu at each recorded temperature. From a plot of p_1 vs. T/K the value of T/K for $p_1 = 1$ atm was read; and the separately determined mole fraction for that T/K (1) was taken to be the x_1 value for the series. Data for the five series were reporte as on the preceding page. From the set of p_1 vs. T/K curves, data given in the second table above were obtained. | $\delta p_1/\text{mmHg} = \pm 1$ REFERENCES: |

| | | ····· | Toproryus services | | |
|---|---|--|--|---|--|
| COMPONENTS : | | | ORIGINAL MEASUREMENTS: | | |
| (1) Hydrogen cl [7647-01-0 |] | | Ionin, M. V.; Kurina, N. V.; Sudoplatova, A. E. | | |
| <pre>(2) 1-Butanol; C₄H₁₀O; [71-36-3] 1-Pentanol; C₅H₁₂O; [71-41-0] 1-Hexanol; C₆H₁₄O; [111-27-3]</pre> | | | Tr. po Khim. i Khim. Tekhnol. <u>1963</u> , (1), 47 - 48. | | |
| VARIABLES: | | PREPARED BY: | | | |
| T/K: 298.15 Total p/kPa: 101.3 (atmospheric) | | | Ψ. | Gerrard | |
| EXPERIMENTAL VALUE | S: | | | | |
| | Refractive | | Concentration | Mol Ratio | Mol Fraction |
| | $\frac{\operatorname{Index}^{1}}{n_{D}^{298}}$ | Density p/g cm ⁻³ | $c_1/mol dm^{-3}$ | n1/n2 | <i>x</i> 1 |
| | 1-Butanol | | | | |
| 298.15 | 1.3992 | 0.93130 | 7.38 | 0.823 | 0.451 |
| | 1-Pentanol | | | | |
| 298.15 | 1.4098 | 0.90946 | 6.37 | 0.829 | 0.453 |
| 1 | 1-Hexanol | | | | |
| 298.15 | 1.4179 | 0.90466 | 5.54 | 0.805 | 0.446 |
| | | | | | |
| | | AUXILIARY | INFORMATION | n | <u></u> |
| METHOD/APPARATUS/P | ROCEDURE : | | SOURCE AND PURITY OF MATERIALS: | | |
| The gas was ab which was not probably barom the solution w pyknometer. Th absorbed was d alkali titrati | osorbed at a stated, and letric. The o vas determine he hydrogen o letermined by | was lensity of ed by a chloride | (1) Hydrogen sodium c acid. Dr (2) 1-Alkano | chloride. hloride and ied by calc | Prepared from sulfuric ium chloride. not given. |
| | | | | : | |
|] | | | | | |
| | | | REFERENCES : | | |
| | | | | | |

| COMPONENTS : | ORIGINAL MEASUREMENTS: |
|--|--|
| <pre>(1) Hydrogen chloride; HCl; [7647-01-0]</pre> | Fernandes, J. B. |
| (2) l-Butanol; C ₄ H ₁₀ O; [71-36-3] | J. Chem. Eng. Data <u>1972</u> , 17, 377 - 379. |
| VARIABLES: $T/K = 315.15$ $p_1/kPa = 101.325$ (1 atm) | PREPARED BY: H. L. Clever |
| EXPERIMENTAL VALUES: | |
| Temperature Mol | Ratio Mol Fraction |
| t∕°C T∕K n | $1/n_2 x_1$ |
| 42 315.15 | 0.66 0.40 |
| The mole fraction va the compiler. | lue was calculated by |
| | |
| AUXILIARY | INFORMATION |
| METHOD / APPARATUS / PROCEDURE : | SOURCE AND PURITY OF MATERIALS: |
| The value above was credited to unpublished work of J. B. Fernandes and M. M. Sharma, University of Bombay, 1966. It is assumed the method was a chemical titration. | No information. |
| | |
| | ESTIMATED ERROR: |
| | ESTIMATED ERROR: |
| | ESTIMATED ERROR: REFERENCES: |
| | |

| COMPONENTS : | | | ORIGINAL MEAS | SUREMENTS: |
|--|--|------------------|--------------------------------|---|
| (1) Hydrogen chlori 7647-01-0 | ide; HCl; | | Kohn, G. | |
| (2) 1-Pentanol | | | Ber. Dt8c 65, 589 - | hn. Chem. Ges. B. <u>1932</u> , 595. |
| or | | | | |
| 3-Methyl-1-buta | | | PREPARED BY: | |
| T/K: 27 P/kPa: 10 | 5.15 - 33 01 tmospheri | | TREFACED DI. | W. Gerrard |
| EXPERIMENTAL VALUES: | | | · ··· ··· ··· | |
| T/K | Alcohol | | Mol Ratio | Mol Fraction |
| | wt/g | Chloride wt/g | ⁿ 1 ^{/n} 2 | <i>x</i> 1 |
| | -Pentanol 71-41-0] | or 1-amyl | alcohol; C | 5 ^H 12 ^O ; |
| 275,15 | 55.0 | 22.9 | 1.005 | 0.501 |
| 278.15 | 50.0 | 19.9 21.5 | 0.961 | 0.490 |
| 318.15 | 55.0 ¹ | 21.5 | 0.944 | 0.485 |
| 308.15 | | 9.5 | 0.976 | 0.494 |
| 308.15 323.15 | 23.6 ³ | 7.6 | 0.777 0.665 | 0.437 |
| 323.15 | 23.6 ³ 23.6 ³ | 6.5 5.6 | | 0.399 0.364 |
| 334.15 3. C | | -butanol o | r isoamyl a | |
| | | | 1 050 | 0.514 |
| 278.15 | 31.6 40.3 | 13.85 17.3 | | 0.514 0.509 |
| ¹ Presuma | ¹ Presumably 55.0 from posit | | | ginal table. |
| | | | ure with pa l as "one ex | |
| The thr | ee varues | | INFORMATION | |
| METHOD/APPARATUS/PROCED | URE : | | SOURCE AND P | URITY OF MATERIALS: |
| the alcohol in a m in an ice-salt mix erature, "end temp | The hydrogen chloride was passed to the alcohol in a measuring cylinder in an ice-salt mixture. The temp- erature, "end temperature", was | | | gen chloride. Prepared from n chloride and sulfuric and dried by sulfuric acid. |
| recorded, and the absorbed gas was weighed. The pressure was presumably atmospheric. | | | The 3. | ols. Kahlbaum specimens. -methyl-l-butanol was stated free from pyridine. |
| | | | ESTIMATED ER | ROR: ówt/g = 0.1 |
| The mole ratio and values were calcul compiler. | i mole fra ated by f | action the | REFERENCES : | |

| COMPONENTS: | ORIGINAL MEASUREMENTS: | | | |
|---|--|--|--|--|
| (1) Hydrogen chloride; HCl; | Gerrard, W.; Macklen, E.D. | | | |
| [7647-01-0] | J. Appl. Chem. <u>1959</u> , 9, 85-88. | | | |
| (2) Alkanols | | | | |
| VARIABLES: | PREPARED BY: | | | |
| T/K: See below Total P/kPa : 101.325 (1 atm) | W. Gerrard | | | |
| EXPERIMENTAL VALUES: T/K | Mole ratio Mole* Smoothed** | | | |
| | HCl ^{/n} alcohol fraction mole fraction | | | |
| | HCl ^x HCl ^x HCl | | | |
| 1-Pentanol; C ₅ H ₁₂ O; 273.15 [71-41-0] 276.25 | 0.516 | | | |
| [71-41-0] ⁵ ² 276.25 283.15 | | | | |
| 285.55 293.15 | 0.947 0.486 | | | |
| 294.15 | 0.867 0.464 | | | |
| 302.15 303.15 | | | | |
| 306.05 | 0.762 0.432 | | | |
| 313.15 313.45 | | | | |
| | | | | |
| Smoothing equation: $\ln x_{HC1} = 14.160$ Standard error in x_{HC1} about the | regression line = 2.68×10^{-4} | | | |
| | | | | |
| 1-Hexanol; $C_{6H_{14}O}$; 279.85 [111-27-3] 283.15 | | | | |
| [111-27-3] 283.15 290.25 | | | | |
| 293.15 295.85 | | | | |
| 303.15 | 0.441 | | | |
| 308.55 313.15 | | | | |
| 318.75 | 0.663 0.399 | | | |
| 323.15 333.15 | | | | |
| 337.35 | 0.530 0.346 | | | |
| Smoothing equation: $\ln x_{HC1} = 16.882 - 22.445/(T/100) - 9.284 \ln(T/100)$ Standard error in x_{HC1}^{HC1} about the regression line = 9.78 × 10 ⁻⁴ | | | | |
| <pre>* calculated by the compiler ** smoothing equation and smoothed v</pre> | alues were calculated by H.L. Clever | | | |
| | | | | |
| AUXILIARY | INFORMATION | | | |
| METHOD/APPARATUS/PROCEDURE: | SOURCE AND PURITY OF MATERIALS: | | | |
| The apparatus and procedure were those described by Gerrard and | (1) Hydrogen chloride: self- prepared and dried. | | | |
| Macklen (1). The hydrogen chloride | | | | |
| was generated in an all glass apparatus. The absorption vessel, previously weighed, was fitted with a stoppered bubbler tube, and a | (2) Alcohols: purified, distilled, and attested by physical constants. | | | |
| stoppered outlet tube. Entrained | ESTIMATED ERROR: | | | |
| liquid was condensed at 273.15 K, and allowed for. The amount of gas | $\delta x_{\rm HCl} / x_{\rm HCl} = \pm 0.005 \text{ to } 0.01$ | | | |
| absorbed by a known weight of liquid | REFERENCES: | | | |
| was determined by weighing. | 1. Gerrard, W.; Macklen, E.D. J. Appl. Chem. <u>1956</u> , 6, 241. | | | |
| <u></u> | | | | |

| COMPONENTS: | ORIGINAL MEASUREMENTS: | |
|---|---|---|
| Hydrogen chloride; HCl; | Gerrard, W.; Macklen, E.D. | |
| [7647-01-0] | J. Appl. Chem. <u>1959</u> , 9, 85-88. | |
| (2) Alkanols | ······································ | |
| EXPERIMENTAL VALUES: T/K | Mole ratio Mole* Smoothed* ⁿ HCl ^{/n} alcohol fraction mole fracti | |
| | | |
| 4-Methyl-2-pentanol; C ₆ H ₁₄ O; 273.1 [108-11-2] 274.7 | | |
| 283.1 287.0 | 5 0.513 | |
| 293.1 294.2 | 5 0.489 | |
| 300.3 | 5 0.893 0.472 | |
| 303.1 307.4 | | |
| 313.1 | 5 0.440 | |
| 319.4 323.1 | | |
| Smoothing equation: $\ln x = 11.406$ | | |
| Smoothing equation: ln x _{HCl} = 11.406 Standard error in x _{HCl} about th | e regression line = 6.14×10^{-4} | |
| 1-Heptanol; C ₇ H ₁₆ O; 279.8 [111-70-6] 283.1 | | |
| 292.4 | 5 0.887 0.470 | |
| 293.1 295.8 | 5 0.855 0.461 | |
| 303.1 308.5 | | |
| 313.1 318.7 | | |
| 323.1 333.1 | 5 0.387 | |
| 337.3 343.1 | 5 0.534 0.348 | |
| | 8 - 21.150/(T/100) - 8.843 ln(T/100) e regression line = 8.16 × 10 ⁻⁴ | |
| | | |
| 1-Decanol; C ₁₀ H ₂₂ O; 273.1 [112-30-1] 273.8 | | |
| 283.1 | 5 0.496 | |
| 283.9 290.2 | | |
| 293.1 | 5 0.470 | |
| 303.1 303.4 | | |
| 312.5 | 5 0.723 0.420 | |
| 313.1 323.1 | | |
| 325.5 | 5 0.623 0.384 | |
| 333.1 | 5 0.365 | |
| Smoothing equation: ln x _{HCl} = 13.79 Standard error in x _{HCl} about th | 4 - 18.096/(T/100) - 7.787 ln(T/100) e regression line = 8.37 × 10 ⁻⁴ | |
| <pre>* calculated by the compiler ** smoothing equation and smoothed</pre> | values were calculated by H.L. Cleve | r |
| | | |
| | | |
| | | |

| nydrogen chloride hi | Non-Aqueous Solvents | |
|---|--|--|
| COMPONENTS: (1) Hydrogen chloride; HCl; [7647-01-0] | ORIGINAL MEASUREMENTS: Fernandes, J. B. J. Chem. Eng. Data 1972, 17, | |
| (2) l-Hexanol; C ₆ H ₁₄ O; [111-27-3] | 377-379. | |
| VARIABLES: | PREPARED BY: | |
| T/K: 353.15 - 393.15 $p_1/kPa:$ 101.325 (1 atm) | H. L. Clever | |
| EXPERIMENTAL VALUES: | | |
| _ | Ratio ¹ Mol Fraction | |
| t/°C T/K n | $\frac{1}{2}$ x_{1} | |
| 80 353.15 0 | .434 0.303 | |
| 80 353.15 0 100 373.15 0 120 393.15 0 | .320 0.242 | |
| 120 393.15 0 | .236 0.191 | |
| ¹ Vapor pressure cor | rection applied. | |
| The mole fraction solubility values w | | |
| Smoothed Data: For use between 353.1 | | |
| | | |
| $\ln x_{1} = -5.7174 + 15.$ | | |
| | regression line is 3.63×10^{-3} . | |
| | Fraction | |
| + | <i>x</i> ₁ | |
| 353.15 0. | 305 | |
| 363.15 0. | 269 | |
| 373.15 0. 383.15 0. | | |
| 383.15 0.214 393.15 0.192 | | |
| AUXILIARY | INFORMATION | |
| | COURCE AND DUDITY OF MATERIALS. | |
| METHOD/APPARATUS/PROCEDURE: The data above were credited to | SOURCE AND PURITY OF MATERIALS: No information. | |
| unpublished work of J. B. Fernandes and M. M. Sharma, University of Bombay, 1966. It is assumed the method is the same as for the HBr + 1-hexanol system. See that data sheet for details. | | |
| | | |
| | ESTIMATED ERROR: | |
| | | |
| | | |
| | REFERENCES : | |
| | | |
| | | |
| | | |

| | | us Solvents | | 119 |
|--|--|--|--|-----|
| COMPONENTS: | ORIGINAL M | EASUREMENTS : | | |
| <pre>(1) Hydrogen chloride; HCl; [7647-01-0]</pre> | drogen chloride; HCl; Ionin, M. V.; Kurina, N. V.; | | , N. V.; | |
| (2) 1-Heptanol; C7H160; [111-70-6] | _ | | Table 1 1000 | |
| l-Octanol; C ₈ H ₁₈ O; [111-87-5] l-Nonanol; C9H ₂₀ O; [143-08-8] | (1), 47 | | Tekhnol. <u>1963</u> , | 1 |
| 1-Decanol; $C_{10}H_{22}O$; [112-30-1] | | | | |
| | | | | |
| VARIABLES: T/K: 298.15 | PREPARED BY: W. Gerrard | | | |
| P/kPa: 101.3 (atmospheric) | | w. Ge | rraru | |
| EXPERIMENTAL VALUES: | | | | |
| T/K Refractive Solution Conc | entration | | Mol Fraction | |
| Index ¹ Density n_{D}^{298} $\rho/g \text{ cm}^{-3}$ | nol dm ⁻³ | n_1/n_2 | <i>x</i> 1 | |
| l-Heptanol | | | | |
| 298.15 1.4241 0.89480 | 5.14 | 0.844 | 0.458 | |
| 1-Octanol | | | | |
| 298.15 1.4293 0.89250 | 4.62 | 0.831 | 0.454 | |
| 1-Nonanol | | | | |
| | 4.16 | 0.815 | 0.449 | |
| l-Decanol | | | | |
| 298.15 1.4373 0.88244 | 3.83 | 0.816 | 0.449 | |
| | | | | |
| | | | | |
| AUXILIARY INFORMATION | | | | |
| | INFORMATIO | N | | |
| METHOD/APPARATUS/PROCEDURE: | SOURCE ANI | D PURITY OF MAT | | |
| The gas was absorbed at a pressure which was not stated, and was | SOURCE ANI (1) Hydr from | D PURITY OF MAT rogen chlorid n sodium chlo | e. Prepared ride and | |
| The gas was absorbed at a pressure which was not stated, and was probably barometric. The density of | SOURCE AND (1) Hydr from sulf | D PURITY OF MAT rogen chlorid n sodium chlo furic acid. | e. Prepared ride and Dried by | |
| The gas was absorbed at a pressure which was not stated, and was probably barometric. The density of the solution was determined by a pyknometer. The hydrogen chloride | SOURCE AND (1) Hydr from sulf calc | D PURITY OF MAT rogen chlorid n sodium chlo furic acid. cium chloride | e. Prepared ride and Dried by | |
| The gas was absorbed at a pressure which was not stated, and was probably barometric. The density of the solution was determined by a | SOURCE AND (1) Hydr from sulf calc (2) 1-AD | D PURITY OF MAT rogen chlorid n sodium chlo furic acid. cium chloride | e. Prepared ride and Dried by • rce not given. | |
| The gas was absorbed at a pressure which was not stated, and was probably barometric. The density of the solution was determined by a pyknometer. The hydrogen chloride absorbed was determined by an | SOURCE AND (1) Hydr from sulf calc (2) 1-AD | D FURITY OF MAT cogen chlorid n sodium chlo furic acid. cium chloride lkanols. Sou | e. Prepared ride and Dried by • rce not given. | |
| The gas was absorbed at a pressure which was not stated, and was probably barometric. The density of the solution was determined by a pyknometer. The hydrogen chloride absorbed was determined by an | SOURCE AND (1) Hydr from sulf calc (2) 1-AD | D FURITY OF MAT cogen chlorid n sodium chlo furic acid. cium chloride lkanols. Sou | e. Prepared ride and Dried by • rce not given. | |
| The gas was absorbed at a pressure which was not stated, and was probably barometric. The density of the solution was determined by a pyknometer. The hydrogen chloride absorbed was determined by an | SOURCE AND (1) Hydr from sulf calc (2) 1-AD | D FURITY OF MAT cogen chlorid n sodium chlo furic acid. cium chloride lkanols. Sou | e. Prepared ride and Dried by • rce not given. | |
| The gas was absorbed at a pressure which was not stated, and was probably barometric. The density of the solution was determined by a pyknometer. The hydrogen chloride absorbed was determined by an | SOURCE AND (1) Hydr from sulf calc (2) 1-AD | D FURITY OF MAT rogen chlorid n sodium chlo furic acid. cium chloride lkanols. Sou ed by calcium | e. Prepared ride and Dried by • rce not given. | |
| The gas was absorbed at a pressure which was not stated, and was probably barometric. The density of the solution was determined by a pyknometer. The hydrogen chloride absorbed was determined by an | SOURCE ANI (1) Hydr from sulf calc (2) 1-Al Drie | D FURITY OF MAT rogen chlorid n sodium chlo furic acid. cium chloride lkanols. Sou ed by calcium | e. Prepared ride and Dried by • rce not given. | |
| The gas was absorbed at a pressure which was not stated, and was probably barometric. The density of the solution was determined by a pyknometer. The hydrogen chloride absorbed was determined by an | SOURCE ANI (1) Hydr from sulf calc (2) 1-Al Drie | D FURITY OF MAT rogen chlorid n sodium chlo furic acid. cium chloride lkanols. Sou ed by calcium | e. Prepared ride and Dried by • rce not given. | |
| The gas was absorbed at a pressure which was not stated, and was probably barometric. The density of the solution was determined by a pyknometer. The hydrogen chloride absorbed was determined by an | SOURCE ANI (1) Hydr from sulf calc (2) 1-A Drie ESTIMATED | D FURITY OF MAT rogen chlorid n sodium chlo Euric acid. cium chloride lkanols. Sou ed by calcium | e. Prepared ride and Dried by • rce not given. | |
| The gas was absorbed at a pressure which was not stated, and was probably barometric. The density of the solution was determined by a pyknometer. The hydrogen chloride absorbed was determined by an | SOURCE ANI (1) Hydr from sulf calc (2) 1-Al Drie | D FURITY OF MAT rogen chlorid n sodium chlo Euric acid. cium chloride lkanols. Sou ed by calcium | e. Prepared ride and Dried by • rce not given. | |
| The gas was absorbed at a pressure which was not stated, and was probably barometric. The density of the solution was determined by a pyknometer. The hydrogen chloride absorbed was determined by an | SOURCE ANI (1) Hydr from sulf calc (2) 1-A Drie ESTIMATED | D FURITY OF MAT rogen chlorid n sodium chlo Euric acid. cium chloride lkanols. Sou ed by calcium | e. Prepared ride and Dried by • rce not given. | |
| The gas was absorbed at a pressure which was not stated, and was probably barometric. The density of the solution was determined by a pyknometer. The hydrogen chloride absorbed was determined by an | SOURCE ANI (1) Hydr from sulf calc (2) 1-A Drie ESTIMATED | D FURITY OF MAT rogen chlorid n sodium chlo Euric acid. cium chloride lkanols. Sou ed by calcium | e. Prepared ride and Dried by • rce not given. | |
| The gas was absorbed at a pressure which was not stated, and was probably barometric. The density of the solution was determined by a pyknometer. The hydrogen chloride absorbed was determined by an | SOURCE ANI (1) Hydr from sulf calc (2) 1-A Drie ESTIMATED | D FURITY OF MAT rogen chlorid n sodium chlo Euric acid. cium chloride lkanols. Sou ed by calcium | e. Prepared ride and Dried by • rce not given. | |
| The gas was absorbed at a pressure which was not stated, and was probably barometric. The density of the solution was determined by a pyknometer. The hydrogen chloride absorbed was determined by an | SOURCE ANI (1) Hydr from sulf calc (2) 1-A Drie ESTIMATED | D FURITY OF MAT rogen chlorid n sodium chlo Euric acid. cium chloride lkanols. Sou ed by calcium | e. Prepared ride and Dried by • rce not given. | |

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| 120 Hy | diogen cinonde in i | Non-Aqueous Solvents | |
|--|---------------------------------------|---|--|
| COMPONENTS : | | ORIGINAL MEASUREMENTS: | |
| <pre>1. Hydrogen chloride; [7647-01-0]</pre> | HCl; | Ahmed, W.; Gerrard, W.; Maladkar, V. K. | |
| 2. 1-Octanol; C ₈ H ₁₈ O; | [111-87-5] | J. Appl. Chem. <u>1970</u> , 20, 109 - 115. | |
| | | | |
| VARIABLES: | 202.15 | PREPARED BY: | |
| T/K: 243.15 - Total P/kPa: 101.325 | | W. Gerrard | |
| | | (smoothed data calculated by H.L. Clever) | |
| EXPERIMENTAL VALUES: | T/K Mol Ra | atio Mol Fraction | |
| | ⁿ HC1/ ⁿ C | H ₁₀ O X _{HC1} | |
| | | | |
| | 243.15 1.44 253.15 1.27 | | |
| | 263.15 1.14 | | |
|) | 273.15 1.02 | | |
| | 283.15 0.89 293.15 0.81 | | |
| | | | |
| The mole fraction solu compiler. | ubilities were ca | alculated from the mole ratio by the | |
| 1 | | $/(T/100K) - 4.901 \ln(T/100K)$ | |
| Standa | ard erior about : | regression line = 2.81×10^{-3} | |
| | - T/K I | Mol Fraction | |
| | | X _{HC1} | |
| | 243.15 | 0.589 | |
| 253.15 0.561 | | | |
| 263.15 0.532 | | | |
| 273.15 0.502 283.15 0.474 | | | |
| 293.15 0.446 | | | |
| | | | |
| | | | |
| | | | |
| | | INFORMATION | |
| METHOD/APPARATUS/PROCEDURE | | SOURCE AND PURITY OF MATERIALS: | |
| Hydrogen chloride was | | 1. Hydrogen chloride. Obtained from a cylinder containing a good com- | |
| known weight of liquid tube at a total press | | mercial specimen. Was dried by | |
| a manometer assembly. | The absorbed | passage through concentrated | |
| gas was weighed by re- | | sulfuric acid. | |
| bubbler tube. The ter | | 2. 1-Octanol. Best obtainable | |
| manually controlled to The procedure and appa | | specimen was suitably purified, | |
| described by Gerrard | | dried, and fractionally dis- | |
| - | | tilled, and attested. | |
| For temperatures below 268 K, a chem- ical titration was performed. | | | |
| | | ESTIMATED ERROR: | |
| | | $\delta T = 0.2$ | |
| | | $\delta x/x = 0.005$ | |
| | | | |
| | | REFERENCES: | |
| | | 1. Gerrard, W. J. Appl. Chem. Biotechnol. <u>1972</u> , | |
| | | 22, 623 - 650. | |
| | | 2. Gerrard, W. | |
| | | "Solubility of Gases and Liquids" | |
| | | Plenum Press, New York, 1976 | |
| | | l | |

| Hydrogen Unioriae in Non-Aqueous Solvents 12 | | | |
|---|--|--|--|
| COMPONENTS : | ORIGINAL MEASUREMENTS: | | |
| <pre>(1) Hydrogen chloride; HCl; [7647-01-0]</pre> | Fernandes, J. B. | | |
| (2) 1-Octanol; $C_{8}H_{18}O$; [111-87-5] J. Chem. Eng. Data <u>1972</u> , 17, 377-379. | | | |
| | | | |
| VARIABLES: T/K: 353.15 - 413.15 p_1/kPa : 101.325 (1 atm) | PREPARED BY: H. L. Clever | | |
| EXPERIMENTAL VALUES: | Ratio ¹ Mol Fraction | | |
| $\begin{array}{c ccccccccccccccccccccccccccccccccccc$ | <pre>26 0.206 129 0.114 0785 0.0728 rection applied. values in ref. (1). ere calculated by the compiler.</pre> | | |
| | | | |
| AUXILIARY | INFORMATION | | |
| METHOD/APPARATUS/PROCEDURE: The data above were credited to unpublished work of J. B. Fernandes and M. M. Sharma, University of Bombay, 1966. It is assumed the method is the same as for the HBr + 1-octanol system. See that data sheet for details. | SOURCE AND PURITY OF MATERIALS: No information. | | |
| | ESTIMATED ERROR: | | |
| | REFERENCES: 1. Gerrard, W.; Mincer, A. M. A.; Wyvill, P. L. J. Appl. Chem. <u>1959</u> , 9, 89. | | |
| | | | |

| COMPONENTS: (1) Hydrogen chloride; HCl; | ORIGINAL MEASUREMENTS: Kohn, G. |
|--|--|
| <pre>[7647-01-0] (2) 2-Octanol or s-octyl alcohol;</pre> | Ber. Dtschn. Chem. Ges. B. <u>1932</u> , 65, 589 - 595. |
| С ₈ н ₁₈ 0; [123-96-6] | |
| | |
| VARIABLES: T/K: 275.15 - 334.15 | PREPARED BY: |
| P/kPa: 101 (atmospheric) | W. Gerrard |
| EXPERIMENTAL VALUES: | |
| | Mol Ratio Mol Fraction |
| Chloride wt/g wt/g | |
| 2-Octanol or s-octy: | alcohol; C ₈ H ₁₈ O; [123-96-6] |
| 279.15 25.15 7.8 | 1.107 0.525 |
| | |
| AUXILIARY | INFORMATION |
| METHOD/APPARATUS/PROCEDURE: | SOURCE AND PURITY OF MATERIALS: |
| The hydrogen chloride was passed to the alcohol in a measuring cylinder in an ice-salt mixture. The temperature, "end temperature", was recorded, and the absorbed gas was weighed. The pressure was presumably atmospheric. | Hydrogen chloride. Prepared from sodium chloride and sulfuric acid, and dried by sulfuric acid. Alcohols. Kahlbaum specimens. |
| | ESTIMATED ERROR: |
| | $\delta wt/g = 0.1$ |
| | REFERENCES : |
| | |
| | |
| | |
| | |

| Hydrogen Chloride in i | Non-Aqueous Solvents 123 | |
|--|--|--|
| COMPONENTS: | ORIGINAL MEASUREMENTS: | |
| <pre>(1) Hydrogen chloride; HCl; [7647-01-0]</pre> | Fernandes, J. B. | |
| (2) 1-Decanol; C ₁₀ H ₂₂ O; [112-30-1] | J. Chem. Eng. Data <u>1972</u> , 17, 377-379. | |
| | | |
| VARIABLES: | PREPARED BY: | |
| T/K: 353.15 - 413.15 $p_1/kPa:$ 101.325 (1 atm) | H. L. Clever | |
| EXPERIMENTAL VALUES: Temperature Mol | Ratio ¹ Mol Fraction | |
| - | $1/n_2$ x_1 | |
| | | |
| 30 303.15 0 40 313.15 0 | .800 ² 0.444 .712 ² 0.416 | |
| 40 313.15 0 60 333.15 0 | .712 ² 0.416 .567 ² 0.362 | |
| 80 353.15 0 | .385 0.278 | |
| 100 373.15 0 | .232 0.188 | |
| 120 393.15 0 | .109 0.098 | |
| 140 413.15 0 | .0655 0.0615 | |
| ¹ Vapor pressure co | rrection applied. | |
| ² Interpolated from | values in ref. (1). | |
| The mole fraction solubility values we | | |
| Smoothed Data: For use between 333.1 | | |
| | | |
| 1 1 | $0.3336/(T/100 \text{ K}) - 49.0594 \ln (T/100 \text{ K})$ | |
| The standard error about the p | regression line is 1.18×10^{-2} . | |
| T/K Mol Fraction x ₁ | T/K Mol Fraction x_1 | |
| 333.15 0.368 | 383.15 0.139 | |
| 343.15 0.321 | 393.15 0.107 | |
| 353.15 0.271 | 403.15 0.080 | |
| 363.15 0.223 | 413.15 0.060 | |
| 373.15 0.178 | | |
| | | |
| | INFORMATION | |
| METHOD/APPARATUS/PROCEDURE: | SOURCE AND PURITY OF MATERIALS: | |
| The data above were credited to | No information. | |
| unpublished work of J. B. Fernandes and M. M. Sharma, University of | | |
| Bombay, 1966. It is assumed the | | |
| method is the same as for the | | |
| HBr + 1-decanol system. See that | | |
| data sheet for the details. | | |
| | | |
| | | |
| | | |
| | | |
| | ESTIMATED ERROR: | |
| | | |
| | | |
| | REFERENCES : | |
| | 1. Gerrard, W.; Mincer, A. M. A.; | |
| 1 | Wyvill, P. L. | |
| | J. Appl. Chem. <u>1959</u> , 9, 89. | |
| | | |
| | | |
| | | |
| | | |

| COMPONENTS : | ORIGINAL MEASUREMENTS: |
|--|---|
| (1) Hydrogen chloride; HCl; | Fernandes, J. B.; Sharma, M. M. |
| [7647-01-0] | |
| (2) 1-Dodecanol; $C_{12}H_{26}O;$ | Indian Chem. Eng. <u>1965</u> , 7, 38 - 40. |
| [112-53-8] | |
| (| |
| | |
| VARIABLES: | |
| T/K: 303.15 - 453.15 | PREPARED BY: |
| HC1 P/kPa: 101.325 (760 mmHg) | W. Gerrard |
| | (smoothed data calculated by H.L. Clever) |
| EXPERIMENTAL VALUES: | |
| | Mol Fraction |
| n_1/n_2 | x ₁ |
| $\frac{1}{303.15}$ $\frac{1}{0.724}$ | |
| 313.15 0.634 | 0.388 |
| 333.15 0.472 | |
| 353.15 0.3234 | 0.244 |
| 373.15 0.1862 393.15 0.0921 | 0.157 |
| 393.15 0.0921 413.15 0.0460 | |
| 433.15 0.0296 | 0.0287 |
| 453.15 0.01728 | 0.01471 |
| ¹ Material turned k | prown. |
| Smoothed Data: $\ln x_1 = 89.891 - 129.$ | |
| 1 = 129.091 = 129.091 = 129.091 | 002/(1/100K) = 43.465 III (1/100K) |
| Standard error about | the regression line = 9.30×10^{-3} |
| | Mol Fraction |
| 1/ K | x ₁ |
| 303.15 | <u> </u> |
| 313.15 | 0.400 |
| 333.15 | 0.321 |
| 353.15 | 0.229 |
| 373.15 | 0.148 |
| 393.15 413.15 | 0.0886 0.0502 |
| 433.15 | 0.0272 |
| 453.15 | 0.0142 |
| | |
| | |
| AUXILIARY | INFORMATION |
| METHOD/APPARATUS/PROCEDURE: | SOURCE AND PURITY OF MATERIALS: |
| Hydrogen chloride was bubbled into | (1) Hydrogen chloride. Self prepared |
| the solvent for more than an hour. | by the method of Sloan (1). |
| Approximately 1 cm ³ of the solution | |
| was transferred to a weighed sample | (2) 1-Dodecanol. Dehydag Deutsche |
| tube and the whole re-weighed. The contents were transferred to water, | Hydrierwerke GMBH. Minimum purity 95 per cent (usually 98+ |
| and the chloride content determined | per cent). Used as received. |
| by the Volhard method. | |
| - | |
| | |
| | |
| | ESTIMATED ERROR: |
| | |
| | $\delta T/K = 0.2$ |
| | $\delta x_1 / x_1 = 0.05$ |
| | |
| | REFERENCES : |
| | 1. Sloan, A. D. B. |
| | Chem. Ind. <u>1964</u> , 574. |
| | |
| | |
| | 1 |
| | |
| | |

| COMPONENTS: (1) Hydrogen chloride; HCl; [7647-01-0] | ORIGINAL MEASUREMENTS: Fernandes, J. B.; Sharma, M. M. | |
|--|--|--|
| (2) 1-Tetradecanol; C ₁₄ H ₃₀ O; [112-72-1] | Indian Chem. Eng. <u>1965</u> , 7, 38 - 40. | |
| 1-Octadecanol; C ₁₈ H ₃₈ O; [112-92-5] | | |
| VARIABLES: T/K: 333.15, 433.15 HCl P/kPa: 101.325 (760 mmHg) | PREPARED BY: W. Gerrard | |
| EXPERIMENTAL VALUES: | 1 | |
| T/K Mol Rati | o Mol Fraction | |
| l-Tetradecano | 1 | |
| 333.15 0.462 433.15 0.0211 | 0.313 0.0207 | |
| 1-Octadecanol | | |
| 333.15 0.448 433.15 0.0178 | 0.309 0.0175 | |
| AUXILIARY METHOD/APPARATUS/PROCEDURE: Hydrogen chloride was bubbled into the solvent for more than an hour. Approximately 1 cm ³ of the solution was transferred to a weighed sample tube and the whole re-weighed. The contents were transferred to water, and the chloride content determined by the Volhard method. | <pre>y values. INFORMATION SOURCE AND PURITY OF MATERIALS: (1) Hydrogen chloride. Self prepared by the method of Sloan (1). (2) 1-Tetradecanol and 1-Octadecanol. Both alcohols supplied by Dehydag Deutsch Hydrierwerke GMBH. Minimum purity 95 per cent (usually 98+ per cent). Used</pre> | |
| | as received. ESTIMATED ERROR: $\delta T/K = 0.2$ $\delta x_1/x_1 = 0.05$ REFERENCES: 1. Sloan, A. D. B. <i>Chem. Ind.</i> <u>1964</u> , 574. | |

| 26 Hydrogen Chloride in | Non-Aqueous Solvents |
|---|---|
| COMPONENTS : | ORIGINAL MEASUREMENTS: |
| (1) Hydrogen chloride; HCl; | Fernandes, J. B.; Sharma, M. M. |
| [7647-01-0] | Indian Chem. Eng. <u>1965</u> , 7, 38 - 40. |
| (2) 1-Hexadecanol; $C_{16}H_{34}O;$ [36653-82-4] | |
| | |
| VARIABLES: | PREPARED BY: |
| T/K: 333.15 - 473.15 HCl P/kPa: 101.325 (760 mmHq) | W. Gerrard |
| nci P/RPa: 101.525 (700 mung) | (smoothed data calculated by H.L. Clever) |
| EXPERIMENTAL VALUES: | |
| T/K Mol Ratic | Mol Fraction |
| $\frac{11}{333.15}$ $\frac{11}{0.462}$ | 0.316 |
| 343.15 0.358 | 0.264 |
| 353.15 0.2445 | 0.196 |
| 373.15 0.1491 | 0.130 |
| 393.15 0.0727 | 0.0678 |
| 413.15 0.0391 | 0.0376 |
| 433.15 0.0227 453.15 0.0141 ¹ | 0.0222 |
| 453.15 0.0141 ⁴ 473.15 0.00876 | 0.0139 5 ¹ 0.00868 |
| ¹ The material turr | |
| | L48/(T/100K)- 20.670 ln (T/100K) |
| Standard error about | the regression line = 9.67×10^{-3} |
| | 101 Fraction |
| | x1 |
| 333.15 | 0.346 |
| 353.15 | 0.205 |
| 373.15 | 0.121 |
| 393.15 | 0.0709 |
| 413.15 433.15 | 0.0417 0.0246 |
| 453.15 | 0.0145 |
| 473.15 | 0.00867 |
| | |
| AUXILIARY | INFORMATION |
| METHOD/APPARATUS/PROCEDURE: Hydrogen chloride was bubbled into | SOURCE AND PURITY OF MATERIALS: (1) Hydrogen chloride. Self prepared |
| the solvent for more than an hour. | by the method of Sloan (1). |
| Approximately 1 cm ³ of the solution | |
| was transferred to a weighed sample | (2) 1-Hexadecanol. Dehydag Deutsche |
| tube and the whole re-weighed. The | Hydrierwerke GMBH. Minimum |
| contents were transferred to water, | 95 per cent purity (usually |
| and the chloride content determined | 98+ per cent). Used as received |
| by the Volhard method. | |
| | |
| | |
| | ESTIMATED ERROR: |
| | |
| | $\begin{cases} \delta T/K = 0.2 \\ \delta x_1/x_1 = 0.05 \end{cases}$ |
| | REFERENCES : |
| | l. Sloan, A. D. B. Chem. Ind. 1964, 574. |
| | CREM. 144. 1707, 514. |
| | |
| | |

| COMPONENTS : | EVALUATOR: |
|---|---|
| <pre>1. Hydrogen Chloride; HCl; [7647-01-0]</pre> | Peter G. T. Fogg Department of Applied Chemistry and Life Sciences, |
| 2. Halogenated Alkanols | Polytechnic of North London, Holloway, London, N7 8DB, U.K. |
| | January 1989 |

CRITICAL EVALUATION:

The Solubility of Hydrogen Chloride in Halogenated Alkanols

Gerrard and co-workers (1-3) measured solubilities in several halogenated alkanols over temperature ranges at a total pressure equal to barometric pressure. Under the conditions of the experiments the differences between these solubilities and values for a partial pressure of 101.3 kPa are likely to be less than experimental error.

The presence of a halogen atom in 2-chloroethanol, 2-bromoethanol, 1-chloro-2-propanol and 1-bromo-2-propanol lowers the mole fraction solubilities of HCl relative to those in the unsubstituted alcohols but these solubilities are nevertheless appreciably higher than reference values from the Raoult's law equation. There is little difference between mole fraction solubilities in these solvents in the overlapping temperature range.

The presence of two halogen atoms in 1,3-dibromo-2-propanol and in 2,3-dibromo-1-propanol causes a greater lowering of solubility. Mole fraction solubilities in 2,3-dibromo-1-propanol are about double those in 1,3-dibromo-2-propanol. Perhaps this is due to steric factors.

Mole fraction solubilities in 2,2,2-trifluoroethanol and in 2,2,2-trichloroethanol are close to each other and lower than in the dibromopropanols but, despite the presence of three halogen atoms, the solubilities lie above the reference line from the Raoult's law equation.

Measurements reported by Gerrard & Macklen (1) for solubility in 2-chloroethanol, and in 2,2,2-trichloroethanol differ to some extent from those reported by Gerrard, Mincer & Wyvill (2,3). The maximum difference between smoothed values of mole fraction solubilities in 2-chloroethanol from the two sources is about 7%. The maximum difference in the case of 2,2,2-trichloroethanol is about 10%. These differences are not sufficient to cast doubt on the overall pattern of measurements in these solvents. Data from other sources are not available for comparison.

Mole fraction solubilities at 293.15 K and a partial pressure of 101.3 kPa.

| Solvent | ×HC1 | Source |
|------------------------|--------|-------------------------|
| (Reference value) | 0.024 | (Raoult's law equation) |
| Ethanol | 0.462 | (evaluated value) |
| 1-Propanol | 0.463 | (evaluated value) |
| 2-Chloroethanol | 0.300 | (2) |
| | 0.295 | (1) |
| 2-Bromoethanol | 0.330 | (1) |
| 1-Chloro-2-propanol | 0.318 | (1) |
| 1-Bromo-2-propanol | 0.329 | (1) |
| 1,3-Dibromo-2-propanol | 0.088 | (1) |
| 2,3-Dibromo-1-propanol | 0.184 | (1) |
| 2,2,2-Trifluoroethanol | 0.0480 | (1) |
| 2,2,2-Trichloroethanol | 0.0600 | (3) |
| | 0.0669 | (1) |

REFERENCES

1. Gerrard, W.; Macklen, E. D. J. Appl. Chem. <u>1959</u>, 9, 85 - 88.

2. Gerrard, W.; Mincer, A. M. A.; Wyvill, P. L. J. Appl. Chem. <u>1959</u>, 9, 89 - 91.

 Gerrard, W.; Mincer, A. M. A.; Wyvill, P. L. J. Appl. Chem. <u>1960</u>, 10, 115 - 121.

| | nyarogen omonao n | , ton , quo | | | |
|--|--------------------------------|---|---------------------|--|--|
| COMPONENTS : | | ORIGINAL | MEASUREMENTS: | ···· ································· | |
| Hydrogen Chloride [7647-01-0] | | Gerrard, W.; Mincer, A. M. A.; Wyvill, P. L. | | | |
| 2. 2-Chloroethanol; | J. App | L. Chem. <u>1959</u> , 9 | , 89 - 93. | | |
| [107-07-3] | | | | | |
| | <u>,</u> | _ | | | |
| VARIABLES: | PREPARED | BY: | | | |
| T/K: 199.15 - 322.65 Total P/kPa: 101.325 (1 atm) | | | W. Gerrard | | |
| 10002 1/ | • (_ uu., | (smoot) | ned data calculated | by H.L. Clever) | |
| EXPERIMENTAL VALUES: | -, | | Nol Fraction | · · · · · · · · · · · · · · · · · · · | |
| | ⁿ HC1/ ⁿ | с ₂ н ₅ с10 | X _{HC1} | | |
| | | <u>25</u> 858 | 0.741 | | |
| | | 110 | 0.678 | | |
| | | 247 | 0.555 | | |
| | | 883 | 0.469 | | |
| | | 557 | 0.358 | | |
| | | 439 | 0.305 | | |
| | | 315 210 | 0.240 | | |
| | 522.05 0. | 210 | 0.174 | | |
| Smoothed Data: $\ln x_1$ | = -66.3023 + 92 | .9619/(T/ | 100K) + 80.1282 | ln (T/100K) | |
| | -18.0080 (T/1 | 00K) | | | |
| Standar | d error about th | e regress | ion line = 1.06 | $\times 10^{-2}$ | |
| T/K | Mole Fraction | T/K | Mole Fraction | | |
| | x_1 | | x_1 | | |
| 100.15 | | 262 15 | 0.424 | | |
| 193.15 203.15 | 0.813 0.717 | 263.15 273.15 | 0.434 0.390 | | |
| 203.15 213.15 | 0.651 | 283.15 | 0.346 | | |
| 223.15 | 0.600 | 293.15 | 0.300 | | |
| 233.15 | 0.556 | 303.15 | 0.256 | | |
| 243.15 | 0.516 | 313.15 | 0.214 | | |
| 253.15 | 0.475 | 323.15 | 0.175 | | |
| The male for | ation volves ver | | tod by the compi | lor | |
| | action values wer | | | .ier. | |
| <u> </u> | | Y INFORMATI | | | |
| METHOD / APPARATUS / PROCEDU | | 3 | D PURITY OF MATERI | | |
| The solvent was weig | | | ogen Chloride. | | |
| tube. The amount of | | drie | n a commercial c | ylinder was | |
| temperatures above 2 mined by reweighing | arte | | | | |
| weight. The total p | ressure was | 2. 2-Ch | loroethanol. C | arefully | |
| barometric, very nea | | | fied, and purit | | |
| (101.325 kPa). | atte | ested. | | | |
| For determinations b | elow 273 K, a | | | | |
| chemical titration w | as carried out. | | | | |
| After the maximum ab | | | | | |
| stated temperature, | | | | | |
| was attached to a fl | ESTIMATE | | | | |
| l dm ³ of water, and allowed to warm slowly (12 hours) to room temperature. | | | | | |
| The contents of the | | | below 273 K | | |
| then added to the wa | | $\delta X_1 / X_1 = 0.$ | 02 | | |
| total chloride ion was determined by | | | | | |
| the Volhard method. | | REFERENC | ES: | | |
| A low temperature, Teddington type | | | | | |
| YM thermostat was us | | | | | |
| tures below 273 K, t | | | | | |
| within <u>+</u> 2 K. | | 1 | | | |
| | | | | | |
| | | | | | |
| | | 1 | | | |

| COMPONENTS: | ORIGINAL MEASUREMENTS: | | | |
|---|---|--|--|--|
| (1) Hydrogen chloride; HCl; | Gerrard, W.; Macklen, E.D. | | | |
| [7647-01-0] | J. Appl. Chem. <u>1959</u> , 9, 85-88. | | | |
| (2) Halogenated alcohols | J. Appr. chem. <u>1939</u> , 9, 65-66. | | | |
| VARIABLES: | PREPARED BY: | | | |
| T/K: See below Total P/kPa : 101.325 (1 atm) | W. Gerrard | | | |
| EXPERIMENTAL VALUES: T/K | Mole ratio Mole* Smoothed** | | | |
| г | HCl ^{/n} alcohol fraction mole fraction | | | |
| | ×HCl ×HCl | | | |
| 2-Chloroethanol; C ₂ H ₅ Cl0; 273.15 [107-07-3] 277.65 | | | | |
| [107-07-3] 277.65 283.15 | | | | |
| 285.15 293.15 | | | | |
| 293.85 | 0.410 0.291 | | | |
| 298.45 303.15 | | | | |
| 308.05 | 0.302 0.232 | | | |
| 313.15 | | | | |
| 323.15 | 0.166 | | | |
| Smoothing equation: $\ln x_{HC1} = 76.741$ Standard error in x_{HC1} about the | - 103.640/(T/100) - 39.616 ln(T/100) e regression line = 2.17 × 10 ⁻³ | | | |
| 2-Bromoethanol; C ₂ H ₅ BrO; 273.15 | | | | |
| [540-51-2] 278.55 282.85 | | | | |
| 283.15 288.75 | 0.330 | | | |
| 293.15 | 0.290 | | | |
| 294.55 | | | | |
| 303.15 | 0.247 | | | |
| 310.05 313.15 | 0.205 | | | |
| 318.35 323.15 | | | | |
| Smoothing equation: $\ln x_{HC1} = 67.476$ Standard error in x_{HC1} about the | | | | |
| * calculated by the compiler ** smoothing equation and smoothed v | alues were calculated by H.L. Clever | | | |
| AUXILIARY INFORMATION | | | | |
| METHOD/APPARATUS/PROCEDURE: | SOURCE AND PURITY OF MATERIALS: | | | |
| The apparatus and procedure were those described by Gerrard and Macklen (1). The hydrogen chloride | (1) Hydrogen chloride: self- prepared and dried. | | | |
| was generated in an all glass apparatus. The absorption vessel, previously weighed, was fitted with a stoppered bubbler tube and a | (2) Halo-alcohols: purified, distilled, and attested by physical constants. | | | |
| stoppered outlet tube. Entrained liquid was condensed at 273.15 K, and allowed for. The amount of gas | ESTIMATED ERROR: $\delta x_{HCl}/x_{HCl} = \pm 0.01$ to 0.02 | | | |
| absorbed by a known weight of liquid | REFERENCES: | | | |
| was determined by weighing. | 1. Gerrard, W.; Macklen, E.D. J. Appl. Chem. <u>1956</u> , 6, 241. | | | |
| | | | | |

| COMPONENTS: | ORIGINAL MEASUREMENTS: | | | | |
|--|--|--|--|--|--|
| (1) Hydrogen chloride; HCl; | Gerrard, W.; Macklen, E.D. | | | | |
| [7647-01-0] | J. Appl. Chem. <u>1959</u> , 9, 85-88. | | | | |
| (2) Halogenated alcohols | <u></u> , ,, ,, | | | | |
| EXPERIMENTAL VALUES: | | | | | |
| T/K | | | | | |
| | ⁿ HCl ^{/n} alcohol fraction mole fraction ^x HCl ^x HCl | | | | |
| | | | | | |
| 1-Chloro-2-propanol; 273. | | | | | |
| $C_{3}H_{7}Clo; [127-00-4] 283. 284.$ | | | | | |
| 292. | 15 0.467 0.318 | | | | |
| 293. | | | | | |
| 301. 303. | | | | | |
| 308. | | | | | |
| 313. | 5 0.228 | | | | |
| 320. 323. | | | | | |
| | | | | | |
| Smoothing equation: $\ln x_{HCl} = 65.50$ Standard error in x_{HCl} about t | 5 - 87.945/(T/100) - 34.079 ln(T/100) ne regression line = 3.74 × 10 ⁻³ | | | | |
| 1-Bromo-2-propanol; 280. | | | | | |
| $C_{3}H_{7}BrO;$ [19686-73-8] 283. | | | | | |
| 293. 295. | | | | | |
| 297. | | | | | |
| 302. | | | | | |
| 303. 312. | | | | | |
| 313. | | | | | |
| 321. | 05 0.269 0.212 | | | | |
| 323. | | | | | |
| Smoothing equation: $\ln x_{HC1} = 60.86$ Standard error in x_{HC1} about t | - 82.074/(T/100) - 31.589 ln(T/100) ne regression line = 1.09 × 10 ⁻³ | | | | |
| 1,3-Dibromo-2-propanol; 273. | | | | | |
| $C_{3}H_{6}Br_{2}; [96-21-9]$ 273. | | | | | |
| 283. 289. | | | | | |
| 293. | | | | | |
| 297. | | | | | |
| 302. 303. | | | | | |
| 303. | | | | | |
| 313. | 5 0.0519 | | | | |
| 318. | | | | | |
| 323. | 5 0.0381 | | | | |
| Smoothing equation: ln x _{HCl} = 86.10 Standard error in x _{HCl} about t | 2 - 114.858/(T/100) - 45.889 ln(T/100) le regression line = 2.35 × 10 ⁻³ | | | | |
| <pre>* calculated by the compiler ** smoothing equation and smoothed values were calculated by H.L. Clever</pre> | | | | | |
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| COMPONENTS: | ORIGINAL MEASUREMENTS: |
|--|--|
| <pre>(1) Hydrogen chloride; HCl; [7647-01-0]</pre> | Gerrard, W.; Macklen, E.D. |
| (2) Halogenated alcohols | J. Appl. Chem. <u>1959</u> , 9, 85-88. |
| EXPERIMENTAL VALUES: T/K | Mole ratio Mole [*] Smoothed ^{**} HCl ^{/n} alcohol fraction mole fraction ^x HCl ^x HCl |
| 2,3-Dibromo-1-propanol; 280.1 C ₃ H ₆ Br ₂ O; [96-13-9] 283.1 291.1 293.1 298.6 303.1 304.8 313.0 313.1 322.0 323.1 | $\begin{array}{cccccccccccccccccccccccccccccccccccc$ |
| Smoothing equation: ln x _{HCl} = 48.152 Standard error in x _{HCl} about the | |
| 2,2,2-Trifluoroethanol; 273.1 C ₂ H ₃ F ₃ O; [75-89-8] 277.8 283.1 284.2 293.1 294.6 302.6 303.1 313.1 313.6 | 0.0728 0.070 0.0654 0.0587 0.060 0.0566 0.0480 0.0480 0.041 0.0394 0.0387 0.0333 |
| Smoothing equation: $\ln x_{HC1} = -8.7$ Standard error in x_{HC1} about t | 41 + 16.720/(T/100) ne regression line = 1.26 × 10 ⁻³ |
| 2,2,2-Trichloroethanol; 273.1 C ₂ H ₃ Cl ₃ O; [115-20-8] 273.5 283.1 288.3 293.1 294.4 302.6 303.1 313.1 | 0.0932 0.102 0.0926 0.081 0.0749 0.0669 0.057 0.0539 0.0528 0.0400 |
| Standard error in x _{HCl} about the * calculated by the compiler | - $132.665/(T/100)$ - $51.580 \ln(T/100)$ e regression line = 1.26×10^{-3} values were calculated by H.L. Clever |

| rsz Hydrogen Chlonde in | i Non-Aqueous Solvents |
|---|---|
| COMPONENTS : | ORIGINAL MEASUREMENTS: |
| <pre>(1) Hydrogen chloride; HCl; [7647-01-0]</pre> | Gerrard, W.; Mincer, A. M. A.; Wyvill, P. L. |
| (2) 2,2,2-Trichloroethanol; C ₂ H ₃ Cl ₃ O; [115-20-8] | J. Appl. Chem. <u>1960</u> , 10, 115-121. |
| VARIABLES : | |
| T/K: 273.15 - 303.15 | PREPARED BY: |
| Total P/kPa: 101.325 (1 atm) | W. Gerrard (smoothed data calculated by H.L. Clever) |
| EXPERIMENTAL VALUES: | |
| T/K Mol Rat | |
| ⁿ HC1 ^{/n} C ₂ H | 3 ^{C1} 3 ^O ^x 1 |
| 273.15 0.104 | |
| 278.15 0.089 | |
| 279.65 0.086 285.15 0.076 | |
| 288.35 0.073 | |
| 294.75 0.060 | |
| 297.85 0.059 | |
| 303.15 0.051 | 1 0.0486 |
| The compiler calculated the mole fra | |
| Smoothed Data: $\ln x_1 = -8.814 + 17.$ | 592/(T/100) |
| Standard error about | the regression line is 1.34×10^{-3} |
| T/K | Mol Fraction x1 |
| 273.15 283.15 293.15 303.15 | 0.0742 |
| AUXILIAR METHOD APPARATUS/PROCEDURE: The liquid component was weighed in a bubbler tube. The amount of gas absorbed was determined by re- weighing to constant weight. The total pressure was barometric, very nearly 1 atm (101.325 kPa). | Y INFORMATION SOURCE AND PURITY OF MATERIALS: (1) Hydrogen chloride. Good specimen from a commercial cylinder was dried. (2) 2,2,2-Trichloroethanol. Care- fully purified, and purity rigorously attested. ESTIMATED ERROR: $\delta x_1/x_1 = 0.02$ REFERENCES: |
| | |

| COMPONENTS: | EVALUATOR: |
|--|--|
| (1) Hydrogen chloride; HCl; [7647-01-0] (2) Alkenols and Alkynols | H. Lawrence Clever Department of Chemistry Emory University Atlanta, GA 30322 USA |
| | 1983, July |

The Solubility of Hydrogen Chloride in Unsaturated Alcohols.

Cook (ref 1) measured the solubility of hydrogen chloride at a partial pressure of 101.325 kPa (1 atm) over the 263 - 293 K temperature interval in eleven unsaturated alcohols. Eight of the alcohols are alkenols and three are alkynols.

The hydrogen chloride is more soluble in the alkenols than in the alkynols of similar molecular weight and structure. The alkenols range from three to seven carbon atoms. The mole fraction solubility increases as the carbon chain length increases and it increases with chain branching. The largest solubility is observed in the branched chain four carbon alkenol.

The data were fitted to an equation of the type

 $\ln x_1 = A_1 + A_2/(T/100 \text{ K}) + A_3 \ln (T/100 \text{ K})$

by the method of least squares. The equations and a table of smoothed mole fraction solubility data are included on each data sheet. The data are classed as tentative.Although an uncertainty of 0.5 percent is noted on the data sheets, the data are considered accurate to 2 to 3 percent because of uncertainties in the pressure measurement.

Table 1 gives smoothed solubility values in mole fraction (x_1) and mole ratio (n_1/n_2) at temperatures of 273.15 and 293.15 K along with the semi-structural formulas of the alcohols. The trends in the hydrogen chloride solubility with structure mentioned briefly above can be seen in the table.

Table 1. Tentative mole ratio and mole fraction solubilities of hydrogen chloride in unsaturated alcohols at a partial pressure of 101.325 kPa and temperatures of 273.15 and 293.15 K.

| Solvent Name and Structure | | Solubility | | | | | |
|----------------------------|--|--------------------------------|-----------------------|--------------------------------|------------|--|--|
| | | 273.15 | 5 K | 293.15 K | | | |
| | | n ₁ /n ₂ | <i>x</i> ₁ | n ₁ /n ₂ | <i>x</i> 1 | | |
| ALKENOLS | | | | | | | |
| 2-Propen-1-ol | CH2=CHCH2OH | 0.887 | 0.470 | 0.689 | 0.408 | | |
| 2-Buten-1-ol | CH ₃ CH=CHCH ₂ OH | 1.024 | 0.506 | 0.828 | 0.453 | | |
| 3-Buten-1-ol | CH2=CHCH2CH2OH | 0.972 | 0.493 | 0.786 | 0.440 | | |
| 2-Methyl-2-pro | . | | | | | | |
| | CH ₂ =C(CH ₃)CH ₂ OH | 1.364 | 0.577 | 1.169 | 0.539 | | |
| 4-Penten-1-ol | Сн ₂ =Снсн ₂ Сн ₂ Сн ₂ Он | 1.045 | 0.511 | 0.848 | 0.459 | | |
| 3-Penten-1-ol | CH3CH=CHCH2CH2OH | 1.033 | 0.508 | 0.838 | 0.456 | | |
| 3-Hexen-1-ol | CH3CH2CH=CHCH2CH2OH | 1.041 | 0.510 | 0.848 | 0.459 | | |
| 3-Hepten-1-ol | CH ₃ CH ₂ CH ₂ CH ₂ CH ₂ CH ₂ CH ₂ OH | 1.053 | 0.513 | | | | |
| ALKYNOLS | | | | | | | |
| 2-Propyn-1-ol | сн≡ссн₂он | 0.429 | 0.300 | 0.272 | 0.214 | | |
| 3-Butyn-1-ol | сн≡ссн ₂ сн ₂ он | 0.706 | 0.414 | 0.592 | 0.372 | | |
| 3-Butyn-2-ol | сн≡сснонсн | 1.033 | 0.508 | 0.876 | 0.467 | | |

| COMPONENTS: | ORIGINAL MEASUREMENTS: | | | | |
|---|---|--|--|--|--|
| <pre>(1) Hydrogen chloride; HCl; [7647-01-0]</pre> | Cook, T.M. | | | | |
| (2) Alkenols and alkynols | Thesis, <u>1966</u> University of London | | | | |
| VARIABLES: | PREPARED BY: | | | | |
| T/K: 252.15 - 303.05 Total P/kPa : 101.325 (1 atm) | W. Gerrard | | | | |
| EXPERIMENTAL VALUES: | | | | | |
| т/к | Mole ratio Mole* Smoothed** | | | | |
| ſ | HCl ^{/n} alcohol fraction mole fraction | | | | |
| | *HC1 *HC1 | | | | |
| 2-Propyn-1-ol, 263.15 | 0,338 | | | | |
| 2-Propyn-1-01, 263.15 (propargyl alcohol); 263.35 | | | | | |
| C ₃ H ₄ O; [107-19-7] 268.65 | | | | | |
| 273.15 | | | | | |
| 275.15 | | | | | |
| 278.15 283.15 | | | | | |
| 283.12 | | | | | |
| 292.65 | | | | | |
| 293.15 | 0.273 0.214 0.214 | | | | |
| 303.15 | 0.174 | | | | |
| Smoothing equation: $\ln x_{HC1} = 62.588$ Standard error in x_{HC1} about the reginator x_{HC1} about the reginator $*$ calculated by the compiler. ** smoothing equations and smoothed we can be a smoothed we can be able to the smoothed we can b | <pre>2 - 81.788/(T/100) - 33.685 ln(T/100) ression line = 1.73 × 10⁻³ values were calculated by H.L. Clever.</pre> | | | | |
| AUXILIARY 1 | NFORMATION | | | | |
| METHOD/APPARATUS/PROCEDURE: The data were cited by Gerrard (1). | | | | | |
| Hydrogen chloride was passed into a k amount of solvent at the specified te weight was constant at the barometric below 273 K a weighed amount (excess injected into the absorption vessel a The tube was then weighed at room ten | emperature until the increase in pressure (2). For temperatures b) of pyridine was quantitatively t the temperature of the thermostat. | | | | |
| SOURCE AND PURITY OF MATERIALS: (1) Hydrogen chloride: sample of bes passed through concentrated sulfuric (2) Alcohols: 2-buten-1-ol self prepa distilled. | | | | | |
| B.Pt.(1 atm)/°C | Refractive Index Density | | | | |
| 2-propyn-1-ol 114 | $d^2 = 0.9712$ | | | | |
| 2-propen-2-ol 96.5 3-butyn-1-ol 128.5-130 r | $n_D^{20} = 1.4133$ $n_D^{21} = 1.4404$ $d^2 = 0.922$ $d^2 = 0.922$ | | | | |
| 3-butyn-2-ol 104-105.5 | $n_0^{21} = 1.4236$ $d_4^{20} = 0.887$ | | | | |
| 2-buten-1-ol 120.5-121.5 r | $d^{15}_{D} = 1.4333$ $d^{15}_{4} = 0.8570$ | | | | |
| (33-34 at 8.5 mmHg) | -16 | | | | |
| 3-buten-1-ol 112-113 | $d^{15}_{\mu} = 0.8382$ $d^{20}_{\mu} = 0.846$ | | | | |
| 2-methyl-2-propen-1-ol 113-114.5 r 3-penten-1-ol 137-138.5 | $n_D^{20} = 1.4262$ $d^{20} = 0.846$ $n_D^{21} = 1.4376$ | | | | |
| 4-penten_1_01 134_138 | | | | | |
| 3-hexen-1-ol 155-157 r | $d^{20} = 1.4380$ $d^{20} = 0.849$ | | | | |
| 3-hepten-1-ol 173-173.5 | $n_{\rm D}^{23} = 1.4394$ | | | | |
| ESTIMATED ERROR: | | | | | |
| $\frac{\delta x_{\rm HC1}/x_{\rm HC1}}{\kappa_{\rm HC1}} = 0.005$ | | | | | |
| REFERENCES: | <i>41</i> 72. | | | | |
| Gerrard, W. J. Chim. Phys. <u>1964</u>, Solubility of Gases in Liquids, 1 | Plenum Press, New York, 1976. | | | | |
| 2. Ahmed, W.; Gerrard, W.; Maladkar, | W.K. J. Appl. Chem. 1970, 20, 109. | | | | |
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| f | · · · · · · | | | |
|---|--------------------------------------|---|---------------------------------------|---|
| COMPONENTS: | | ORIGINAL ME | ASUREMENTS | : |
| <pre>(1) Hydrogen chloride; HCl; [7647-01-0]</pre> | | Cook, T.M. | _ | |
| (2) Alkenols and alkynols | | Thesis, <u>196</u> University | | |
| EXPERIMENTAL VALUES: | | Mole ratio IC1 ^{/n} alcohol | Mole* fraction ^x HCl | |
| 2-Propen-1-ol, (<i>allyl alcohol</i>); C ₃ H ₆ O; [107-18-6] | 263.15 273.15 278.15 | 0.993 | 0.498 | 0.498 0.470 |
| | 283.15 288.15 289.45 | 0.733 | 0.423 | 0.440 |
| | 291.35 293.15 296.15 | 0.712 | 0.416 | 0.408 |
| | 303.05 303.15 | 0.606 | 0.377 | 0.375 |
| Smoothing equation: ln x _{HCl} = Standard error in x _{HCl} about th | 19.291 ne regre | - 24.988/(T/ ession line = | 100) - 10. 2.36 × 10 | 845 ln(T/100) -3 |
| 3-Butyn-1-ol; C ₄ H ₆ O; [927-74-2] | 262.45 263.15 273.15 273.65 | | 0.442 | 0.440 0.414 |
| | 280.45 283.15 285.75 | 0.659 | 0.397 0.392 0.386 | 0.391 |
| Smoothing equation: ln x _{HCl} = Standard error in x _{HCl} about th | 293.15 -3.030 ne regre | + 5.107/(T/1 ession line = | 00) + 0.27 4.21 × 1 | 0.372 7 ln(T/100) 0 ⁻⁴ |
| 3-Butyn-2-01; C ₄ H ₆ O; [2028-63-9] | 263.15 268.90 | 1.057 | 0.514 | 0.519 |
| | 273.15 278.65 283.15 | 0.977 0.965 | 0.499 0.491 | 0.508 |
| | 283.15 284.45 293.15 | 0.950 | 0.487 | 0.490 0.467 |
| Smoothing equation: ln x _{HCl} = Standard error in x _{HCl} about th | 24.510 ne regre | - 33.231/(T/ ession line = | 100) - 12. 8.94 × 10 | 958 ln(T/100) -4 |
| 2-Buten-1-ol, (<i>3-methylallyl alcohol</i>); C ₄ H ₈ O; [6117-91-5] | 273.15 276.65 280.45 | 1.007 0.980 | 0.502 0.495 | 0.506 |
| 7.0 | 283.15 283.35 284.55 291.35 | | 0.487 0.484 0.460 | 0.488 |
| Smoothing equation: In y - | 293.15 | | | 0.453 |
| Smoothing equation: $\ln x_{HC1} = $ Standard error in x_{HC1} about th * calculated by the compiler. | ne regre | ession line = | 3.22 × 10 | -4 |
| ** smoothing equations and smoo | othed va | lues were ca | lculated b | y H.L. Clever. |
| | | | | |
| | | | | |

| COMPONENTS: | ORIGINAL ME | ASUREMENTS | • |
|--|---|---------------------------------------|-------------------------|
| <pre>(1) Hydrogen chloride; HCl; [7647-01-0]</pre> | Cook, T.M. | | |
| (2) Alkenols and alkynols | Thesis, <u>196</u> University | | |
| | Mole ratio HC1 ^{/n} alcohol | Mole* fraction ^x HCl | |
| 3-Buten-1-ol; C ₄ H ₈ O; 263.15 [627-27-0] 270.15 | 1.005 | 0.501 | 0.518 |
| 273.15 274.45 277.55 | 0.960 | 0.490 0.480 | 0.493 |
| 282.75 283.15 290.35 | 0.882 0.811 | 0.469 0.448 | 0.467 |
| 292.75 293.15 | | 0.441 | 0.440 |
| Smoothing equation: $\ln x_{HC1} = 10.571$ Standard error in x_{HC1} about the regr | - 13.408/(T/ ession line = | 100) - 6.3 1.17 × 10 | 39 ln(T/100) -3 |
| 2-Methyl-2-propen-1-ol; 263.15 C ₄ H ₈ O; [513-42-8] 270.05 | 1.40 | 0.583 | 0.594 |
| 273.15 277.65 283.15 | 1.31 | 0.567 | 0.577 |
| 283.65 293.15 | 1.26 | 0.558 | 0.539 |
| | 1.16 1.15 1.11 | 0.537 0.535 0.526 | |
| 303.15 | | | 0.519 |
| Smoothing equation: $\ln x_{HC1} = 6.298$ Standard error in x_{HC1} about the regr | - 8.152/(T/10 ession line = | 0) - 3.845 1.31 × 10 | $\frac{\ln(T/100)}{-3}$ |
| 3-Penten-1-ol; C ₅ H ₁₀ O; 263.15 [39161-19-8] 265.55 | 1.115 | 0.527 | 0.532 |
| 273.15 275.25 280.05 | 1.009 | 0.502 | 0.508 |
| 282.45 283.15 | 0.939 | 0.484 | 0.482 |
| 285.55 293.15 | 0.910 | 0.476 | 0.456 |
| Smoothing equation: $\ln x_{HC1} = 11.093$ Standard error in x_{HC1} about the regr | - 14.188/(T/ ession line = | 100) - 6.5 1.23 × 10 | 44 ln(T/100) -3 |
| 4-Penten-1-ol; C ₅ H ₁₀ O; 252.15 [821-09-0] 253.15 263.15 273.15 | 1.426 | 0.588 | 0.584 0.545 0.511 |
| 275.45 278.75 279.95 | 0.979 0.968 | 0.504 0.495 0.492 | 0.511 |
| 281.55 283.15 286.25 293.15 | | 0.487 0.475 | 0.483 0.459 |
| 293.15 | + 7.868/(T/1 | 00) + 1.25 | |
| Smoothing equation: $\ln x_{\text{HCl}} = -4.807$ | estion line | 3 60 - 10 | - 4 |
| Smoothing equation: $\ln x_{HC1} = -4.807$ Standard error in x_{HC1} about the regret * calculated by the compiler. ** smoothing equations and smoothed variables | | | |

| COMPONENTS: | | ORIGINAL ME | ASUREMENTS | : |
|---|-----------------------|---|---|---|
| <pre>(1) Hydrogen chloride; HCl; [7647-01-0]</pre> | | Cook, T.M. | | |
| (2) Alkenols and alkynols | | Thesis, <u>196</u> University | | |
| EXPERIMENTAL VALUES: | | Mole ratio HCl ^{/n} alcohol | Mole* fraction ^x HCl | Smoothed** mole fraction ^x HCl |
| 3-Hexen-1-ol; C ₆ H ₁₂ O; [2305-21-7] | 293.15 | 0.953 0.940 0.897 0.849 | 0.536 0.488 0.485 0.473 0.459 | 0.537 0.510 0.484 0.459 |
| Smoothing equation: ln x _{HCl} = Standard error in x _{HCl} about t | = 5.733 the regre | - 6.804/(T/1) | 00) - 3.89 9.91 × 10 | 6 ln(T/100) -4 |
| 3-Hepten-1-ol; C ₇ H ₁₄ O; [10606-47-0] | 282.75 | 1.056 0.963 0.956 | 0.537 0.514 0.491 0.489 | 0.538 |
| | 282.85 283.15 | 0.955 | 0.488 | 0.488 |
| Smoothing equation: $\ln x_{HC1} = Standard error in x_{HC1}$ about t | = 8.160 - he regre | 10.185/(T/1 ession line = | 00) - 5.07 3.76 × 10 | 4 ln(T/100) -4 |
| <pre>* calculated by the compiler. ** smoothing equations and smo</pre> | | | | |
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| COMPONENTS : | EVALUATOR: |
|--|--|
| <pre>(1) Hydrogen chloride; HCl; [7647-01-0] (2) Alkanediols</pre> | H. Lawrence Clever Department of Chemistry Emory University Atlanta, GA 30322 USA |
| (2) Alkanediois | 1983, July |

The solubility of hydrogen chloride in alkanediols.

Hydrogen chloride + 1,2-Ethanediol; C₂H₆O₂; [107-21-1]

Three laboratories have reported solubility data on the system. O'Brien, Kenny and Zeurcher (ref. 1) studied the HCl + CH_2OHCH_2OH system at 298.15 K and HCl partial pressure range of 0.081 to 43.0 kPa. Matuzak (ref. 2) reported one solubility value at 310.9 K and 99.1 kPa partial pressure. Gerrard and Macklen (ref. 3) reported the solubility at a partial pressure of 101.3 kPa and ten temperatures between 273.15 and 319.65 K. All of the data are classed as tentative although, as discussed below, there is evidence the O'Brien *et al.* solubility data may be too small.

The one value of Matuszak at 310.9 K, when corrected to 101.3 kPa pressure by Henry's law, agrees exactly with the 310.9 K solubility value calculated from the smoothed data equation obtained from Gerrard and Macklen's data. This tends to support the reliability of the results of both laboratories.

At 298.15 K a graph of $\ln p_1$ vs. either $\ln x_1$ or $\ln(n_1/n_2)$ shows a poor correlation between the results of O'Brien *et al.* and of Gerrard and Macklen. If the Gerrard and Macklen value at 101.3 kPa is correct then the O'Brien *et al.* solubility values appear to be in error by being too small. Selected values of the data of O'Brien *et al.* at partial pressures of 0.081, 0.253, 0.324 and 3.67 kPa (0.0008, 0.0025, 0.0032 and 0.0357 atm) could form a line that would correlate with Gerrard and Macklen's value, but the other nine values, which fall on a satisfactory straight line, are too small. There is not enough evidence to discredit the results of O'Brien *et al.* but their data should be used with caution until confirmed by additional experiments.

Hydrogen chloride + Alkanediols (Table 1)

Gerrard and Macklen (ref. 3) report the solubility of hydrogen chloride in six alkanediols, including the 1,2-ethanediol discussed above, at 101.3 kPa hydrogen chloride partial pressure over the temperature interval of about 273 to 323 K.

The data were fitted by the method of least squares to an equation of the type

 $\ln x_1 = A_1 + A_2/(T/100 \text{ K}) + A_3 \ln(T/100 \text{ K})$

The equation and a table of smoothed mole fraction solubility data are included on each data sheet. Table 1 contains the smoothed solubility values in mole fraction (x_1) and mole ratio (n_1/n_2) at temperatures of 273.15, 293.15 and 323.15 K and a partial pressure of 101.3 kPa along with the name and formula of each alkanediol.

Although only a limited number of solvents were studied one can observe several trends between solubility and structure. For alkanediols, $C_n H_{2n+2} O_2$, the solubility in l,n-alkanediols increases as n increases. Within the butanediols the solubility decreases as the hydroxy groups are spaced nearer together. Thus the solubility decreases in the order

1,4-Butanediol > 1,3-Butanediol > 2,3-Butanediol

| ······································ | | | | | | | |
|---|----------------------------|----------------------------|--|--|--------------------------------|----------|----------|
| COMPONENTS : | | H | EVALUATOR | : | | | <u> </u> |
| Hydrogen chloride; H [7647-01-0] Alkanediols | | | | H. Lawrence Clever Department of Chemistry Emory University Atlanta, GA 30322 USA 1983, July | | | |
| RITICAL EVALUATION: | | | | | | | <u></u> |
| fr ch pr | action loride essure | (x_1) so in alka of 101. | atio (n olubilit nediols 325 kPa 5 and 3 | ies of at a p and te | hydroge artial mperatu | en | |
| Solvent Name and Structure | | | y of HC | | | | |
| | | 15 K | | 15 K | <u></u> | 15 K | |
| <u></u> | $\frac{n_{1}/n_{2}}{2}$ | <u>x</u> | $\frac{n_{1}/n_{2}}{2}$ | <u> </u> | $\frac{n_{1}^{/n}n_{2}^{}}{2}$ | <u> </u> | |
| l,2-Ethanediol CH ₂ OHCH ₂ OH [107-21-1] | 1.037 | 0.509 | 0.815 | 0.449 | 0.637 | 0.389 | |
| l,3-Propanediol CH ₂ OHCH ₂ CH ₂ OH [504-63-2] | 1.132 | 0.531 | 0.873 | 0.466 | 0.689 | 0.408 | |
| l,3-Butanediol CH ₂ OHCH ₂ CHOHCH ₃ [107-88-0] | 1,597 | 0.615 | 1.217 | 0.549 | 0.942 | 0.485 | |
| 1,4-Butanediol CH ₂ OHCH ₂ CH ₂ CH ₂ OH [110-63-4] | 1.674 | 0.626 | 1.353 | 0.575 | 1.088 | 0.521 | |
| 2,3-Butanediol CH ₃ CHOHCHOHCH ₃ [513-85-9] | 1.288 | 0.563 | 0.961 | 0.490 | 0.745 | 0.427 | |
| 1,5-Pentanediol CH ₂ OHCH ₂ CH ₂ CH ₂ CH ₂ OH [111-29-5] | | | 1.506 | 0.601 | 1.212 | 0.548 | |

REFERENCES:

 O'Brien, S. J.; Kenny, C. L.; Zeurcher, R. A. J. Am. Chem. Soc. <u>1939</u>, 61, 2504.
 Matuszak, M. P. U. S. Patent 2,520,947 Sept. 5, <u>1950</u>.

3. Gerrard, W.; Macklen, E. D. J. Appl. Chem. 1960, 10, 57.

| 140 | nyuruger | i chioride în î | Non-Aqueous Sol | ivents | | |
|--|--|---|--|--|--|--|
| COMPONENTS : | | | ORIGINAL MEASUREMENTS: | | | |
| <pre>(1) Hydrogen chloride; HCl; [7647-01-0]</pre> | | O'Brien, S. J.; Kenny, C. L.; Zeurcher, R. A. | | | | |
| <pre>(2) 1,2-Ethanediol or ethylene glycol; C₂H₆O₂; [107-21-1]</pre> | | J. Am. Chem 2504 - 2507 | . Soc. <u>1939</u> , 61, • | | | |
| VARIABLES: | · | | PREPARED BY: | <u></u> | | |
| P/kI | K: 298.15 a: 0.081 - 0008 - 0.42 | 42.96 | W. Gerr | ard | | |
| EXPERIMENTAL VALUES: | | | | | | |
| T/K | Pressure | | Mol Ratio | Mol Fraction | | |
| | p ₁ /atm | m1/mol kg- | -1 n ₁ /n ₂ | <i>x</i> 1 | | |
| ¹ Value plot o | of the abov e ratio and | e x ₁ vs. p ₁ | data. | 0.0359 0.0598 0.0642 0.0708 0.0780 0.0792 0.0801 0.0806 0.115 0.155 0.157 0.162 0.197 0.249) ¹ Tapolation of the series calculated by | | |
| | | AUXILIARY | INFORMATION | | | |
| METHOD/APPARATUS/PRO | CEDURE : | | | TY OF MATERIALS: | | |
| The method and apparatus are almost identical to those of Saylor (1). The main difference is the use of a 1 to 2 day instead of a 5 to 7 day equilibration time. The apparatus consists of two bulbs which are separated by a tap. The solvent is partially saturated with the gas, and the solution added to the lower bulb. The bulbs are partially evacuated, the tap opened, | | (1) Hydrogen chemical chloride by phosp (2) 1,2-Etha Used as | a chloride. Prepared from ly pure potassium e and sulfuric acid. Dried phorus pentoxide. anediol. Eastman Kodak Co. received. | | | |
| and the whole apparatus put in a thermostat from 1 to 2 days. | | ESTIMATED ERROR | ° δT/K = 0.02 | | | |
| The tap is closed. The HCl in the upper bulb is quantitatively removed and titrated with NaOH. The HCl partial pressure is calculated from the bulb volume and the number of moles of HCl assuming ideal gas behavior. A weighed solution sample is removed from the lower bulb and titrated with NaOH. | | REFERENCES: | I. H. Lem. Soc. <u>1937</u> , 59, 1712. | | | |
| 1 | | | | | | |

| COMPONENTS: | | ORTGINAL M | EASUREMENTS | • |
|---|------------------|---|---------------------------------------|---|
| | | | | |
| <pre>(1) Hydrogen chloride; HCl; [7647-01-0]</pre> | | | .; Macklen, | |
| (2) Diols | | J. App1. C | hem. <u>1960</u> , | 10, 57-62. |
| VARIABLES: | | PREPARED B | | |
| T/K: See below Total P/kPa : 101.325 (1 atm) | | W. G | errard | |
| EXPERIMENTAL VALUES: | | | | |
| | т/к | Mole ratio ⁿ HCl ^{/n} diol | Mole* fraction ^x HCl | Smoothed** mole fraction ^x HCl |
| | 273.15 | 1.038 | 0.509 | 0.509 |
| glycol); C ₂ H ₆ O ₂ ; [107-21-1] | 276.25 283.15 | 1.000 | 0.500 | 0.479 |
| | 284.15 | 0.902 | 0.474 | 0.175 |
| | 292.95 293.15 | 0.816 | 0.449 | 0.449 |
| | 295.35 | | 0.442 0.425 | |
| | 303.15 | | 0.403 | 0.419 |
| | 311.15 | | 0.396 | |
| | 313.15 317.85 | | 0.374 | 0.389 |
| | 319.65 | 0.585 | 0.369 | 0.360 |
| <pre>** smoothing equation and smoo</pre> | thed va | alues were c | alculated by | y H.L. Clever |
| AUXI | LIARY 1 | INFORMATION | | |
| METHOD/APPARATUS/PROCEDURE: | | SOURCE AND | PURITY OF | MATERIALS: |
| The method and procedure were described by Gerrard and Mackle The amount of gas absorbed by a | | | gen chlorid red and drie | |
| measured weight of solvent was determined by re-weighing the bubbler tube to constant weight the measured total pressure was barometric, very nearly 101.325 The temperature control was wit 0.1 K. | kPa. | metho boili index | ; distilled | attested by d refractive |
| | | ESTIMATED ^{6x} HCl | δτ/κ | $= \pm 0.1$ 0.005 to 0.025 |
| | | REFERENCES | • | |
| | | | , W.; Mackle . Chem. <u>195</u> | |
| | | | | |

| COMPONENTS: | | ORIGINAL ME | EASUREMENTS | : |
|---|------------------------|---|----------------------------|-------------------------------------|
| <pre>(1) Hydrogen chloride; HCl; [7647-01-0]</pre> | | Gerrard, W. | | |
| (2) Diols | | J. Appl. Cł | nem. <u>1960</u> , . | 10, 57-62. |
| | | | | |
| VARIABLES: T/K: See below | | PREPARED BY | <pre>/: errard</pre> | |
| Total P/kPa : 101.325 (1 atm) | | | | |
| EXPERIMENTAL VALUES: | | | | |
| | т/к | Mole ratio ⁿ HCl ^{/n} diol | Mole* fraction | Smoothed** mole fraction |
| | | net dioi | *нсі | ×HC1 |
| | | | | |
| 1,3-Propanediol, (propylene | 273.15 277.65 | 1.138 1.068 | 0.532 0.516 | 0.531 |
| glycol); C ₃ H ₈ O ₂ ; [504-63-2] | 280.35 | 1.036 | 0.509 | |
| | 282.65 | 0.994 | 0.498 | |
| | 283.15 | | | 0.498 |
| | 290.25 | 0.903 | 0.475 | |
| | 293.15 | | | 0.466 |
| | 297.45 | 0.833 | 0.454 | |
| | 306.65 | 0.748 0.705 | 0.428 0.413 | |
| | 310.85 313.15 | 0.705 | 0.413 | 0.408 |
| | 317.85 | 0.652 | 0.395 | 0.400 |
| | 303.15 | 01001 | 0.000 | 0.436 |
| | 323.15 | | | 0.381 |
| ncı | | - 8.297/(T/10 e regression | 00) - 4.776 line = 1.42 | |
| 1,3-Butanediol, (1,3-butylene | | 1 452 | 0 500 | 0.615 |
| glycol); C4 ^H 10 ^O 2; [107-88-0] | 279.65 281.25 | 1.453 1.430 | 0.592 0.588 | |
| | 283.15 | 1.130 | 0.500 | 0.582 |
| | 285.65 | 1.353 | 0.575 | |
| | 293.15 | | | 0.549 |
| | 293.35 | 1.222 | 0.550 | |
| | 298.65 | 1.128 | 0.530 | |
| | 300.15 | 1.111 | 0.526 | 0 546 |
| | 303.15 | 1 040 | 0 510 | 0.516 |
| | 303.75 307.65 | 1.049 1.013 | 0.512 0.503 | |
| | 310.35 | 0.974 | 0.493 | |
| | 313.15 | | | 0.485 |
| | 318.15 | 0.884 | 0.469 | |
| | 323.15 | | | 0.454 |
| | 326.35 | 0.801 | 0.445 | 0 405 |
| | 333.15 | | | 0.425 |
| Smoothing equation: ln × _{HCl} = Standard error in × _{HCl} = | = 9.533 - about the | - 11.646/(T/1 e regression | 00) - 5.728 line = 1.39 | 3 ln(T/100) 9 × 10 ⁻³ |
| * calculated by the compiler ** smoothing equation and smo | othed va | lues were ca | lculated by | H.L. Clever |
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| COMPONENTS: | | ORIGINAL ME | ASUREMENTS | : |
|--|---------------------|---|----------------------------|-------------------------------------|
| (1) Hydrogen chloride; HCl; | | Gerrard, W. | ; Macklen, | E.D. |
| [7647-01-0] | | J. Appl. Ch | em. 1960, 1 | 0, 57-62. |
| (2) Diols | | | | |
| EXPERIMENTAL VALUES: | т/к | Mole ratio ⁿ HCl ^{/n} diol | Mole* fraction | Smoothed** mole fraction |
| | | | ^x HCl | ×HC1 |
| 2,3-Butanediol, (2,3-butylene | 273.15 | | | 0.563 |
| <i>glycol</i>); C ₄ H ₁₀ O ₂ ; [513-85-9] | 275.05 276.85 | 1.246 1.217 | 0.555 0.549 | |
| | 280.55 | 1.154 | 0.536 | 0 535 |
| | 283.15 284.15 | 1.088 | 0.521 | 0.525 |
| | 288.85 | 1.011 | 0.503 | 0.490 |
| | 293.15 294.55 | 0.936 | 0.483 | 0.490 |
| | 302.75 303.15 | 0.852 | 0.460 | 0.458 |
| | 308.25 | 0.793 | 0.442 | |
| | 313.15 314.45 | 0.738 | 0.425 | 0.427 |
| | 321.05 | 0.671 | 0.402 | |
| | 323.15 | | | 0.399 |
| Smoothing equation: ln x _{HCl} = Standard error in x _{HCl} , a | 5.667 - bout the | - 5.930/(T/10 e regression | 00) - 4.051 line = 1.74 | ln(T/100) 4 × 10 ⁻³ |
| 1,4-Butanediol, | 273.15 | | 0.626 | 0.626 |
| (tetramethylene glycol); C ₄ H ₁₀ O ₂ ; [110-63-4] | 280.55 283.55 | 1.552 1.500 | 0.608 0.600 | |
| 4-10-27 | 283.15 | 1 401 | 0 500 | 0.601 |
| | 284.65 288.25 | 1.491 1.433 | 0.599 0.589 | |
| | 290.35 293.15 | 1.395 | 0.582 | 0.575 |
| | 293.35 | 1.360 | 0.576 | 0.373 |
| | 294.35 298.35 | 1.337 1.279 | 0.572 0.561 | |
| | 303.15 | | | 0.548 |
| | 304.75 312.55 | 1.193 1.096 | 0.544 0.523 | |
| | 313.15 | | | 0.521 |
| Smoothing equation: ln x _{HCl} = Standard error in x _{HCl} = | 10.370 bout the | - 13.365/(T/ e regression | (100) - 5.9 line = 7.50 | 7 ln(T/100) 5 × 10 ⁻⁴ |
| 1,5-Pentanediol, | 283.15 | | | 0.630 |
| (pentamethylene glycol); C ₅ H ₁₂ O ₂ ; [111-29-5] | 286.55 291.75 | 1.620 1.532 | 0.618 0.605 | |
| -5-12-27 | 293.15 | | | 0.601 |
| | 298.95 303.15 | 1.421 | 0.587 | 0.573 |
| | 312.35 | 1.223 | 0.550 | |
| | 313.15 316.95 | 1.163 | 0.538 | 0.548 |
| | 322.35 | 1.095 | 0.523 | 0.524 |
| | 323.15 | 1.017 | 0.504 | |
| | 333.15 | | | 0.502 |
| Smoothing equation: ln x _{HCl} = Standard error in x _{HCl} a | 2.064 - bout the | - 1.545/(T/10 e regression |)0) - 1.903 line = 2.27 | ln(T/100) × 10 ⁻³ |
| * calculated by the compiler | | | | |
| <pre>** smoothing equation and smo</pre> | othed va | alues were ca | alculated by | H.L. Clever |
| | | | | |

| COMPONENTS : | FVALUATOR. |
|---|--|
| <pre>1. Hydrogen Chloride; HCl; [7647-01-0]</pre> | Peter G. T. Fogg Department of Applied Chemistry and Life Sciences, |
| Aromatic and alicyclic alcohols | Polytechnic of North London, Holloway, London, N7 8DB, U.K. January 1989 |

Solubility of Hydrogen Chloride in Aromatic and Alicyclic Alcohols

Gerrard & Macklen (1) measured solubilities in benzenemethanol, phenylethanol and phenyl-1-propanol over temperature ranges at a total pressure of 1.013 bar. The contribution of the vapor pressure of the solvent to the total pressure was negligible under the conditions of the measurements and data may be taken to correspond to solubilities at a partial pressure of 1.013 bar. Measurements are self-consistent and correspond to a small increase in mole fraction solubility with increase in carbon number. No other data for these systems are available for comparison.

Mole fraction solubilities at 293.15 K and a partial pressure of 1.013 bar.

| Methanol Ethanol | 0.434 0.462 | (evaluated value) (evaluated value) |
|---------------------|----------------|--|
| Propanol | 0.463 | (evaluated value) |
| Benzenemethanol | 0.412 | (smoothed data based upon |
| Phenylethanol | 0.425 | measurements by |
| Phenyl-1-propanol | 0.446 | Gerrard & Macklen) |

Gerrard & Macklen (2) also measured solubilities in cyclohexanol and in 2-methylcyclohexanol at a total pressure equal to barometric pressure over the temperature ranges 280.95 K to 314.75 K and 277.85 K to 321.85 K respectively. Both sets of measurements are self-consistent with mole fraction solubilities at the same temperature very close to each other. The smoothed value at 293.15 K for cyclohexanol is 0.507 and that for 2-methylcyclohexanol in 0.510. Under the conditions of measurement mole fraction solubilities for a total pressure of 1.013 bar are likely to be close to those at a partial pressure of gas of 1.013 bar. The corresponding smoothed value for solubility in 1-hexanol from measurements by these authors is 0.468. The data for cyclohexanol and 2-methylcyclohexanol may be accepted on a tentative basis.

REFERENCES

| 1. | Gerrard, | W.; | Macklen, | Ε. | D. | J. | <i>App1</i> . | Chem. | <u>1956</u> , | 6, | 241 - | 244. |
|----|----------|-----|----------|----|----|----|---------------|-------|---------------|----|--------|------|
| 2. | Gerrard, | W.; | Macklen, | E. | D. | J. | App1. | Chem. | <u>1959</u> , | 9, | 85 - 8 | 38. |

| COMPONENTS: | ORIGINAL MEASUREMENTS: |
|---|--|
| <pre>(1) Hydrogen chloride; HCl; [7647-01-0]</pre> | Gerrard, W.; Macklen, E.D. |
| (2) Cyclic alkanols | J. Appl. Chem. <u>1959</u> , 9, 85-88. |
| VARIABLES: | PREPARED BY: |
| T/K: See below Total P/kPa : 101.325 (1 atm) | W. Gerrard |
| EXPERIMENTAL VALUES: T/K | Mole ratio Mole* Smoothed** HCl ^{/n} alcohol fraction mole fraction ^x HCl ^x HCl |
| Cyclohexanol; C ₆ H ₁₂ O; 273.15 [108-93-0] 280.95 | |
| 283.15 285.15 289.55 | 1.013 0.503 |
| 203.15 293.15 299.75 | 0.484 |
| 303.15 | 0.460 |
| 307.85 313.15 314.75 | 0.437 |
| Smoothing equation: $\ln x_{HC1} = 6.643 - $ Standard error in x_{HC1} about the | |
| 2-Methylcyclohexanol; 273.15 | 0.533 |
| C ₇ H ₁₄ O; [583-59-5] 277.85 283.15 | 1.096 0.523 |
| 285.05 293.15 | 1.026 0.506 |
| 296.05 302.35 | |
| 303.15 312.55 | 0.463 |
| 313.15 321.85 | 0.722 0.419 |
| 323.15 - Smoothing equation: ln x _{HCl} = 9.687 Standard error in x _{HCl} about the | |
| * calculated by the compiler | alues were calculated by H.L. Clever |
| AUXILIARY | INFORMATION |
| METHOD/APPARATUS/PROCEDURE: | SOURCE AND PURITY OF MATERIALS: |
| The apparatus and procedure were those described by Gerrard and Macklen (1). The hydrogen chloride was generated in an all glass apparatus. The absorption vessel, previously weighed, was fitted with | (1) Hydrogen chloride: self- prepared and dried. (2) Alcohols: purified, distilled, and attested by physical constants. |
| a stoppered bubbler tube, and a stoppered outlet tube. Entrained liquid was condensed at 273.15 K, and allowed for. The amount of gas | ESTIMATED ERROR: $\delta x_{HCl} / x_{HCl} = \pm 0.01$ |
| absorbed by a known weight of liquid was determined by weighing. | REFERENCES: |
| "as determined by werghing. | 1. Gerrard, W.; Macklen, E.D. J. Appl. Chem. <u>1956</u> , 6, 241. |
| | |

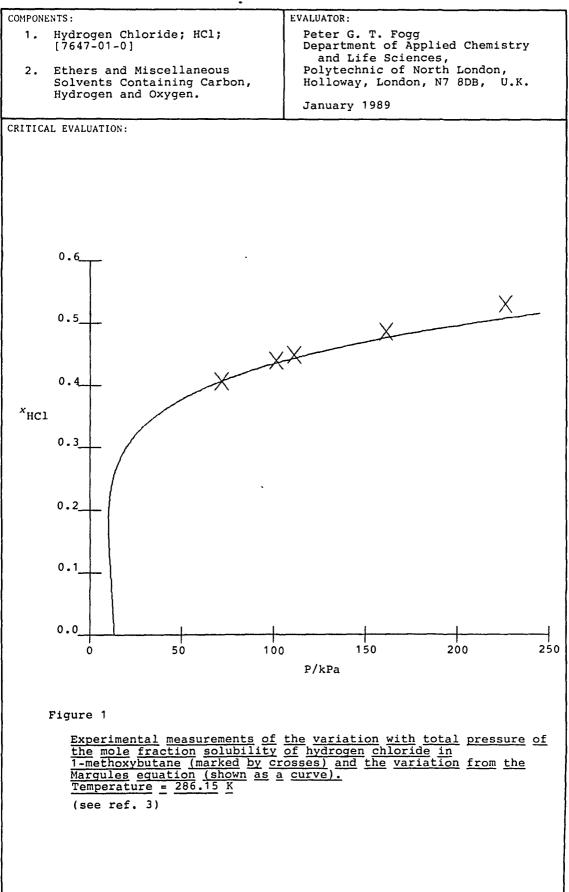
| Hydrogen Chlo | ride in l | Non-Aqueous Solvents 14 |
|---|--|---|
| COMPONENTS : | | ORIGINAL MEASUREMENTS: |
| (1) Hydrogen chloride; HCl; | | Gerrard, W.; Macklen, E. D. |
| [7647-01-0] | | |
| | | J. Appl. Chem. <u>1956</u> , 6, 241-244. |
| (2) Benzenemethanol or benzyl | | |
| alcohol; C ₇ H ₈ O; [100-51-6] | | |
| | | |
| | | |
| VARIABLES: | | PREPARED BY: |
| T/K: 278.65 - 316.85 Total P/kPa: 101.325 (1 atm) | | W. Gerrard |
| | | (smoothed data calculated by H.L. Clever) |
| | | |
| EXPERIMENTAL VALUES: | e Ratic | Mole Fraction |
| -, | | |
| -HCI | / ⁿ c ₇ н ₈ | |
| 278.65 | 0.875 | 0.467 |
| | 0.793 | 0.422 |
| | 0.720 | 0.419 |
| | 0.657 0.597 | 0.396 0.374 |
| | 0.525 | 0.344 |
| | | |
| The mole fraction solubility va | lues w | ere calculated by the compiler. |
| | | _ |
| Smoothed Data: $\ln x_1 = -3.085$ | + 6.44 | 1/(T/100) |
| Chandand owner | about | regression line = 9.91×10^{-3} |
| Standard erfor | | |
| T/ | к мо | le Fraction |
| | | <i>x</i> 1 |
| | | 0.483 |
| 273. 283. | | 0.445 |
| 293. | | 0.412 |
| 303. | - | 0.383 |
| 313. | | 0.358 0.336 |
| 323. | T.2 | 0.338 |
| | | |
| | | |
| | | |
| AU | XILIARY | INFORMATION |
| | · | |
| METHOD/APPARATUS/PROCEDURE: | in an | SOURCE AND PURITY OF MATERIALS: (1) Hydrogen chloride. Self pre- |
| all-glass apparatus. | in an | pared and dried. |
| are dropp abbaracap. | | purca and arrows |
| The all glass absorption vessel | | (2) Benzenemethanol or benzyl |
| cm ³) comprised an inlet bubbler | | alcohol. High-grade specimen |
| an outlet tube, and the part ho a weighed amount of liquid. Ea | | was distilled and attested. |
| tube was fitted with a tap, and | | |
| either a B-19 cone, or a B-19 | | |
| socket. Entrained liquid was c | | |
| lected and allowed for. Temper control was within 0.1 K. The | ature | |
| amount of gas absorbed was dete | r- | |
| mined by weighing. | - | ESTIMATED ERROR: |
| | | $\delta T/K = 0.1$ |
| | | $\delta x_{1}/x_{1} = 0.01$ |
| | | |
| | | REFERENCES : |
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| | | 1 |

| | Non-Aqueous bolients |
|--|---|
| COMPONENTS : | ORIGINAL MEASUREMENTS: |
| (1) Hydrogen chloride; HCl; | Gerrard, W.; Macklen, E. D. |
| [7647-01-0] | 1 |
| (2) Phonylothanol, C.H. O. | J. Appl. Chem. <u>1956</u> , 6, 241-244. |
| (2) Phenylethanol; C ₈ H ₁₀ O; | |
| [1321-27-3] | |
| | |
| VARIABLES: | PREPARED BY: |
| т/к: 278.35 - 315.85 | W. Gerrard |
| Total P/kPa: 101.325 (1 atm) | |
| | (smoothed data calculated by H.L. Clever) |
| EXPERIMENTAL VALUES: | |
| T/K Mole Rat | |
| ⁿ HCl/ ⁿ C ₈ H | x ₁₀ 0 ^x 1 |
| 278.35 0.878 | 0.468 |
| 287.05 0.796 | |
| 292.35 0.747 | 0.428 |
| 299.25 0.686 309.35 0.608 | 0.407 |
| 309.35 0.608 315.85 0.565 | 0.378 0.361 |
| | |
| The mole fraction solubility values w | vere calculated by the compiler. |
| | |
| Smoothed Data: $\ln x_1 = 12.392 - 15.6$ | 587 (T/100) - 7.351 In (T/100) |
| Standard error about | regression line = 6.09×10^{-4} |
| | |
| T/K Mc | ole Fraction |
| | <i>x</i> ₁ |
| 273.15 | 0.483 |
| 283.15 | 0.454 |
| 293.15 | 0.425 |
| 303.15 313.15 | 0.396 0.368 |
| 323.15 | 0.341 |
| | |
| | |
| | |
| AUXILIARY | INFORMATION |
| METHOD APPARATUS / PROCEDURE : | SOURCE AND PURITY OF MATERIALS: |
| Hydrogen chloride was generated in ar | |
| all-glass apparatus. | pared and dried. |
| | |
| The all glass absorption vessel (50 cm ³) comprised an inlet bubbler tube, | (2) Phenylethanol. High-grade specimen was distilled and |
| an outlet tube, and the part holding | attested. |
| a weighed amount of liquid. Each | |
| tube was fitted with a tap, and | |
| either a B-19 cone, or a B-19 socket. Entrained liquid was col- | |
| lected and allowed for. Temperature | |
| control was within 0.1 K. The | |
| amount of gas absorbed was deter- mined by weighing. | ESTIMATED ERROR: |
| ······································ | $\delta T/K = 0.1$ |
| | $\delta x_1 / x_1 = 0.005$ |
| | |
| | REFERENCES: |
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| | |

| Hydrogen Ch | loride in I | Non-Aqueous Solvents | 149 |
|--|--|--|-----|
| COMPONENTS : | | ORIGINAL MEASUREMENTS: | |
| <pre>(1) Hydrogen chloride; HCl; [7647-01-0]</pre> | | Gerrard, W.; Macklen, E. D. | |
| (2) Phenyl-1-propanol; C ₉ H ₁₂ O; [1335-12-2] | | J. Appl. Chem. <u>1956</u> , 6, 241-244. | |
| VARIABLES: | | PREPARED BY: | |
| T/K: 280.15 - 317.75 | | W. Gerrard | |
| Total P/kPa: 101.325 (1 atm) | | (smoothed data calculated by H.L. Clever |) |
| EXPERIMENTAL VALUES: | | | |
| | ole Rati | | |
| nHC | с1/ ⁿ с9 ^н 1 | 2 ⁰ ^x 1 | |
| 280.15 | 0.922 | 0.480 | |
| 286.55 | 0.860 | 0.462 | |
| 293.55 300.55 | 0.801 0.740 | 0.445 0.425 | |
| 303.85 | 0.714 | 0.417 | |
| 310.25 317.75 | 0.659 | 0.397 | |
| 317.73 | 0.601 | 0.375 | |
| Smoothed Data: $\ln x_1 = 19.778$ | 3 - 26.3 | ere calculated by the compiler. $54/(T/100) - 10.781 \ln (T/100)$ | |
| Standard error | about | regression line = 1.03×10^{-3} | |
| د | г/к мо | le Fraction ^x 1 | |
| 27: | 3.15 | 0.495 | |
| | 3.15 | 0.472 | |
| | 8.15 8.15 | 0.446 0.418 | |
| | 3.15 | 0.389 | |
| | 3.15 | 0.360 | |
| | AUXILIARY | INFORMATION | |
| METHOD/APPARATUS/PROCEDURE: | | SOURCE AND PURITY OF MATERIALS; | |
| Hydrogen chloride was generate all-glass apparatus. | ed in an | (1) Hydrogen chloride. Self pre- pared and dried. | |
| The all glass absorption vesses cm^3) comprised an inlet bubble an outlet tube, and the part H a weighed amount of liquid. H tube was fitted with a tap, an either a B-19 cone, or a B-19 socket. Entrained liquid was lected and allowed for. Tempe control was within 0.1 K. The | er tube, holding Each hd col- erature | (2) Phenyl-1-propanol. High-grade specimen was distilled and attested. | |
| amount of gas absorbed was det | ter- | ESTIMATED ERROR: | |
| mined by weighing. | | $\delta T/K = 0.1$ $\delta x_1/x_1 = 0.005$ | |
| | | | _ |
| | | REFERENCES : | |
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COMPONENTS: EVALUATOR: 1. Hydrogen Chloride; HCl; Peter G. T. Fogg Department of Applied Chemistry and Life Sciences, [7647-01-0] Polytechnic of North London, 2. Ethers and Miscellaneous Solvents Containing Carbon, Hydrogen and Holloway, London, N7 8DB, U.K. Oxygen. January 1989 CRITICAL EVALUATION: The Solubility of Hydrogen Chloride in Ethers and Miscellaneous Solvents Containing Carbon, Hydrogen and Oxygen. The solubility in a wide range of alkyl ethers has been measured by Gerrard and his co-workers (1-3) over the temperature range 197 K to 301 K at a total pressure equal to barometric pressure. The solubility in 1-methoxybutane has also been measured over a total pressure range of 7 kPa to 226 kPa at temperatures 233.45 K to 286.15 K. Mole fraction solubilities are appreciably higher than values corresponding to the Raoult's law equation i.e. mole fraction = partial pressure / vapor pressure of liquid HCl The variations of mole fraction solubility with pressure at a constant temperature for 1-methoxybutane may be compared with the variations expected from the Margules equation i.e. $P_{total} = P_g^{\circ} x_g \exp(\alpha x_s^2) + P_s^{\circ} x_s \exp(\alpha x_g^2)$ where 'g' refers to the gas and 's' refers to the solvent. P°_{s} and P°_{s} are the vapor pressures of pure liquefied gas and solvent respectively. The value of α may be found by substitution in the equation of the mole fraction solubility for one value of the total pressure at a particular temperature. The equation may then be used to draw the variation of mole fraction solubility with pressure which follows from the equation. As may be seen from fig. 1 the experimental data for 1-methoxybutane approximate to the curve from the Margules equation but do not exactly coincide with it except at the data point used to calculate the value of α . The curve does not pass through the origin because the pure solvent has a small vapor pressure at this temperature. Both the experimental measurements and the theoretical curve indicate that, at total pressures of about 101.3 kPa, there is relatively small change in mole fraction solubility with change of pressure, whereas at very low total pressures the change is relatively large. Solubilities in other dialkyl ethers have not been measured over pressure ranges but the evaluator considers that the Margules equation is likely to give an approximate prediction of behaviour which is valid for the comparison of one system with another. At the higher temperatures of measurement the lower ethers are appreciably volatile. 1,1'-Oxybisethane has a vapor pressure of about 75 kPa at 299 K, the highest temperature of measurement of solubility in this ether. According to Kapoor et al. the mole fraction solubility of hydrogen chloride in this solvent Margules equation applied to this system that a saturated solution under these conditions is likely to have a partial pressure of hydrogen chloride of 82.3 kPa with the partial pressure of 1,1'-oxybisethane reduced to 19.0 kPa. It also follows from the Margules equation that the mole fraction solubility for a partial pressure of hydrogen chloride of 101.3 kPa would be about 0.374 compared with the solubility of 0.357 for a total pressure of 101.3 kPa. This difference is small despite the very high volatility of the pure solvent. At lower temperatures for this solvent and at this temperature for higher ethers the difference between mole fraction solubility at a total pressure of 101.3 kPa and mole fraction solubility at this partial pressure is likely to be much smaller. At 283.95 K the vapor pressure of pure 1,1'-oxybisethane is about 40 kPa and experimental value of the mole fraction solubility of hydrogen chloride at a total pressure of 101.3 kPa is 0.475. The partial pressure of 1,1'-oxybisethane over the saturated solution is likely to be about 2.2 kPa and the corresponding value of mole fraction solubility for a partial pressure of 101.3 kPa to be about 0.477.

The evaluator considers that, for the purpose of general comparison of these sets of data for dialkyl ethers at a total pressure of 101.3 kPa, either one with another or with data for other systems, the contribution of the vapor pressure of the ether to the total pressure may be disregarded. Solubilities at



| COMPO | DNENTS: | EVALUATOR: |
|-------|---|--|
| 1. | Hydrogen Chloride; HCl; [7647-01-0] | Peter G. T. Fogg Department of Applied Chemistry and Life Sciences, |
| 2. | Ethers and Miscellaneous Solvents Containing Carbon, Hydrogen and Oxygen. | Polytechnic of North London, Holloway, London, N7 8DB, U.K. January 1989 |
| | | |

a total pressure of 101.3 kPa may be considered to differ from solubilities at a partial pressure of 101.3 kPa by less than the experimental error in measurement.

The general pattern of data for a total pressure of 101.3 kPa is consistent but unusual. Over much of the temperature range the variation with temperature of mole fraction solubilities in the various ethers is almost linear. The solubility curves are very close to one another and there is very little change in pattern on going from the lower alkyl ethers with carbon number of four to higher ones with carbon number of 16. Mole fraction solubilities in 2-ethoxybutane are slightly higher than in the other alkyl ethers. At 273.15 the smoothed value given by Kapoor *et al.*(3) is 0.574 compared with the smoothed value of 0.537 for dissolution in 1-ethoxybutane.

Kapoor *et al.*(3) repeated some of the earlier measurements of the solubility in 1-methoxybutane, 1,1'-oxybispropane, 1,1'-oxybisbutane 1,1'-oxybispentane, and 1,1'-oxybis[3-methyl]-butane made with similar apparatus in the same laboratory by Gerrard & Macklen (1) or Ahmed, Gerrard & Maladkar (2). In all cases there is agreement within about 2%. Some measurements of solubility in alkyl ethers have been reported from other laboratories. Perkin's measurements (4) of solubility in 1,1'-oxybis[3-methyl]-butane over the temperature range 273.15 K to 298.15 K are close to the later measurements by Gerrard & Macklen and by Kapoor *et al.* The single measurement reported by Matuszak (5) at 297.6 K is significantly lower than solubilities reported by other authors and is rejected by the evaluator.

The evaluator recommends the following equation for solubilities in 1,1'-oxybis[3-methyl]-butane at a total pressure of 101.3 kPa for the temperature range 272.9 K to 307.45 K which is based upon experimental data obtained within this range :

 $\ln x_{\rm HCl} = 299.563 - 11887.3/(T/K) - 45.7625 \ln(T/K)$

The standard deviation in values of x_{HC1} is 0.0081.

The data obtained by Kapoor $et \ al.$ should be used for solubilities at lower temperatures down to 194.65 K. These data are probably reliable but there are no other measurements at very low temperatures for comparison.

The solubility in 1,1'-oxybisethane at a total pressure equal to barometric pressure was also measured by Kapoor *et al.*(3) over the temperature range 201.15 K to 299.55 K, by Schunke (6) over the range 263.95 K to 303.15 K, by Ionin & Shverina (7) and by Chesterman (8) at 298.15 K and also by Mirsaidov *et al.*(9) at 273.15 K and 298.15 K. As explained above, the solubility in ethers is relatively insensitive to changes in pressure at pressures close to 101.3 kPa. Variation in barometric pressure from one set of data to another does not cause significant changes in solubility. Data presented by Kapoor *et al.*, by Schunke and by Chesterman agree fairly closely. The solubilities published by Mirsaidov *et al.* are appreciably lower and the value given by Ionin & Shverina higher than values given by other authors. The following equation based upon measurements by Kapoor *et al.*, by Schunke and by Chesterman is recommended for solubilities in the range 260 K to 303 K :

 $\ln x_{\rm HC1} = 75.090 - 2391.9/(T/K) - 11.940 \ln(T/K)$

The standard deviation in values of x_{HC1} is 0.0177.

Data published by Kapoor *et al.* for lower temperatures down to 201.15 K are likely to be reliable. No other measurements down to this temperature are available for comparison.

Ionin & Shverina (7) measured the solubility in 1,1'-oxybisbutane at 298.15 K and a total pressure equal to barometric pressure. Their value of the fraction solubility is 0.447 which is high compared with the value of 0.39 from measurements by Kapoor *et al.*(3), and by Gerrard & Macklen (1) which are in

| COMPO | NENTS: | EVALUATOR: |
|-------|---|--|
| 1. | Hydrogen Chloride; HCl; [7647-01-0] | Peter G. T. Fogg Department of Applied Chemistry and Life Sciences, |
| 2. | Ethers and Miscellaneous Solvents Containing Carbon, Hydrogen and Oxygen. | Polytechnic of North London, Holloway, London, N7 8DB, U.K. January 1989 |

satisfactory agreement where the two temperature ranges overlap. Ionin & Shverina also measured the solubility in 2,2'-oxybisbutane at 298.15 K. No other measurements of the solubility of hydrogen chloride in this solvent are available for comparison. In view of the uncertainty cast on their measurement of solubility in 1,1'-oxybisethane and in 1,1'-oxybisbutane published in the same paper the value for 2,2'-oxybisbutane should be treated with caution.

Gerrard & Macklen (1) measured the solubility of hydrogen chloride in (methoxymethyl)benzene, (ethoxymethyl)benzene, (butoxymethyl)benzene and 1,1'-[oxybis(methylene)]bisbenzene at total pressures equal to barometric pressure in the temperature range 273.15 K to 312.95 K. The measurements are self-consistent and likely to be reliable but no other measurements of solubility in these solvents are available for comparison. Mole fraction solubilities are appreciably higher than given by the Raoult's law equation but the presence of the benzene rings lowers solubility relative to that in dialkyl ethers as shown below:

Table 1 Mole fraction solubility of hydrochloric acid at 283.15 K, total pressure 101.325 kPa

| Solvent | ×HC1 | Source |
|------------------------------------|------------------|----------------------|
| (Raoult's law equation) | 0.0305 | |
| 1,1'-Oxybisethane | 0.478 | evaluator's equation |
| (Methoxymethy1)benzene | 0.421 | (1) |
| (Ethoxymethyl)benzene | 0.419 | (1) |
| (Butoxymethyl)benzene | 0.407 | (1) |
| 1,1'-[Oxybis(methylene)]bisbenzene | 0.352 | (1) |
| Methoxybenzene | 0.144 | evaluator's equation |
| Ethoxybenzene | 0.149 | evaluator's equation |
| 1-Methoxy-2-methylbenzene | 0.112 | (1) |
| 1,1'-Oxybisbenzene | 0.049 (298.15 K) | (11) |
| | 0.059 (298.15 K) | (1) |
| Tetrahydrofuran | 0.581 | (1) |
| 1.4-Dioxane | 0.517 | (1) |

Mole fraction solubility at barometric pressure is further reduced if the benzene ring is directly attached to the ether linkage. Unlike the ethers discussed above there is, in the case of alkyl aryl ethers and diaryl ethers, significant variation in mole fraction solubility with change in pressure at pressures close to 101.3 kPa. The assumption that mole fraction solubility varies linearly with pressure to about 101.3 kPa is probably a valid approximation for many purposes.

The solubility in methoxybenzene has been measured over a pressure and temperature range by O'Brien (10). Solubility at a total pressure of 101.3 kPa has also been measured over temperature ranges by Gerrard & Macklen and by Kapoor *et al.* Mole fraction solubilities at a partial pressure of 101.3 kPa by extrapolation of O'Brien's data are close to values from the other two sources, corrected where necessary for the small contribution of the solvent to the total vapor pressure. The evaluator recommends the following equation for mole fraction solubilities in the temperature range 277 K to 321.65 K based upon data from the three sources:

 $\ln x_{\rm HC1} = -217.535 + 11508.4/(T/K) + 30.9874 \ln(T/K)$

The standard deviation in values of x_{HC1} is 0.0506.

Measurements made down to 195.65 K by Kapoor *et al.* are likely to be reliable but no other data for low temperatures are available for comparison.

O'Brien & King (11) measured Henry's constants for solubility in ethoxybenzene over the temperature range 283.15 K to 298.15 K. Gerrard and Macklen reported solubilities in this solvent at a total pressure of 101.3 kPa for the range 282.75 K to 322.95 K. The two sets of data are consistent to within 6%.

Hydrogen Chloride in Non-Aqueous Solvents EVALUATOR: COMPONENTS : Hydrogen Chloride; HCl; Peter G. T. Fogg 1. [7647-01-0] Department of Applied Chemistry and Life Sciences, Ethers and Miscellaneous Solvents Polytechnic of North London, 2. Holloway, London, N7 8DB, U.K. Containing Carbon, Hydrogen and Oxygen. January 1989 CRITICAL EVALUATION: The corresponding values of mole fraction solubilities fit the following equation : $\ln x_{\rm HC1} = 67.4844 - 1288.90/(T/K) - 11.4837 \ln(T/K)$ The standard deviation for values of x_{HC1} is 0.0020. O'Brien & King also measured Henry's constants for dissolution of hydrogen chloride in butoxybenzene at 293.15 k and 298.15 K. No other measurements for dissolution of the gas in this solvent are available for comparison. The corresponding mole fraction solubilities for a partial pressure of 101.3 kPa are close to those for dissolution in ethoxybenzene. There is no reason to doubt their reliability, within the limits of experimental error given by the author. Solubility in 1-methoxy-2-methylbenzene at a total pressure of 101.3 kPa over the range 273.15 K to 316.45 K was measured by Gerrard & Macklen (1). The data indicate that the presence of the methyl group adjacent to the ether linkage reduces the mole fraction solubility relative to that in methoxy- and ethoxybenzene. There is no reason to doubt the reliability of the data but no other measurements on this system are available for comparison. The solubility in 1,1'-oxybisbenzene was measured by O'Brien & King (11) at 298.15 K and 303.15 K and by Gerrard & Macklen (1) who reported solubilities at 101.3 kPa over the temperature range 273.15 K to 323.55 K. Matuszak (5) reported the solubility at a pressure of 99.6 kPa at 307.0 K. There is poor agreement between measurements by different authors as may be seen below: $x_{\rm HC1}$ at 101.3 kPa total pressure. Authors T/K Gerrard & Macklen (1) 298.15 0.0593 (interpolated) 303.15 0.0535 0.0496 307.0 O'Brien & King (11) 298.15 0.0486 0.0461 303.15 Matuszak (5) 307.0 0.0290 The measurement by Matuszak can be rejected because it is so much smaller than values from the other sources. Gerrard's measurements are self consistent over a range of seven temperatures and may be more reliable than those published by O'Brien but further measurements on this system are needed for confirmation. Chlorination of dialkyl ethers lowers the solubility of hydrogen chloride. Gerrard & Macklen (1) measured the solubility in 1,1'-oxybis[2-chloroethane] at a total pressure of 101.3 kPa from 273.15 K to 311.55 K. The contribution of the vapor pressure of the solvent to the total pressure may be disregarded over this temperature range. O'Brien (10) measured solubilities over pressure ranges below barometric pressure at 293.15 K to 313.15 K. Mole fraction solubilities are appreciably higher than values from the Raoult's law equation. Linear extrapolation of O'Brien's data to a partial pressure of 101.3 kPa gives mole fraction solubilities which are greater than values from Gerrard's measurements.

At 293.15 K O'Brien's value is 0.149 compared with Gerrard's value of 0.132. At 313.15 K the values are 0.0927 and 0.0766 respectively. If the variation in mole fraction solubility with partial pressure of gas approximates to the Margules equation then the above differences are partly due to errors from the linear extrapolation of solubilities to a partial pressure of 101.3 kPa. Gerrard's data are likely to be the more reliable for a partial or total pressure of 101.3 kPa.

Gerrard & Macklen (1) also measured solubilities in oxybis[chloromethane] , 1-chloro-1-(2-chloroethoxy)ethane and in 1,1'-oxybis[3-chloropropane] at a total pressure of 101.3 kPa over temperature ranges. The solubility in 1-chloro-1-(2-chloroethoxy)ethane is close to that in 1,1'-oxybis[2-chloroethane]. The effect of the chlorine in reducing solubility of hydrogen chloride is greatest in oxybis[chloromethane] and least in 1,1'-oxybis[3-chloropropane]. No other measurements of solubility in these three ethers are available for comparison but there is no reason to doubt their reliability.

| COMPO | NENTS: | EVALUATOR: |
|-------|---|--|
| 1. | Hydrogen Chlorıde; HCl; [7647-01-0] | Peter G. T. Fogg Department of Applied Chemistry and Life Sciences, |
| 2. | Ethers and Miscellaneous Solvents Containing Carbon, Hydrogen and Oxygen. | Polytechnic of North London, Holloway, London, N7 8DB, U.K. January 1989 |

Solubility in 1,4-dioxane at a total pressure of 101.3 kPa over the temperature range 279.65 K to 312.85 K was also measured by Gerrard & Macklen. Solubilities are close to those in dialkyl ethers under the same conditions and are likely to be relatively insensitive to changes in partial pressure at pressures close to 101.3 kPa. A measurement by Matuszak at 305.4 K and a total pressure of 99.6 kPa is equivalent to a mole fraction solubility of 0.372 under these conditions. Correction of this measurement to a partial pressure of 101.3 kPa gives a value of 0.375, on the assumption that variation of pressure with composition may be approximately represented by the Margules equation. Interpolation of Gerrard's data to give a solubility at 307.4 k and correction to a partial pressure of 101.3 kPa gives a value of the mole fraction solubility of 0.401. Measurements of the solubility in other ethers reported by Matuszak are lower than solubilities reported by other workers and, in this case also, ought to be rejected in favour of the data reported by Gerrard & Macklen.

Gerrard & Macklen (1) also measured the solubility in tetrahydrofuran at a total pressure of 101.3 kPa over the range 278.15 K to 304.35 K. The measurements show that, under the conditions of the measurement the mole fraction solubility is higher than that in any other ether for which data are available. The measurements are likely to be reliable but data from other workers are not available for comparison.

Gerrard *et al.*(12) measured the solubility in 1,1,1-triethoxyethane at a total pressure equal to 101.3 kPa over the range 279.15 K to 314.35 K. The mole fraction solubility is 0.731 at 279.15 K but measurements show that there is a marked decrease over this temperature range with a value of 0.322 at 314.35 K. These authors also measured solubilities under similar conditions in 1,3-benzodioxole, 2,3-dihydro-1,4-benzodioxin, 3,4-dihydro-2H-1,2-benzodioxepin, 2-methyl-1,4-benzodioxan (12) and in phenol (13). All values of mole fraction solubilities fall above the reference line corresponding to the Raoult's law equation. No other data for these compounds are available for comparison.

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- Gerrard, W.; Mincer, A. M. A.; Wyvill, P. L. J. Appl. Chem. <u>1959</u>, 9, 85 - 88.

| ORIGINAL MEASUREMENTS: (1) Hydrogen chloride; HC1; (7647-01-0] (2) Ethers VARIABLES: 7/K: see below Total P/KPa: 101.325 (1 atm) T/K T/K Nole Mole T/K Nole T/K T/K Nole T/K Nole Nole T/K Nole T/K Nole Nole < | | Non-Aqueous Solvents |
|--|---|---|
| (1) (2) Ethers Sandbach, J.A. (2) Ethers J. Appl. Chem. Biotech. 1971, 21, 97-100. VARIABLES: T/K see below Total P/Kmar 101.325 (1 atm) PREPARED BY: EXFERTMENTAL VALUES: Nole* T/K Mole* Authors' smoothed x _{HC1} ** Methoxyethane, 231.15 231.15 2.91 0.746 0.789 Cyligor, 1540-57-01 241.15 241.15 2.93 0.746 0.638 0.664 Smoothing equation: In x _{HC1} = -2.154 + 4.317/(T/100) 665 Smoothing equation and mole fractions from the equation were calculated by the compiler • ** calculated by the compiler • ** smoothing equation and mole fractions from the equation were calculated by H.L. Clever SOURCE AND PURITY OF MATERIALS: METHOD/APPARATUS/PROCEDURE: SOURCE AND PURITY OF MATERIALS: The bubbler-tube technique described Surger and Yuili 11 was used. Sort temperatures less than 23 K. SOURCE AND PURITY OF MATERIALS: The bubbler-tube technique described (1) "crybisilia-methyli-butane, 1, 1'crybisilia-methyli-butane, 1, 1'crybisilia-methyli-butane, 1, 1'crybisilia-methyli-butane, 1, 1'crybisilia-methyli-but | COMPONENTS: | ORIGINAL MEASUREMENTS: |
| 21, 97-100. VARIABLES: T/K: see below Total P/kPa: 101.325 (1 atm) EXPERIMENTAL VALUES: T/K Mole Mole* ratio fraction n _{HCl} /n ₂ x _{HCl} adata frem! Wethoxyethane, C ₃ H ₈ O; [540-67-0] 231.15 2.91 0.744 (ethv! aethyl other); 233.15 2.93 0.746 0.789 C ₃ H ₈ O; [540-67-0] 233.15 0.664 0.638 Smoothing equation: ln x _{HCl} = -2.154 + 4.317/(T/100) (for use between 233.15 K and 253.15 K) 0.638 Smoothing equation and mole fractions from the equation were calculated by the compiler ** smoothing equation and mole fractions from the equation were calculated by H.L. Clever SOURCE AND PURITY OF MATERIALS: (1) Hydrogen chloride: a good cylinder, and dried. (2) 1/1-cxybispethane, methoxy- b; 1/-cxybispethane, methoxy- b; 1/-cxybispethane, methoxy- b; 1/-cxybispethane, methoxy- b; 1/-cxybispethane was prepared anitained within t1 K. For 273.15 K it was assumed that the loss of solvent by entrainment could be ignored. After staturation at a recorded imperature, the temperature was carefully added drop-wise to fix the bydrogen chloride as the pyrtainim aalt. After treatment with water, the chloride ion content was deternined by the Volhard method or by use of an automatic titrineter. STIMATED ERROR: (2) CH (-KRC) AM, A, K, Wyvill, PL. | <pre>(1) Hydrogen chloride; HCl; [7647-01-0]</pre> | Kapoor, K.P.; Luckcock, R.G.; Sandbach, J.A. |
| Total P/KPa: see below W. Gerrard Total P/KPa: 101.325 (1 atm) W. Gerrard EXPERIMENTAL VALUES: T/K Mole fraction data from a from | (2) Ethers | |
| Total P/KPa: see below W. Gerrard Total P/KPa: 101.325 (1 atm) W. Gerrard EXPERIMENTAL VALUES: T/K Mole fraction data from a from | VARIABLES: | PREPARED BY: |
| T/KMole ratioMole* ratioAuthors' smoothed data r_{HCI}^{1*} n_{HCI}/n_2 n_{HCI}/n_2 r_{HCI} r_{HCI} r_{HCI}^{1*} Methoxyethane, (6thyl methyl other); 233.152.91 0.744 0.789 $(0,h)$ 243.15 2.93 0.746 0.685 251.65 1.806 0.644 0.638 Smoothing equation: n_{HCI} $=-2.154 + 4.317/(T/100)$ (for use between 233.15 K and 253.15 K)Standard error in x_{HCI} r_{HCI} $=-2.154 + 4.317/(T/100)$ (for use between 233.15 K and 253.15 K)Standard error in x_{HCI} about the regression line = 9.98×10^{-3} * calculated by the compiler ** smoothing equation and mole fractions from the equation were calculated by H.L. CleverSOURCE AND PUEITY OF MATERIALS: (1) Hydrogen chloride: a good specimen was obtained from a cylinder, and dried. (2) 1,1'-oxybispentane, 1,1'-oxybispent | T/K: see below | |
| ratio fraction data ftbm ⁺ n _{HCl} /n ₂ x _{HCl} n _{HCl} /n ₂ x _{HCl} equation Methoxyethane, 231.15 2.91 0.744 0.685 (6thv) mothyl othor); 233.15 2.93 0.746 0.685 3HgO; [540-67-0] 243.15 0.614 0.638 Smoothing equation: ln x _{HCl} =-2.154 + 4.317/(T/100) (for use between 233.15 K and 253.15 K) Standard error in x _{HCl} about the regression line = 9.98 × 10 ⁻³ * * calculated by the compiler * * ** smoothing equation and mole fractions from the equation were calculated by H.L. Clever SOURCE AND PURITY OF MATERIALS: METHOD/APPARATUS/PROCEDURE: SOURCE AND PURITY OF MATERIALS: The bubbler-tube technique described by H.L. Clever SOURCE AND PURITY OF MATERIALS: Mattion of small pieces of solid carbon doxide and manual Stirring enabled the temperatures between 303 K alcributane, rit-oxybispettane, methoxy-benzene, 1,1'-oxybispettane, methoxy-benzene, 1,1'-oxybispettane, methoxy-benzene and 1,1'-oxybispettane was prepared from a cylinder, and dried. For temperatures below 273.15 K it was assumed that the loss of solvent by oth sulfuric acid method. Other ethers were prepared from an alcohol, sodium and an alkyl halide. All ethers were rigorously purifie | EXPERIMENTAL VALUES: | |
| (othyl methyl ether); 233.15 2.93 0.746 0.789 C_3H_8O; [540-67-0] 243.15 0.638 251.65 1.806 0.644 0.638 Smoothing equation: ln x _{HC1} = -2.154 + 4.317/(T/100) (for use between 233.15 K and 253.15 K) Standard error in x _{HC1} about the regression line = 9.98 × 10 ⁻³ 0.638 * calculated by the compiler ** ** ** smoothing equation and mole fractions from the equation were calculated by H.L. Clever SOURCE AND PURITY OF MATERIALS: METHOD/APPARATUS/PROCEDURE: SOURCE AND PURITY OF MATERIALS: The bubler-tube technique described by Gerard, Mincer and Wyvill (1) was used. SOURCE AND PURITY OF MATERIALS: Addition of small pieces of solid (2) 1,1'-oxybispentane, 1 | ratio | o fraction data from t |
| (othyl methyl ether); 233.15 2.93 0.746 0.789 C _{3Hg} O; [540-67-0] 243.15 0.638 251.65 1.806 0.644 0.638 Smoothing equation: ln x _{HC1} -2.154 + 4.317/(T/100) (for use between 233.15 K and 253.15 K) Standard error in x _{HC1} about the regression line = 9.98 × 10 ⁻³ 0.638 * calculated by the compiler * * ** smoothing equation and mole fractions from the equation were calculated by H.L. Clever SOURCE AND PURITY OF MATERIALS: METHOD/APPARATUS/PROCEDURE: (1) Hydrogen chloride: a good sciented by Gerard, Mincer and Wyvill (1) was used. For temperatures between 303 K and 253 K and LBI thermostat SOURCE AND PURITY OF MATERIALS: Rot temperatures less than 253 K alditing liquid paraffin was used. For temperatures between 303 K a slurry of ice and water was used. SOURCE AND PURITY OF MATERIALS: For temperatures below 273.15 K it was assumed that the loss of solvent by entrainment could be ignored. SOURCE AND PURITY OF MATERIALS: For temperatures below 273.15 K it was assumed that the loss of solvent by entrainment could be ignored. SOURCE AND PURITY OF MATERIALS: For temperatures below 273.15 K it was assumed that the loss of solvent by entrainment could be ignored. SOURCE AND PURITY OF MATERIALS: Mydrogen chloride as the pyridinin was carefully added drop-wise to fix the hydrogen ch | Methoxyethane, 231.15 2.91 | 0.744 |
| 251.65 1.806 0.644 253.15 0.638 Smoothing equation: ln x _{HC1} =2.154 + 4.317/(T/100) (for use between 233.15 K and 253.15 K) Standard error in x _{HC1} about the regression line = 9.98 × 10 ⁻³ * * calculated by the compiler ** ** smoothing equation and mole fractions from the equation were calculated by H.L. Clever Source AND PURITY OF MATERIALS: METHOD/APPARATUS/PROCEDURE: Source AND PURITY OF MATERIALS: The bubbler-tube technique described by Gerrad, Mincer and Wyvill (1) was used. For temperatures between 303 K and LB1 thermostat containing liquid paraffin was used. For temperatures tess than 253 K addition of small pieces of solid carbon dioxide and manual stirring enabled the temperature to be maintained within 1 K. For 273.15 K it was assumed that the loss of solvent by entrainment could be ignored. After saturation at a recorded temperature, the temperature was lowered by 10 K and pyridine was carefully added drop-wise to fix the hydrogen chloride as the pyridinium salt. After treatment with water, the chirdle ion content was determined by the Volhard method or by use of an automatic tirimeter. Strimate Wilner, A.M.A.; Wyvill, P.L. | (ethy1 methy1 ether); 233.15 2.93 | 0.746 0.789 |
| 253.15 Smoothing equation: ln x _{HCl} = -2.154 + 4.317/(T/100) (for use between 233.15 K and 253.15 K) Standard error in x _{HCl} about the regression line = 9.98 × 10 ⁻³ * calculated by the compiler ** smoothing equation and mole fractions from the equation were calculated by H.L. Clever METHOD/APPARATUS/PROCEDURE: The bubler-tube technique described by Gerrard, Mincer and Wyill (1) was used. For temperatures between 303 K and 253 K and LB1 thermostat containing liquid paraffin was used. For temperatures less than 253 K addition of small pieces of solid carbon dixide and manual stirring enabled the temperature to be maintained within 11 K. For 273.15 K it was assumed that the loss of solvent by entrainment could be ignored. After saturation at a recorded temperature, the temperature was lowered by 10 K and pyridine was carefully added drop-wise to fix the hydrogen chloride as the pyridinium salt. After treatment with water, the chloride ion content was determined by the Volhard method or by use of an automatic tirimeter. | $C_{3}H_{8}O; [540-67-0] 243.15 251.65 1.800$ | |
| <pre>(for use between 233.15 K and 253.15 K) Standard error in x_{HC1} about the regression line = 9.98 × 10⁻³ * calculated by the compiler ** smoothing equation and mole fractions from the equation were calculated by H.L. Clever AUXILIARY INFORMATION METHOD/APPARATUS/PROCEDURE: The bubbler-tube technique described by Gerard, Mincer and Wyill (1) was used. For temperatures between 303 K and 253 K and LBI thermostat containing liquid paraffin was used. For temperatures less than 253 K addition of small pieces of solid carbon dioxide and manual stirring enabled the temperature to be maintained within ±1 K. For 273.15 K a slurry of ice and water was used. For temperatures below 273.15 K it was assumed that the loss of solvent by entrainment could be ignored. After reatment with water, the chloride ion content was determined by the Volhard method or by use of an automatic titrimeter. (for use between 233.15 K it was assumed that the loss of solvent by entrainment could be ignored. After reatment with water, the chloride ion content was determined by the Volhard method or by use of an automatic titrimeter. (for use between 233.15 K it was assumed that the loss of solvent by description at a recorded temperature, the temperature was lowered by 10 K and pyridine was carefully added drop-wise to fix the hydrogen chloride as the pyridinium salt. After treatment with water, the chloride ion content was determined by the Volhard method or by use of an automatic titrimeter. (for use between 233.15 K it was assumed that the loss of solvent by description at a recorded temperature, the temperature was lowered by 10 K and pyridine was carefully added drop-wise to fix the hydrogen chloride as the pyridinium salt. After treatment with water, the chloride ion content was determined by the Volhard method or by use of an automatic titrimeter. (for the provide the termined with water, the chloride ion content was determined by the Volhard method or by use of an automatic titrimeter. (for the provide the termined with water, the us</pre> | | |
| METHOD/APPARATUS/PROCEDURE:SOURCE AND PURITY OF MATERIALS:The bubbler-tube technique describedSOURCE AND PURITY OF MATERIALS:The bubbler-tube technique describedspecimen was obtained from a cylinder, and dried.and 253 K and LBI thermostat(1) Hydrogen chloride: a good specimen was obtained from a cylinder, and dried.and 253 K and LBI thermostat(2) 1,1'-oxybisethane, methoxy- benzene, 1,1'-oxybisethane, 1,1'-oxybisethane, harder, and dried.For temperatures less than 253 K addition of small pieces of solid carbon dioxide and manual stirring enabled the temperature to be maintained within ±1 K. For 273.15 K it was assumed that the loss of solvent by entrainment could be ignored. After saturation at a recorded temperature, the temperature was lowered by 10 K and pyridine was carefully added drop-wise to fix the hydrogen chloride as the pyridinium salt. After treatment with water, the chloride ion content was determined by the Volhard method or by use of an automatic titrimeter.SOURCE AND PURITY OF MATERIALS: (1) Hydrogen chloride: a good specimen was obtained from a cylinder, and dried.METHOD/APPARATUS/PROCEDURE: (2) 1,1'-oxybisethane, methoxy- bezene, 1,1'-oxybispentane, 1,1'-oxybispentane, 1,1'-oxybispertane, 1,1'-oxybispertane were commercial samples. (1,1'-oxybispertane was prepared by the sulfuric acid method. Other ethers were prepared from an alcohol, sodium and an alkyl halide. All ethers were to 5 (253-303 K) $= \pm 1$ (< 253 K) $\delta x_{\rm HC1}/x_{\rm HC1} = \pm 0.02$ For temperature, the volhard method or by use of an automatic titrimeter.Source AND PURITY OF MATERIALS: (2) 1,1'-oxybispethane, methoxy- (2) 1,1'-oxybispethane, 1,1'-oxybispethane, 1,1'-oxybispethane | <pre>Standard error in x_{HCl} about the regre * calculated by the compiler ** smoothing equation and mole fraction</pre> | ession line = 9.98×10^{-3} |
| The bubbler-tube technique described by Gerrard, Mincer and Wyvill (1) was used. For temperatures between 303 K and 253 K and LBI thermostat containing liquid paraffin was used. For temperatures less than 253 K addition of small pieces of solid carbon dioxide and manual stirring enabled the temperature to be maintained within ± 1 K. For 273.15 K a slurry of ice and water was used. For temperatures below 273.15 K it was assumed that the loss of solvent by entrainment could be ignored. After saturation at a recorded temperature, the temperature was lowered by 10 K and pyridine was carefully added drop-wise to fix the hydrogen chloride as the pyridinium salt. After treatment with water, the chloride ion content was determined by the Volhard method or by use of an automatic titrimeter. (1) Hydrogen chloride: a good specimen was obtained from a cylinder, and dried. (2) 1,1'-oxybisebtane, methoxy- benzene, 1,1'-oxybispentane, 1,1'-oxybis- hexane and 1,1'-oxybisoctane were commercial samples. 1,1'-oxybisheptane was prepared by the sulfuric acid method. Other ethers were prepared from an alcohol, sodium and an alkyl halide. All ethers were rigorously purified and attested. $\delta T/K = \pm 0.5 (253-303 K)$ $= \pm 1 (< 253 K)$ $\delta x_{HC1}/x_{HC1} = \pm 0.02$ | AUXILIARY | INFORMATION |
| | The bubbler-tube technique described by Gerrard, Mincer and Wyvill (1) was used. For temperatures between 303 K and 253 K and LBI thermostat containing liquid paraffin was used. For temperatures less than 253 K addition of small pieces of solid carbon dioxide and manual stirring enabled the temperature to be maintained within ±1 K. For 273.15 K a slurry of ice and water was used. For temperatures below 273.15 K it was assumed that the loss of solvent by entrainment could be ignored. After saturation at a recorded temperature, the temperature was lowered by 10 K and pyridine was carefully added drop-wise to fix the hydrogen chloride as the pyridinium salt. After treatment with water, the chloride ion content was determined by the Volhard method or | <pre>(1) Hydrogen chloride: a good specimen was obtained from a cylinder, and dried. (2) 1,1'-oxybisethane, methoxy- benzene, 1,1'-oxybisbutane, 1,1'-oxybis[3-methyl]-butane, 1,1'-oxybispentane, 1,1'-oxybis- hexane and 1,1'-oxybisoctane were commercial samples. 1,1'-oxybisheptane was prepared by the sulfuric acid method. Other ethers were prepared from an alcohol, sodium and an alkyl halide. All ethers were rigorously purified and attested. ESTIMATED ERROR: $\delta T/K = \pm 0.5 (253-303 \text{ K})$ $= \pm 1 (< 253 \text{ K})$ $\delta x_{HC1}/x_{HC1} = \pm 0.02$ REFERENCES: 1. Gerrard, W.; Mincer, A.M.A.; Wyvill, P.L.</pre> |

Hydrogen Chloride in Non-Aqueous Solvents

| COMPONENTS: (1) Hydrogen chloride [7647-01-0] (2) Ethers | e; HCl; | | ORIGINAL M Kapoor, K. Sandbach, J. Appl. C 21, 97-100 | P.; Luckc J.A. Them. Biot | ock, R.G | |
|--|--|---|---|----------------------------------|------------------|--------------------------------|
| EXPERIMENTAL VALUES: | т/к | Mole ratio | | Authors' da | | ed × _{HCl} ** from |
| | | ⁿ HC1 ^{/n} 2 | | ⁿ HC1 ^{/n} 2 | ×HC1 | equation |
| 1,1'-Oxybisethane (diethyl ether); | 201.15 | 7.45 | 0.882 | 6.80 | 0.872 | 0.868 |
| C ₄ H ₁₀ O; [60-29-7] | 206.15 213.15 223.15 | 6.08 | 0.859 | 2 10 | 0.750 | 0.851 |
| | 233.15 234.15 243.15 | 3.01 | 0.751 | 3.10 | 0.756 | 0.767 |
| | 251.15 253.15 259.65 | 1.982 1.470 | 0.595 | 1.80 | 0.643 | 0.650 |
| | 262.15 263.15 273.15 | 1.365 | | 1.160 | 0.537 | 0.589 0.528 |
| | 277.65 282.65 283.15 | 1.018 0.955 | | 0.930 | 0.482 | 0.471 |
| | 283.65 283.95 286.95 290.55 299.55 | 0.898 0.903 0.874 0.776 0.556 | 0.475 0.466 0.437 | | | |
| Smoothing equation: | In x _{HCl} = | 19.385 - | 23.089/(T/ | 100) - 11 203-15 K | .514 ln(| т/100) 15 к) |
| Standard error in x _{HC} | cl about | the regre | ssion line | = 1.50 × | 10 ⁻² | |
| 1-Methoxypropane, (methyl propyl ether); C ₄ H ₁₀ O; | 203.15 204.65 213.15 | 5.43 | 0.844 | 5.70 | 0.851 | 0.843 |
| ether); C ₄ H ₁₀ O; [557-17-5] | 215.65 223.15 233.15 | 3.91 2.55 | 0.796 0.718 | 2.45 | 0.710 | 0.765 |
| | 243.15 253.15 | | | 1.45 | 0.592 | 0.663 |
| | 255.15 263.15 273.15 | 1.325 | 0.517 | 1.085 | 0.520 | 0.558 0.508 |
| | 282.65 283.15 283.15 | 0.913 0.896 | 0.473 | 0.896 | 0.473 | 0.461 |
| | 283.35 297.35 | 0.891 0.609 | | | | |
| Smoothing equation: | | (for u | se between | 203.15 K | and 283. | :/100) 15 к) |
| Standard error in x_{HC} * calculated by the c | compiler | | | | | |
| ** smoothing equation by H.L. Clever | and mol | e fractio | ns from the | equation | were ca | liculated |
| | | | | | | |
| | | | | | | |
| | | | | | | |

| COMPONENTS: (1) Hydrogen chlorid [7647-01-0] (2) Ethers | e; HCl; | | ORIGINAL M Kapoor, K. Sandbach, J. Appl. C 21, 97-100 | P.; Luckc J.A. 'hem. Biot | ock, R.G | |
|--|--------------------------------------|----------------------------------|---|----------------------------------|---------------|-------------------------|
| EXPERIMENTAL VALUES: | | l. | | | | |
| | т/к | Mole ratio | Mole* fraction | Authors' da | smoothe ta | d xHCl** |
| | | ⁿ HC1 ^{/n} 2 | ×HC1 | ⁿ HC1 ^{/n} 2 | *HC1 | equation |
| 1-Methoxypentane, (methyl pentyl | 230.65 233.15 | 3.07 | 0.754 | 2.70 | 0.730 | 0.734 |
| ether); C ₆ H ₁₄ O; [628-80-8] | 243.15 251.65 253.15 | 1.617 | 0.618 | 1.55 | 0.608 | 0.677 0.621 |
| | 263.15 273.15 | 1.049 | 0.512 | 1.060 | 0.515 | 0.568 0.518 |
| | 273.15 283.15 283.35 | 1.070 | 0.517 0.479 | 0.910 | 0.476 | 0.472 |
| | 283.35 283.35 283.55 298.65 | 0.920 0.916 0.908 0.658 | 0.479 0.478 0.476 0.397 | | | |
| Smoothing equation: Standard error in $x_{\rm H}$ | | (for us | se between | 233.15 K | and 283. | /100) 15 К) |
| 2-Ethoxybutane, | 198.15 | 6.14 | | | | 0.045 |
| (2-buty1 ethy1 ether); C ₆ H ₁₄ O; [2679-87-0] | 203.15 209.15 213.15 | 4.81 | 0.828 | 5.45 | 0.845 | 0.845 |
| | 219.15 | 4.00 | 0.800 | | | 0.803 |
| | 233.15 243.15 | | | 3.00 | 0.750 | 0.763 |
| | 253.15 254.15 | 1.96 | 0.662 | 2.00 | 0.667 | 0.664 |
| | 263.15 273.15 283.15 | 1.35 | 0.574 | 1.35 | 0.574 | 0.611 0.558 0.506 |
| | 284.35 294.15 | 1.00 0.793 | 0.500 0.442 | | | |
| Smoothing equation: Standard error in × _H | | (IOT US | se petween | 203.15 M | anu 205. | /100) 15 к) |
| 1,1'-Oxybispropane, (dipropyl ether); | 203.15 204.15 | 6.00 | 0.857 | 6.30 | 0.863 | 0.858 |
| $C_{6}^{H_{14}O; [111-43-3]}$ | 213.15 213.65 | 4.84 | 0.829 | | | 0.837 |
| | 223.15 233.15 233.65 | 3.35 | 0.770 | 3.00 | 0.750 | 0.801 0.753 |
| | 243.15 253.15 | | | 1.70 | 0.630 | 0.699 0.642 |
| | 253.65 263.15 273.15 | 1.649 | 0.622 | 1.110 | 0.526 | 0.584 0.527 |
| | 282.65 282.95 | 0.918 | 0.479 | | | |
| | 283.15 283.35 298.35 | 0.900 0.653 | 0.474 0.395 | 0.920 | 0.479 | 0.473 |
| Smoothing equation: $\ln x_{HC1} = 17.491 - 20.745/(T/100) - 10.486 \ln(T/100)$ (for use between 203.15 K and 283.15 K) | | | | | | |
| Standard error in × _H | - | the regres | ssion line | = 1.10 × | 10-2 | , |
| <pre>* calculated by the ** smoothing equatio by H.L. Clever</pre> | | e fraction | ns from the | equation | were ca | lculated |

Hydrogen Chloride in Non-Aqueous Solvents

Hydrogen Chloride in Non-Aqueous Solvents

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|--|--|--------------------------|-------------------|-------------------|----------------|
| COMPONENTS: (1) Hydrogen chloride; HCl; | | ORIGINAL M Kapoor, K. | | | . |
| [7647-01-0] | | Sandbach, | | JUR, R.G | ••• |
| (2) Ethers | | J. App1. C | hem. Biot | ech. <u>19</u> 7 | 1, |
| | | 21, 97-100 | • | | _ |
| EXPERIMENTAL VALUES: T/K | Mole | Mole* | Authors' | smoothe | a v ** |
| EXPERIMENTAL VALUES: 1/K | ratic | | da | | from |
| | $n_{\rm HCl}/n_2$ | | $n_{\rm HC1}/n_2$ | ×HC1 | equation |
| | | HCI | HCI Z | HCI | - |
| 1 Mathewshewana 202 15 | | | 6.90 | 0 073 | 0 0 0 1 |
| 1-Methoxyhexane, 203.15 (hexyl methyl ether); 206.15 | 6.68 | 0.870 | 0.90 | 0.873 | 0.881 |
| C ₇ H ₁₆ O; [4747-07-3] 213.15 | 4.64 | 0.823 | | | 0.831 |
| 223.15 | | | | | 0.778 |
| 232.15 | 2.93 | 0.746 | 2 5 2 | 0 744 | 0 700 |
| 233.15 243.15 | | | 2.50 | 0.714 | 0.723 0.668 |
| 251.95 | 1.505 | 0.601 | | | 0,000 |
| 253.15 | | | 1.50 | 0.600 | 0.615 |
| 263.15 | | | | | 0.564 |
| 273.15 283.15 | 1.060 0.918 | | 1.060 0.900 | 0.515 0.474 | 0.517 |
| 283.75 | 0.900 | | 0.900 | 0.4/4 | 0.472 |
| 289.95 | 0.827 | | | | |
| 297.95 | 0.667 | 0.400 | | | |
| Smoothing equation: $\ln x_{HC1} = 2$ | 9.712 - | 10.777/(T/1 | 00) - 6.3 | 96 ln(T/ | 100) |
| | (tor u | ise between | 203.15 K | and 283. | 15 K) |
| Standard error in x _{HCl} about th | he regre | ssion line | = 1.36 × | 10 ⁻² | |
| 1-Propoxybutane, 203.15 | | | 6.50 | 0.867 | 0.862 |
| (butv1 propy1 ether); 203.65 | 6.17 | 0.861 | 0.00 | | 0.002 |
| C ₇ H ₁₆ O; [3073-92-5] 213.15 | | | | | 0.834 |
| 213.65 | 4.80 | 0.828 | | | 0 706 |
| 223.15 233.15 | | | 3.15 | 0.759 | 0.796 0.750 |
| 233.15 | 3.24 | 0.764 | 3.15 | 0.755 | 0.750 |
| 243.15 | | | | | 0.701 |
| 250.45 | 1.820 | 0.645 | | | 0 4 7 9 |
| 253.15 263.15 | | | 2.00 | 0.667 | 0.650 0.598 |
| 273.15 | 1.199 | 0.545 | 1.215 | 0.549 | 0.548 |
| 273.15 | 1.223 | | | | |
| 282.75 | 1.030 | | | | |
| 283.65 | 1.013 | 0.503 | 1.020 | 0.505 | 0.500 |
| 283.15 283.95 | 0.975 | 0.494 | 1.020 | 0.505 | 0.500 |
| 294.35 | 0.821 | | | | |
| 297.75 | 0.750 | 0.429 | | | |
| Smoothing equation: $\ln x_{HC1} = 7$ | 13.255 - | 15.510/(T/ | 100) - 8. | 139 ln(T | /100) |
| | (Ior u | se between | 203.15 K | and 283. | 15 K) |
| Standard error in x _{HC1} about th | ne regre | ssion line | = 1.01 × | 10 * | |
| 1-Methoxyheptane, 200.15 | 6.67 | 0.870 | | | |
| (heptv1 methv1 203.15 | | · · · • | 6.20 | 0.861 | 0.862 |
| ether); C ₈ H ₁₈ O; 213.15 | | | | | 0.818 |
| | 4.31 | 0.812 | | | 0.769 |
| 223.15 233.15 | | | 2.45 | 0.710 | 0.769 |
| 234.15 | 2.76 | 0.734 | | | |
| 243.15 | | | | | 0.665 |
| 249.65 | 1.554 | 0.608 | 1 45 | 0 600 | 0 610 |
| 253.15 263.15 | | | 1.45 | 0.592 | 0.613 0.562 |
| 273.15 | 1.041 | 0.510 | 1.040 | 0.510 | |
| 283.15 | 0.905 | 0.475 | 0.895 | 0.472 | 0.469 |
| 283.35 | 0.899 | | | | |
| 283.55 | 0.890 | | | | |
| 297.15 0.686 0.407 | | | | | |
| Smoothing equation: $\ln x_{HC1} = 10.724 - 12.136/(T/100) - 6.912 \ln(T/100)$ | | | | | |
| (for use between 203.15 K and 283.15 K) Standard error in x_{HC1} about the regression line = 1.36 × 10 ⁻² | | | | | |
| | | | | | |
| * calculated by the compiler; and mole fractions from the | TT SN | oothing equ | ation | | lover |
| and more tractions if on the | e equati | on were car | culated D | يك منه المعقام ال | LEVEL |

160

Hydrogen Chloride in Non-Aqueous Solvents

| COMPONENTS: (1) Hydrogen chloride [7647-01-0] (2) Ethers | ∍; HCl; | | ORIGINAL M Kapoor, K. Sandbach, J. Appl. C 21, 97-100 | P.; Lucko J.A. Chem. Biot | ock, R.G | |
|--|----------------------------|----------------------------------|---|----------------------------------|------------------|-----------------------|
| EXPERIMENTAL VALUES: | т/к | Mole ratio | | Authors' da | smoothe ta | d x _{HCl} ** |
| | | ⁿ HC1 ^{/n} 2 | ^x HCl | ⁿ HCl ^{/n} 2 | ^x HCl | equation |
| 1,1'-Oxybisbutane, | 198.15 | 7.28 | 0.879 | | | |
| (dibutyl ether); | 203.15 205.65 | 5.93 | 0.856 | 6.20 | 0.861 | 0.873 |
| C ₈ H ₁₈ O; [142-96-1] | 213.15 | 5.55 | 0.050 | | | 0.844 |
| | 223.15 230.65 | 3.35 | 0.770 | | | 0.802 |
| | 233.15 235.15 | 3.09 | 0.756 | 2.70 | 0.730 | 0.750 |
| | 235.65 | 3.06 | 0.754 | | | 0 603 |
| | 243.15 252.95 | 1.59 | 0.614 | | | 0.693 |
| | 253.15 263.15 | | | 1.60 | 0.615 | 0.634 0.576 |
| | 273.15 283.15 | 1.048 0.841 | | 1.055 0.850 | 0.513 0.459 | 0.519 0.465 |
| | 283.35 | 0.848 | 0.459 | 0.000 | 0.455 | 0.405 |
| | 296.15 296.55 | 0.693 0.674 | | | | |
| Smoothing equation: | n _Y HCl = | 16.533 - | 19 .42 0/(T/ | 100) - 10 | .032 ln(| т/100) |
| Standard error in ^x HC | | (IOT U | se between | 203.15 K | and 283. | 15 K) |
| 1-Methoxyoctane, (methyl octyl ether); C ₉ H ₂₀ O; [929-56-6] | 232.65 233.15 243.15 | 2.67 | 0.728 | 2.55 | 0.718 | 0.726 0.682 |
| 9 20 | 243.45 253.15 263.15 | 2.14 | 0.682 | 1.45 | 0.592 | 0.632 0.579 |
| | 273.15 282.15 282.45 | 1.097 0.917 0.915 | 0.478 0.478 | 1.080 | 0.519 | 0.525 |
| | 282.65 283.15 288.65 | 0.913 0.797 | | 0.905 | 0.475 | 0.473 |
| Smoothing equation: 1 | | (for u | se between | 233.15 K | and 283. | т/100) 15 к) |
| Standard error in * _{HC} | l about t | he regre | ssion line | = 1./8 × | 10-3 | |
| <pre>1,1'-Oxybispentane, (dipentyl ether);</pre> | 200.15 209.15 | 6.80 5.19 | 0.872 0.838 | | | |
| C ₁₀ ^H 22 ^O , [693-65-2] | 213.15 | 4.91 | 0.831 | | | 0.833 0.793 |
| | 223.15 231.15 | 3.17 | 0.760 | | | |
| | 233.15 243.15 | | | 2.80 | 0.737 | 0.744 0.689 |
| | 244.15 | 2.05 | 0.672 | 1.65 | 0.623 | 0.631 |
| | 255.65 | 1.529 | | | 0.025 | |
| | 263.15 273.15 | 1.377 | 0.579 | 1.105 | 0.525 | 0.574 0.518 |
| | 273.95 283.15 | 1.086 | 0.521 | 0.900 | 0.474 | 0.464 |
| | 283.55 283.75 298.05 | 0.894 0.879 0.614 | 0.468 | | | |
| Smoothing equation: $\ln x_{HC1} = 16.682 - 19.668/(T/100) - 10.091 \ln(T/100)$ (for use between 213.15 K and 283.15 K) | | | | | | |
| Standard error in x_{HC} | | he regre | ssion line | = 9.95 × | 10-3 | |
| * calculated by the c and mole fraction | | | | | у н.г. с | lever. |

| COMPONENTS: | | | ORIGINAL M | EASUREMEN | TS: | |
|--|----------------------------|----------------------------------|----------------------------|----------------------------------|-----------------|-------------------------------|
| (1) Hydrogen chloride [7647-01-0] | e; HCl; | | Kapoor, K. Sandbach, | | ock, R.G | •; |
| (2) Ethers | | | J. App1. C 21, 97-100 | | ech. <u>197</u> | <u>1</u> , |
| EXPERIMENTAL VALUES: | | , | | | | |
| | т/к | Mole ratic | Mole* fraction | | smoothe ta | d * _{HC1} ** from |
| | | ⁿ HC1 ^{/n} 2 | e ^x HCl | ⁿ HC1 ^{/n} 2 | *HCl | equation |
| 1,1'-Oxybis- | 194.65 | 6.31 | 0.863 | | | |
| [3-methyl]butane, | 196.15 203.15 | 6.06 | 0.858 | 5.10 | 0.836 | 0.852 |
| (d11soamyl ether); C ₁₀ H ₂₂ O; [544-01-4] | 209.15 | 4.40 | 0.815 | 5.10 | 0.030 | |
| 10 22 | 213.15 223.15 | | | | | 0.838 0.801 |
| | 231.15 | 2.82 | 0.738 | 0 F F | 0 710 | |
| | 233.15 243.15 | | | 2.55 | 0.718 | 0.748 0.706 |
| | 244.15 253.15 | 1.94 | 0.660 | 1.60 | 0.615 | 0.619 |
| | 263.15 | | | 1.00 | 0.015 | 0.551 |
| | 272.95 273.15 | 1.103 | 0.524 | 1.025 | 0.506 | 0.485 |
| | 283.15 | | | 0.800 | 0.444 | 0.424 |
| | 288.15 293.15 | 0.708 | 0.415 | | | 0.367 |
| | 303.15 | 0 405 | | | | 0.316 |
| | 306.75 307.45 | 0.405 | | | | |
| | 313.15 | | | | | 0.270 |
| Smoothing equation: Standard error i | | (for | : use betwee | n 203.15 | K and 31 | 3.15 K) |
| 1-Pentyloxyhexane, (pentyl hexyl ether); | ; 203.15 | 0.07 | 0.099 | 6.80 | 0.872 | 0.881 |
| C _{11^H24} 0; [32357-83-8] | 210.65 213.15 223.15 | 5.25 | 0.840 | | | 0.852 0.809 |
| | 229.65 | 3.68 | 0.786 | | | |
| | 231.15 233.15 | 3.52 | 0.779 | 3.00 | 0.750 | 0.755 |
| | 243.15 | | | | | 0.696 |
| | 253.15 253.65 | 1.507 | 0.601 | 1.65 | 0.623 | 0.634 |
| | 263.15 273.15 | | | 1.080 | 0.519 | 0.572 0.513 |
| | 274.15 | 1.057 | 0.514 | | | |
| | 283.15 283.65 | 0.875 | 0,467 | 0.890 | 0.471 | 0.457 |
| | 283.95 | 0.870 | 0.465 | | | |
| | 296.95 299.65 | 0.620 | | | | |
| Smoothing equation: 1 Standard error in x _{HC} * calculated by the ** smoothing equation | compiler | (for he regre | use between ession line | = 1.78 × | 10^{-2} | .15 K) |
| by H.L. Clever. | | | | | | |

| COMPONENTS: | | | ORIGINAL M | | | |
|---|-----------------------|----------------------------------|---------------------------|-------------------|---------------------|-------------------|
| (1) Hydrogen chlorid | e; HCI; | | Kapoor, K. | | ock, R.G | .; |
| [7647-01-0] (2) Ethers | | 1 | Sandbach, J. Appl. C | | ech 197 | 1 |
| (2) Beners | | | 21, 97-100 | | <u> </u> | <u> </u> |
| | | | 21, 27, 27, 100 | • | | |
| EXPERIMENTAL VALUES: | T/K | Mole | Mole* | Authors | smoothe | d xuci** |
| | | ratio | | | ta | d xHCl ** from |
| 1 | | ⁿ HC1 ^{/n} 2 | ×HC1 | $n_{\rm HC1}/n_2$ | ×HC1 | equation |
| | | | | | | |
| 1,1'-Oxybishexane, | 198.15 | 8.37 | 0.893 | | | |
| (dihexyl ether); | 203.15 | 0.07 | 0.055 | 6.60 | 0.868 | 0.874 |
| C ₁₂ H ₂₆ O; [112-58-3] | 211.65 | 5.07 | 0.835 | | | - |
| 12 20 | 213.15 | | | | | 0.847 |
| | 223.15 | | | | | 0.805 |
| | 233.15 | 3.03 | 0.752 | 2.85 | 0.740 | 0.752 |
|] | 240.15 243.15 | 2.67 | 0.728 | | | 0.694 |
| | 253.15 | | | 1.65 | 0.623 | 0.634 |
| | 254.65 | 1.490 | 0.598 | 1.05 | 0.025 | 0.034 |
| | 263.15 | 1.353 | | | | 0.573 |
| | 273.15 | 1.109 | 0.526 | 1.090 | 0.522 | 0.515 |
| | 283.15 | 0.877 | | 0.895 | 0.472 | 0.459 |
| | 289.55 | 0.780 | | | | |
| | 296.95 | 0.632 | | | | |
| | 301.15 | 0.561 | 0.359 | | | |
| Smoothing equation: | 1n x = | 17.576 - | 20.702/(T/ | (100) - 10 | .610 ln(| т/100) |
| | | (for use | between 20 |)3.15 K an | d 283.15 | K) |
| Standard error | in xual at | out the | regression | line = 1 . | 53×10^{-1} | 2 |
|) | HCI | | | | | |
| 1,1'-Oxybisheptane, | | 7.32 | 0.880 | | | |
| (diheptyl ether); | 203.15 | | 0.000 | 6.80 | 0.872 | 0.867 |
| C ₁₄ H ₃₀ O; [629-64-1] | 212.65 | 5.11 | 0.836 | | | 0.847 |
| | 213.15 223.15 | | | | | 0.808 |
| | 226.15 | 3.75 | 0.789 | | | 0.000 |
| | 233.15 | | | 3.10 | 0.756 | 0.757 |
| | 243.15 | | | | | 0.699 |
| | 249.65 | 1.830 | 0.647 | | | |
| | 253.15 | | | 1.70 | 0.630 | 0.636 |
| | 263.15 | 1 076 | 0 510 | 1 100 | 0.524 | 0.573 |
| | 273.15 283.15 | 1.076 0.909 | | 1.100 0.905 | 0.475 | 0.512 0.454 |
| | 296.55 | 0.605 | | 0.903 | 0.475 | 0.454 |
| | 297.65 | 0.583 | | | | |
| | | | | | | |
| Smoothing equation: | $\ln x_{HC1} =$ | 19.856 | - 23.594 /(| T/100) - | 11.830 1 | n(T/100) |
| 1 | | (IOT US | e petween z | :03•15 r d | nu 203.1 | 5 K) |
| Standard error | in xHCl at | out the | regression | line = 1 . | 47 × 10 | - |
| 1-Heptyloxyoctane, | 200.65 | 6.94 | 0.874 | | | |
| (heptyl octyl ether) | | 0.24 | 0.0/3 | 6.60 | 0.868 | 0.865 |
| $C_{15}H_{32}O;$ [32357-84-9 | 213.15 | 5.10 | 0.836 | | | 0.842 |
| 15-32-7 1 | 223.15 | | | | | 0.802 |
| | 233.15 | 3.11 | 0.757 | 3.00 | 0.750 | 0.751 |
| 1 | 243.15 | | | | | 0.693 |
| | 251.15 | 1.719 | 0.632 | 1 70 | 0 | 0 6 0 0 |
| | 253.15 | 1 400 | A 597 | 1.70 | 0.630 | 0.633 |
| } | 258.65 263.15 | 1.423 | 0.587 | | | 0.572 |
| | 273.15 | 1.094 | 0.522 | 1.100 | 0.524 | 0.513 |
| 1 | 282.95 | 0.914 | | | | |
| | 283.15 | | | 0.900 | 0.474 | 0.457 |
| | 283.95 | 0.854 | | | | |
| 1 | 297.55 | 0.605 | | | | |
| 1 | 298.15 | 0.594 | 0.373 | | | |
| Cmeething equations | 1 | 10 334 | 21 602/17 | 1/1001 1 | 1 004 1- | (1002) |
| Smoothing equation: | | | - 21.692/(T between 20 | | | |
| Standard erro | r in v | | e regressio | n line - | 1.23 × 1 | 0-2 |
| Standard erro * calculated by the | compiler ¹ | | ** smoo | othing equ | ation an | d mole |
| fractions from the | equation | were cal | | | | |
| fractions from the equation were calculated by H.L. Clever. | | | | | | |

| COMPONENTS: | <u></u> | | ORIGINAL M | EASUREMEN | ITS: | |
|--|--------------------------------------|---|--------------------------|----------------|------------------------------------|----------------------------|
| <pre>(1) Hydrogen chloride [7647-01-0]</pre> | e; HCl; | | Kapoor, K. Sandbach, | | cock, R.G | .; |
| (2) Ethers | | | J. Appl. C 21, 97-100 | | ech. <u>197</u> | <u>1</u> , |
| EXPERIMENTAL VALUES: | | 1 | | | | |
| | т/к | Mole ratic ⁿ HCl ^{/n} 2 | fraction | | smoothe ita ^x HCl | d x ** from equation |
| | <u> </u> | | | | | |
| 1,1'-Oxybisoctane, (<i>dioctyl ether</i>); C ₁₆ H ₃₄ O; [629-82-3] | 198.15 200.15 203.15 213.15 | 9.55 7.48 | 0.905 0.882 | 7.20 | 0.878 | 0.888 0.859 |
| | 213.15 223.15 233.15 242.15 | 2.46 | 0.711 | 3.20 | 0.762 | 0.815 0.760 |
| | 243.15 253.15 257.15 257.15 | 1.525 1.396 | | 1.75 | 0.636 | 0.699 0.635 |
| | 263.15 272.15 | 1.111 | 0.526 | | | 0.572 |
| | 273.15 283.15 283.55 299.55 | 0.878 0.870 0.548 | 0.468 | 1.080 0.878 | 0.519 0.468 | 0.511 0.453 |
| Smoothing equation: 1 Standard error in x _{HC} | | (for | use betweer | 1 203.15 F | (and 283 | 1, 100K) 15 K) |
| Methoxybenzene, (<i>anisole</i>); C ₇ H ₈ O; [100-66-3] | 195.65 203.15 211.65 | 4.50 1.79 | 0.818 | 2.80 | 0.737 | 0.762 |
| [100-00-3] | 213.15 223.15 | | | | | 0.677 0.580 |
| | 231.15 233.15 243.15 | 0.960 | 0.490 | 0.90 | 0.474 | 0.485 0.395 |
| | 252.65 253.15 263.15 | 0.478 | 0.323 | 0.50 | 0.333 | 0.317 |
| | 273.15 | 0.228 | 0.186 | 0.25 | 0.200 | 0.195 |
| | 283.15 286.25 | 0.158 | 0.136 | 0.16 | 0.138 | 0.151 |
| | 295.05 302.35 | 0.120 0.100 | | | | |
| Smoothing equation:] | .n × _{HCl} = | 33.800 - | 38.791/(T/ use betwee | /100) - 21 | .130 ln(| т/100) 2.35 К) |
| Standard error i | n x _{HCl} al | oout the | regression | line = 9. | 11 × 10 | 3 |
| <pre>* calculated by the c ** smoothing equation by H.L. Clever.</pre> | | e fractic | ns from the | equatior | were ca | lculated |
| _ | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |

| COMPONENTS : | | | | INAL MEASUREMEN | NTS: | |
|---|--|-------------------------|-----------|---|---|--------------|
| <pre>(1) Hydrogen chloride; HCl; [7647-01-0]</pre> | | Sc | hunke, J. | | | |
| (2) 1,1'-Oxybise | thane or diethy 0; [60-29-7] | 1 | | Phys. Chem. 1 - 345. | . <u>1894</u> , <i>14</i> | • |
| Total P/kPa: | 263.95 - 303.15 97.1 - 98.7 28 - 740 mmHg) | | PREP. | ARED BY: W. C | Gerrard | |
| EXPERIMENTAL VALUES: | | | | | | |
| Т/К | Hydrogen Chloride + Diethyl Ether (Wtl + Wt2)/g | Chlor | ide | Hydrogen M Chloride g g ⁻¹ | 401 Ratio n _l /n ₂ | Mol Fraction |
| 263.95 | 1.1770 1.7330 1.4565 | 0.436 0.657 0.567 | 0 | 0.3705 0.3796 0.3752 0.3751 av. | 1.219 | 0.549 |
| 273.55 | 2.3430 1.5170 2.00 | 0.839 0.534 0.711 | 72 | 0.35407 0.35246 0.35585 0.3541 av. | 1.115 | 0.527 |
| 287.95 | 1.9420 1.242 1.4370 | 0.540 0.346 0.397 | 75 | 0.2781 0.2792 0.2768 0.2780 av. | 0.782 | 0.439 |
| 303.15 | | 0.503 0.543 | | 0.1945 0.1949 0.1947 av. | 0.491 | 0.329 |
| The value compiler | es of mole ratio | and n | nole | fraction we: | re calcula | ated by the |
| | AUX | ILIARY | INFOR | MATION | | |
| METHOD/APPARATUS/PRO | CEDURE : | | SOUR | CE AND PURITY | OF MATERIAL | S; |
| Hydrogen chloride was passed as a slow stream through 50 cm ³ of ether in a wide-necked flask of 100 cm ³ capacity. The prevailing pressure was barometric, 728 - 740 mmHg (97.1 - 98.7 kPa). (101.325 kPa = 760 mmHg) The amount of hydrogen chloride absorbed was determined by an alkali | | | | rock salt dried by s calcium ch Diethyl et standard t over sodiu | and sulfu ulfuric ad loride. her. Purit echnique a m. It had | fied by a |
| titration. | | | | MATED ERROR: RENCES: | | |
| | | | | | | |

| COMPONENTS : | ORIGINAL MEASUREMENTS: | | |
|---|---|--|--|
| <pre>(1) Hydrogen chloride; HCl; [7647-01-0]</pre> | Chesterman, D. R. | | |
| <pre>(2) 1,1'-Oxybisethane or diethyl ether; C₄H₁₀O; [60-29-7]</pre> | J. Chem. Soc. <u>1935</u> , 906 - 910. | | |
| VARIABLES: | DDEDADED DV. | | |
| T/K: 298.15 Total P/kPa: 101 (~1 atm) | PREPARED BY: W. Gerrard | | |
| EXPERIMENTAL VALUES: | <u> </u> | | |
| T/K Observed So Pressure g HCL p/mmHg | lubility Mol Fraction g ⁻¹ Solution ^x l | | |
| 298.15 760 | 0.22 0.36 | | |
| The mole fraction value wa | s calculated by the compiler. | | |
| AUXILIARY | INFORMATION | | |
| METHOD /APPARATUS / PROCEDURE : | SOURCE AND PURITY OF MATERIALS: | | |
| The apparatus was that used for the conductivity. A sample of the saturated solution was removed, weighed, the hydrogen chloride was reacted with excess standard base which was back titrated with standard acid solution. | Hydrogen chloride. Prepared from conc. sulfuric acid and pure sodium chloride. Passed through sulfuric acid and over P2⁰5. Diethyl ether. Was stated to be the purest obtainable. Freed from alcohol and acetone, and dried with sodium, b.p./°C (765 mmHg) = 35.5. | | |
| | ESTIMATED ERROR: | | |
| | | | |
| | REFERENCES : | | |

| 100 | Hydrogen Chloride in i | Non-Aqueous a | orvents | |
|---|--|--|--|-----------------|
| COMPONENTS : | | ORIGINAL MEASU | REMENTS : | |
| <pre>(1) Hydrogen chloride; HCl; [7647-01-0]</pre> | | Mirsaidov, U.; Dzhuraev, Kh.Sh.; Semenenko, K. N. | | |
| <pre>(2) 1,1'-Oxybisethane or diethyl ether; C₄H₁₀O; [60-29-7]</pre> | | Dokl. Akad. Nauk Tadzh. SSR <u>1975</u> , 18, 30 - 31. | | |
| | · | | | |
| VARIABLES: T/K = 273.15, 298.15 $p_1/kPa = 101.325 (1 atm)$ | | PREPARED BY: | W. Gerrard | |
| EXPERIMENTAL VALUES: | | | | |
| Т/К | Hydrogen Chloride N | lol Ratio M | ol Fraction | |
| | $10^2 w_{\gamma}/\text{wt}$ | n_{1}/n_{2} | <i>x</i> 1 | |
| 273.15 | 26.5 | 0.732 | 0.423 | |
| 298.15 | 17.0 | 0.416 | 0.294 | |
| | | | | |
| | AUXILIARY | INFORMATION | | |
| METHOD / APPARATUS / PRO | ······· | | RITY OF MATERIALS: | |
| Hydrogen chloride liquid until the remained constant solved was detern titration. The f | e was passed into the concentration t. The amount dis- nined by an alkali final pressure was al pressure equal to | <pre>(1) Hydrog from i solutio concen (2) 1,1'-0</pre> | en chloride. Obtain ts concentrated aque on by treatment with trated sulfuric acid xybisethane. Not st | eous 1 1. |
| | | ESTIMATED ERF | OR: | |
| | | | | |

| COMPONENTS: | ORIGINAL MEASUREMENTS: | | |
|--|--|--|--|
| (1) Hydrogen chloride; HCl; | Gerrard, W.; Macklen, E.D. | | |
| [7647-01-0] | J. Appl. Chem. <u>1960</u> , 10, 57-62. | | |
| (2) Ethers | | | |
| VARIABLES: | PREPARED BY: | | |
| T/K: See below Total P/kPa : 101.325 (1 atm) | W. Gerrard | | |
| | | | |
| EXPERIMENTAL VALUES: T/K | Mole ratio Mole* Smoothed** | | |
| n 1 n | HCl ^{/n} ether fraction mole fraction ^x HCl ^x HCl | | |
| | | | |
| 1-Methoxybutane, 273.15 (buty1 methy1 ether); 277.55 | | | |
| $C_5H_{12}O; [628-28-4] 280.95$ | 0.915 0.478 0.468 | | |
| 283.15 | 0.845 0.458 | | |
| 289.15 | 0.792 0.442 0.741 0.426 0.426 | | |
| Smoothing equation: $\ln x_{max} = 31.559$ | - 41.243/(T/100) - 17.056 ln(T/100) | | |
| Smoothing equation: ln x _{HCl} = 31.559 Standard error in x _{HCl} about the | regression line = 8.23×10^{-4} | | |
| 1,1'-Oxybis propane, 273.15 | 1.157 0.536 0.536 | | |
| (dipropyl ether); 279.05 | 1.055 0.513 | | |
| 283.15 | 0.496 | | |
| 283.75 287.55 | 0.970 0.492 0.915 0.478 | | |
| 290.45 293.15 | 0.862 0.463 0.450 | | |
| 297.15 303.15 | 0.757 0.431 0.402 | | |
| Smoothing equation: ln × _{HCl} = 39.791 Standard error in × _{HCl} about the | - 52.612 /(T/100) - 21.052 $\ln(T/100)$ regression line = 1.16 × 10 ⁻³ | | |
| HCI | | | |
| * calculated by the compiler | | | |
| ** smoothing equation and smoothed va | alues were calculated by H.L. Clever | | |
| | | | |
| AUXILIARY | INFORMATION | | |
| METHOD/APPARATUS/PROCEDURE: | SOURCE AND PURITY OF MATERIALS: | | |
| The method and procedure were | (1) Hydrogen chloride: self- | | |
| described by Gerrard and Macklen (1). The amount of gas absorbed by a | prepared and dried. | | |
| measured weight of solvent was determined by re-weighing the | (2) Ethers: purified by known methods; purity attested by | | |
| bubbler tube to constant weight. the measured total pressure was | boiling point and refractive index; distilled into the | | |
| barometric, very nearly 101.325 kPa. | absorption vessel just before | | |
| The temperature control was within 0.1 K. | use. | | |
| | ESTIMATED ERROR: $\delta T/K = \pm 0.1$ | | |
| | $\delta x_{\rm HCl} / x_{\rm HCl} = \pm 0.005 \text{ to } 0.025$ | | |
| | REFERENCES: | | |
| | Gerrard, W.; Macklen, E.D. J. Appl. Chem. <u>1956</u>, 6, 241. | | |
| | | | |

| COMPONENTS: | ORIGINAL MEASUREMENTS: | | | |
|--|---|--|--|--|
| (1) Hydrogen chloride; HCl; | Gerrard, W.; Macklen, E.D. | | | |
| [7647-01-0] | J. Appl. Chem. <u>1960</u> , 10, 57-62. | | | |
| (2) Ethers | <u></u> | | | |
| EXPERIMENTAL VALUES: | | | | |
| т/к | Mole ratio Mole* Smoothed** HCl ^{/n} ether fraction mole fraction | | | |
| | HCl HCl HCl | | | |
| · · · · · · · · · · · · · · · · · · · | ······································ | | | |
| 1,1'-Oxybisbutane, 273.15 (<i>dibutyl ether</i>); C ₈ H ₁₈ O; 278.35 | 1.061 0.515 0.511 0.971 0.493 | | | |
| [142-96-1] 8 18 281.25 283.15 | 0.922 0.480 | | | |
| 291.25 | 0.762 0.432 | | | |
| 293.15 297.65 | 0.423 | | | |
| 303.15 303.35 | 0.364 | | | |
| 310.85 | 0.467 0.318 | | | |
| 313.15 313.75 | 0.303 | | | |
| Smoothing equation: $\ln x_{HC1} = 75.759$ | -102.235/(T/100) - 38.813 lp(T/100) | | | |
| Standard error in x_{HC1} about the | regression line = 3.14×10^{-3} | | | |
| 1,1'-Oxybispentane, 273.15 | 0.516 | | | |
| (dipentyl ether); C ₁₀ H ₂₂ O; 278.85 [693-65-2] 283.15 | 0.992 0.498 0.480 | | | |
| 284.15 - 290.35 | 0.901 0.474 0.799 0.444 | | | |
| 293.15 | 0.430 | | | |
| 295.85 301.05 | 0.709 0.415 0.632 0.387 | | | |
| 303.15 304.95 | 0.374 | | | |
| 308.85 | 0.515 0.340 | | | |
| 313.15 | 0.317 | | | |
| Smoothing equation: $\ln x_{HC1} = 65.285$ Standard error in x_{HC1} about the | - 87.839/(T/100) - 33.625 ln(T/100) regression line = 1.30 × 10 ⁻³ | | | |
| 1,1'-Oxybis [3-methyl butane], 273.15 | 0.994 0.498 0.497 | | | |
| (d11sopentyl ether); C ₁₀ H ₂₂ O; 278.65 [544-01-4] 282.75 | 0.881 0.468 0.818 0.450 | | | |
| 283.15 286.85 | 0.447 | | | |
| 290.75 | 0.676 0.403 | | | |
| 293.15 297.15 | 0.386 0.559 0.359 | | | |
| 303.15 | 0.321 | | | |
| Smoothing equation: ln × _{HC1} = 79.232 Standard error in × _{HC1} about the | - 105.846/(T/100) - 40.983 ln(T/100) regression line = 2.45 × 10 ⁻³ | | | |
| Methoxybenzene, 279.85 | 0.182 0.154 | | | |
| (methyl phenyl ether, 283.15 anisole); C ₇ H ₈ O; [100-66-3] 290.35 | 0.137 | | | |
| 293.15 296.15 | 0.103 0.0934 0.101 | | | |
| 303.15 | 0.0785 | | | |
| 304.35 313.15 | 0.082 0.0758 0.0647 | | | |
| 313.65 321.65 | 0.068 0.0637 0.061 0.0575 | | | |
| 323.15 | 0.0561 | | | |
| Smoothing equation: ln × _{HCl} = -89.382 Standard error in × _{HCl} about the | + 135.432/(T/100) + 38.016 ln(T/100) regression line = 9.29 × 10 ⁻⁴ | | | |
| * calculated by the compiler ** smoothing equation and smoothed values were calculated by H.L. Clever | | | | |

| COMPONENTS: | ORIGINAL MEASUREMENTS: | | |
|--|--|--|--|
| (1) Hydrogen chloride; HCl; | Gerrard, W.; Macklen, E.D. | | |
| [7647-01-0] | | | |
| (2) Ethers | J. Appl. Chem. <u>1960</u> , 10, 57-62. | | |
| | | | |
| EXPERIMENTAL VALUES: T/K | Mole ratio Mole* Smoothed** | | |
| | Mole ratio Mole* Smoothed** HCl ^{/n} ether fraction mole fraction | | |
| | ^x HCl ^x HCl | | |
| 1-Methoxy-2-methylbenzene, 273.15 | 0.181 0.153 0.152 | | |
| (methyl o-tolyl ether); 277.65 | 0.147 0.128 | | |
| C ₈ H ₁₀ O; [578-58-5] 283.15 284.35 | 0.126 0.112 | | |
| 288.15 293.15 | | | |
| 296.15 | 0.086 0.0792 | | |
| 302.75 303.15 | 0.0691 | | |
| 308.75 313.15 | | | |
| 316.45 | 0.059 0.0557 | | |
| 323.15 | 0.0498 | | |
| | + 87.230/(T/100) + 22.744 ln(T/100) regression line = 2.70 × 10 ⁻³ | | |
| | | | |
| (Methoxymethyl) benzene, 273.15 (benzyl methyl ether); 278.95 | | | |
| C ₈ H ₁₀ O; [538-86-3] 280.65 283.15 | | | |
| 284.85 | 0.712 0.416 | | |
| 284.65 | | | |
| 293.15 297.35 | | | |
| 302.35 | 0.474 0.322 | | |
| 303.15 | | | |
| Smoothing equation: $\ln x_{HC1} = 60.979$ Standard error in x_{HC1} about the | - 81.245/(T/100) - 31.851 ln(T/100) regression line = 2.64 × 10 ⁻³ | | |
| Ethoxybenzene, (phenyl ethyl 282.75 | | | |
| <i>ether; phenetole</i>); C ₈ H ₁₀ O; 283.15 [103-73-1] 290.55 | | | |
| 293.15 298.15 | | | |
| 303.15 305.15 | 0.0902 | | |
| 311.25 | 0.079 0.0732 | | |
| 313.15 | | | |
| 323.15 | | | |
| Smoothing equation: $\ln x_{HC1} = -9.547$ Standard error in x_{HC1} about the | + 21.649/(T/100) regression line = 1.65 × 10 ⁻³ | | |
| * calculated by the compiler | | | |
| | alues were calculated by H.L. Clever | | |
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| COMPONENTS: | ORIGINAL MEASUREMENTS: |
|--|--|
| (1) Hydrogen chloride; HCl; | Gerrard, W.; Macklen, E.D. |
| [7647-01-0] | J. Appl. Chem. <u>1960</u> , 10, 57-62. |
| (2) Ethers | |
| | |
| EXPERIMENTAL VALUES: T/K | Mole ratio Mole* Smoothed** |
| n ₁ | ICl ^{/n} ether fraction mole fraction |
| | ×HCl ×HCl |
| (Ethoxymethyl) benzene, 282.35 | 0.737 0.424 |
| (benzyl ethyl ether); 283.15 C ₉ H ₁₂ O; [539-30-0] 288.25 | 0.419 0.658 0.397 |
| 289.15 | 0.649 0.394 0.376 |
| 300.15 | 0.504 0.335 |
| 303.15 304.85 | 0.321 |
| 309.75 313.15 | 0.398 0.285 0.261 |
| 314.05 319.35 | 0.343 0.255 0.288 0.224 |
| 323.15 | 0.204 |
| Smoothing equation: $\ln x_{HC1} = 105.948$ | - 145.039/(T/100) - 53.416 ln(T/100) |
| Standard error in *HCl about the | regression line = 3.04×10^{-3} |
| (Butoxymethyl) benzene, 273.15 | 0.810 0.448 0.448 |
| (benzyl butyl ether); 277.25 | 0.764 0.433 |
| C ₁₁ H ₁₆ O; [588-67-0] 282.15 283.15 | 0.695 0.410 0.407 |
| 287.85 292.85 | 0.621 0.383 0.556 0.357 |
| 293.15 | 0.355 |
| 298.05 303.15 | 0.486 0.327 0.299 |
| 307.75 310.55 | 0.379 0.275 0.348 0.258 |
| 313.15 | 0.245 |
| Smoothing equation: $\ln x_{HC1} = 73.440$ Standard error in x_{HC1} about the | 98.334/(T/100) - 38.058 ln(T/100) regression line = 9.24 × 10 ⁻⁴ |
| HCI | - |
| 1,1'-Oxybisbenzene 273.15 | 0.117 0.105 0.105 |
| (diphenyl ether); C ₁₂ H ₁₀ O; 280.15 [101-84-8] 283.15 | 0.094 0.0859 0.0824 |
| 290.25 | 0.076 0.0706 0.0659 |
| 298.65 303.15 | 0.065 0.0610 0.0535 |
| 307.15 | 0.052 0.0494 |
| 313.15 314.35 | 0.0440 0.045 0.0431 |
| 323.55 323.15 | 0.037 0.0357 0.0367 |
| | |
| Smoothing equation: ln x _{HCl} = -9.038 - Standard error in x _{HCl} about the | regression line = 1.57×10^{-3} |
| | |
| * calculated by the compiler | |
| ** smoothing equation and smoothed va | lues were calculated by H.L. Clever |
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| COMPONENTS: | ORIGINAL M | IEASUREMENTS: | |
|--|--------------------------------------|---|------------------------------------|
| (1) Hydrogen chloride; HCl; | Gerrard, W | .; Macklen, 1 | E.D. |
| [7647-01-0] | J. Appl. C | hem. 1960, 1 | 0, 57-62. |
| (2)· Ethers | | <u>, , , , , , , , , , , , , , , , , , , </u> | , ., |
| EXPERIMENTAL VALUES: | Mole ratio | Mole* | Smoothed** |
| | ⁿ HCl ^{/n} ether | | nole fraction ^x HCl |
| 1,1'-[Oxybis(methylene)]bis- 273. | 15 0.643 | 0.391 | 0.389 |
| benzene, (<i>dibenzyl ether</i>); 277. C ₁₄ H ₁₄ O; [103-50-4] 280. | | 0.374 0.363 | |
| 14 14 283. 284. | | 0.345 | 0.352 |
| 287. 292. | 35 0.500 | 0.333 0.308 | |
| 293. | 15 | | 0.309 |
| 299. 303. | | 0.281 | 0.263 |
| 305. 312. | | 0.253 0.218 | |
| 313. | | | 0.219 |
| Smoothing equation: $\ln x_{HC1} = 61.35$ Standard error in x_{HC1} about t | 6 - 81.792/(T/ he regression | 100) - 32.199 line = 2.01 | 9 ln(T/100) < 10 ⁻³ |
| Tetrahydrofuran; C ₄ H ₈ O; 273. | 15 | | 0.624 |
| [109-99-9] ⁴ ⁶ 278. 279. | | 0.607 0.601 | |
| 283. | 05 1.382 | 0.580 | 0.581 |
| 283. 288. | 15 1.226 | 0.551 | 0.501 |
| 290. 293. | | 0.534 | 0.515 |
| 296. 302. | | 0.487 0.442 | |
| · 303. 304. | 15 | 0.427 | 0.436 |
| Smoothing equation: ln × _{HCl} = 91.03 Standard error in × _{HCl} about t | | | 23 ln(T/100) < 10 ⁻³ |
| 1,4-Dioxane; $C_{4}H_{0}O_{2}$; 273. | 15 | | 0.548 |
| [123-91-1] 482 279. | 65 1.134 | 0.531 | |
| 283. 284. | 85 1.031 | 0.508 | 0.517 |
| 289. 293. | | 0.486 | 0.470 |
| 296. 302. | | 0.450 0.419 | |
| 303. | 15 | | 0.414 |
| 308. 312. | 85 0.549 | 0.385 0.354 | |
| 313. | | | 0.354 |
| Smoothing equation: $\ln x_{HC1} = 67.10$ Standard error in x_{HC1} about t | 0 - 90.850/(T/ he regression | 100) - 34.276 line = 1.92 > | 5 ln(T/100) < 10 ⁻³ |
| <pre>* calculated by the compiler ** smoothing equation and smoothed</pre> | values were c | alculated by | H.L. Clever |
| | | | |
| | | | |
| • | | | |

| COMPONENTS: | | ORIGINAL | MEASUREMENTS | : |
|---|--------------------|---------------------------|---------------------------------|-----------------------------------|
| (1) Hydrogen chloride; HCl; | | Gerrard. | W.; Macklen, | E.D. |
| [7647-01-0] | | [| Chem. <u>1960</u> , | |
| (2) Ethers | | | <u>(1)00</u> | 10, 3, 02. |
| | | | | |
| EXPERIMENTAL VALUES: | т/к | Mole ratio | o Mole* | Smoothed** |
| | | HCl ^{/n} ether | fraction | mole fraction |
| | | | ×HCl | ×HC1 |
| Oxybis [chloromethane], | 273.15 | 0.072 | 0.0672 | 0.0669 |
| (dichloromethyl ether): | 277.35 | 0.059 | 0.0557 | 0.0460 |
| 242 | 286.55 | 0.044 | 0.0421 | 0.0400 |
| | 292.15 | 0.038 | 0.0366 | 0.0360 |
| | | 1 . 260 42 | 2/(m/100) . 9 | |
| Smoothing equation: ln x _{HCl} = - Standard error in x _{HCl} abo | out the | 4 + 268.433 regression | 3/(17/100) + 8 n line = 6.93 | × 10 ⁻⁴ |
| ner | | | | |
| 1-Chloro-1-(2-chloroethoxy) | 273.15 | 0 347 | 0 100 | 0.242 |
| ethane, $(\alpha\beta-dichloroethyl ether); C_4^H_8^{Cl}_2^O; [1462-34-6]$ | 279.85 283.15 | 0.247 | 0.198 | 0.180 |
| 402 | 284.85 285.75 | 0.206 0.201 | 0.171 0.167 | |
| | 291.45 | 0.167 | 0.143 | |
| _ | 293.15 | 0.145 | 0.127 | 0.135 |
| | 298.05 | 0.134 | 0.118 | 0.103 |
| | 303.15 309.65 | 0.093 | 0.0851 | |
| | 313.15 318.15 | 0.074 | 0.0689 | 0.0783 |
| | 323.15 | | | 0.0601 |
| Smoothing equation: $\ln x_{HC1} = 1$ Standard error in x_{HC1} above | 0.599 - out the | - 5.264/(T/ regression | /100) - 10.04 n line = 6.67 | 4 ln(T/100) × 10 ⁻⁴ |
| | | | | |
| <pre>1,1'-Oxybis [2-chloroethane], 2 (ββ'-dichloroethyl ether);</pre> | 273.15 | 0.297 | 0.229 | 0.228 0.174 |
| $C_{4}H_{8}Cl_{2}O;$ [111-44-4] 2 | 284.15 | 0.202 | 0.168 | |
| | 288.85 293.15 | 0.175 | 0.149 | 0.132 |
| | 297.65 303.15 | 0.133 0.114 | 0.117 0.102 | 0.101 |
| 3 | 306.45 | 0.100 | 0.0909 | 0.101 |
| | 311.55 313.15 | 0.087 | 0.0800 | 0.0766 |
| Smoothing equation: $\ln x_{HC1} = 2$ | 23.200 - | - 23.438/(1 | r/100) - 16.0 | 18 ln(T/100) |
| Standard error in xHCl abo | Juc the | rediessio | 1 111e = 1.09 | |
| 1,1'-Oxybis [3-chloropropane], | 273.15 | 0.391 | 0.281 | 0.285 |
| (YY'-dichloropropyl ether); | 283.15 | | | 0.213 |
| C ₆ H ₁₂ Cl ₂ O; [629-36-7] | 283.55 290.85 | 0.269 0.213 | 0.212 0.176 | |
| | 293.15 298.15 | 0.162 | 0.139 | 0.159 |
| | 303.15 | | | 0.119 |
| | 303.45 | 0.131 | 0.116 | 0.0895 |
| | 314.15 323.15 | 0.090 0.075 | 0.0826 0.0698 | 0.0634 |
| Smoothing equation: $\ln x_{HC1} = 2$ Standard error in x_{HC1} abo | | | | |
| * calculated by the compiler ** smoothing equation and smoo | | | | |
| | | | | |

| COMPONENTS: (1) Hydrogen chloride; HCl; (1) Hydrogen chloride; HCl; (2) 1-methoxybutane or butyl methyl ether; $C_{3}H_{12}O$; (628-28-4] (2) 10-methoxybutane or butyl methyl (2) 1-methoxybutane or butyl methyl (moothed data calculated by H.L. Clever) EXPERIMENTAL VALUES: T/K MOI Ratio MOI Fraction n_{1}/n_{2} 203.15 0.565 0.665 0.407 205.15 0.666 0.407 205.15 0.665 0.407 205.15 0.665 0.407 205.15 0.665 0.407 205.15 0.665 0.407 205.15 0.665 0.407 205.15 0.666 0.407 205.15 0.666 0.407 205.15 0.666 0.407 205.15 0.666 0.407 205.15 0.666 0.407 205.15 0.667 0.857 0.856 223.15 0.070 0.476 0.857 0.666 233.15 0.407 0.476 0.427 233.15 0.907 0.476 0.427 0.427 0.427 0.427 0.427 0.427 0.427 0.427 0.427 0.427 0.427 0.427 0.427 0.427 0.427 0.427 0.427 0.427 0 | | 173 |
|--|--|---|
| ether; $C_{5}H_{12}O$; $[628-28-4]$ 7/K: 203.15 - 296.55 Total P/KPa: 101.325 (1 atm) EXPERIMENTAL VALUES: 7/K MOI Ratio MOI Fraction $\frac{n_1/n_2}{203.15} - \frac{2}{5.98}$ $\frac{2}{214.15} - \frac{1}{1.15} - \frac{2}{214.15} - \frac{1}{1.26} - \frac{1}{214.15} - \frac{1}{216.15} -$ | (1) Hydrogen chloride; HCl; | Kapoor, K. P.; Luckcock, R. G.; |
| T/K: 203.15 - 296.55 Total P/kPa: 101.325 (1 atm) EXPERIMENTAL VALUES: T/K MOI Ratio MOI Fraction n1/n2 $\frac{1}{203.15}$ (5.98 203.15 5.98 203.15 5.98 204.15 4.11 0.804 246.15 1.706 0.630 The mole fraction 251.15 1.523 0.604 solubility values 266.55 1.312 0.667 were calculated 273.15 1.073 0.318 by the compiler. 286.55 0.407 296.55 0.688 0.408 Smoothed Data: For use between 203.15 and 293.15 K. In $x_1 = 8.308 - 9.080/(T/100K) - 5.635 ln (T/100K)$ Standard error about the regression line is 9.71 x 10 ⁻³ T/K Author's Smoothed Data Compiler's Eqn. Mol Ratio MOI Fraction Mol Fraction n_1/n_2 x_1 x_1 203.15 6.600 0.857 0.856 213.15 0.080 0.476 213.15 0.080 0.476 213.15 0.080 0.476 213.15 0.080 0.476 213.15 0.0807 0.466 223.15 2.45 0.710 0.700 233.15 1.45 0.592 0.552 273.15 1.45 0.592 0.552 273.15 1.45 0.592 0.552 273.15 1.45 0.592 0.552 273.15 1.45 0.592 0.639 223.15 0.907 0.476 0.426 223.15 0.907 0.476 0.426 223.15 0.907 0.476 0.426 223.15 1.45 0.592 0.552 273.15 1.075 0.518 0.507 233.15 1.45 0.592 0.552 273.15 1.45 0.592 0.552 273.15 1.45 0.592 0.552 273.15 1.075 0.518 0.507 283.15 0.907 0.476 0.426 293.15 AUXILIARY INFORMATION METHON/AFPAATUS/FROCEDURE: AUXILIARY INFORMATION METHON/AFPAATUS/FROCEDURE: AUXILIARY INFORMATION METHON/AFPAATUS/FROCEDURE: AUXILIARY INFORMATION METHON/AFPAATUS/FROCEDURE: FOR temperatures below 273.15 K it was used. For temperature was carboul joi ca and water in a vacuum flask was used. For temperatures below 273.15 K it was used. For temperature was lowered by 10 K and pyridine was carboul joi dic and water in a vacuum flask was used. For temperatures below 273.15 K it was used. For temperature was lowered by 10 K and pyridine was carboul joi dic and peridinue was lowered by 10 K and pyridine was lowered by 10 K a | <pre>(2) 1-methoxybutane or butyl methyl ether; C₅H₁₂O; [628-28-4]</pre> | |
| T/K: 203.15 - 296.55 Total P/kPa: 101.325 (1 atm) EXPERIMENTAL VALUES: T/K MOI Ratio MOI Fraction n1/n2 x_1 203.15 5.98 214.15 4.11 0.004 246.15 1.706 0.630 The mole fraction 251.15 1.523 0.604 solubility values 266.55 1.312 0.687 were calculated 273.15 1.073 0.518 by the compiler. 286.55 0.406 0.476 296.55 0.688 0.409 Smoothed Data: For use between 203.15 and 293.15 K. In $x_1 = 8.308 - 9.080/(T/100K) - 5.635 ln (T/100K)$ Standard error about the regression line is 9.71 x 10 ⁻³ T/K Author's Smoothed Data Compiler's Eqn. Mol Ratio Mol Fraction Mol Fraction n_1/n_2 x_1 x_1 $203.15 6.000 0.857 0.856 213.15 0.0685 0.409 Standard error about the regression line is 9.71 x 10-3 T/K Author's Smoothed Data Compiler's Eqn. Mol Ratio Mol Fraction Mol Fraction n_1/n_2 x_1 x_1203.15 6.000 0.857 0.856 213.15 0.059 0.476 0.855 0.646213.15 0.059 0.552273.15 1.45 0.592 0.599263.15 1.45 0.592 0.599263.15 1.45 0.592 0.599263.15 1.45 0.592 0.599273.15 1.075 0.518 0.507283.15 0.907 0.476 0.466293.15 0.907 0.476 0.466293.15 0.907 0.476 0.426293.15 1.075 0.518 0.507283.15 1.055 0.518 0.507283.15 1.055 0.518 0.507283.15 1.057 0.518 0.507283.15 1.057 0.518 0.507283.15 1.057 0.518 0.507283.15 1.057 0.518 0.507283.15 1.057 0.518 0.507283.15 1.057 0.518 0.507283.15 1.057 0.518 0.507283.15 1.057 0.518 0.507283.15 1.057 0.518 0.507283.15 0.907 0.476 0.466293.15AUXILIARY INFORMATIOMEXTHOM/AFPAATUS/FROCEDURE:AUXILIARY INFORMATIOMEXTHOM/AFPAATUS/FROCEDURE:FUEND/AFPAATUS/FROCEDURE:AUXILIARY INFORMATIOMEXTHOM/AFPAATUS/FROCEDURE:FUENCINF assumed that the loss of solventSource Auy of ice and water in a vaccumflask was used.For temperatures below 273.15 K itwas used. For temperature waslowered by 10 K and pyridine wascarefully added drop-wise to fix thehydrogen chloride as the pyridiniumsalt. A fler treatment with water,the chloride ion content wasdetermined by the Vohard method orX^{2} Appl. Chem. 1959, 9, 89.$ | | |
| T/K: 203.15 - 296.55 Total P/kPa: 101.325 (1 atm) EXPERIMENTAL VALUES: T/K MOI Ratio MOI Fraction n ₁ /n ₂ x ₁ 203.15 5.98 214.15 4.11 0.804 246.15 1.706 0.630 The mole fraction 256.65 1.312 0.667 were calculated 256.65 1.312 0.667 were calculated 236.15 0.695 0.442 236.15 0.695 0.442 236.15 0.685 0.407 296.55 0.688 0.408 Smoothed Data: For use between 203.15 and 233.15 K. In x ₁ = 8.308 - 9.080/(T/100K) - 5.635 In (T/100K) Standard error about the regression line is 9.71 x 10 ⁻³ T/K Author's Smoothed Data Compiler's Eqn. Mol Ratio Mol Fraction Mol Fraction n ₁ /n ₂ x ₁ x ₁ 201.15 6.000 0.857 0.856 211.15 0.685 0.407 236.15 0.409 0.857 0.856 213.15 0.000 0.429 233.15 1.45 0.592 0.599 233.15 1.45 0.592 0.599 243.15 0.907 0.476 0.466 293.15 0.907 0.476 0.466 293.15 0.907 0.476 0.466 293.15 0.907 0.476 0.466 293.15 0.907 0.476 0.427 243.15 1.075 0.518 0.507 243.15 1.075 0.518 0.507 243.15 1.095 0.518 0.507 243.15 0.907 0.476 0.426 293.15 0.907 0.476 0.426 201.16 demardument me the eth | VARIABLES: | PREPARED BY: |
| $ \begin{array}{c c c c c c c c c c c c c c c c c c c $ | | |
| EXPERIMENTAL VALUES: T/K MOI Ratio Mol Fraction n_1/n_2 x_1 203.15 5.98 0.857 214.15 4.11 0.804 246.15 1.706 0.630 The mole fraction 256.65 1.312 0.567 were calculated 262.95 0.908 0.476 283.15 0.895 0.472 283.15 0.895 0.472 283.15 0.897 0.476 296.15 0.688 0.407 296.55 0.688 0.407 296.55 0.688 0.407 296.55 0.688 0.407 296.55 0.688 0.407 236.55 0.689 0.476 231.5 0.689 0.476 233.15 0.689 0.476 233.15 0.689 0.407 236.55 0.688 0.407 236.55 0.688 0.407 236.55 0.688 0.407 236.55 0.688 0.407 236.55 0.688 0.407 236.55 0.688 0.408 Smoothed Data: For use between 203.15 and 293.15 K. In $x_1 = 8.308 - 9.080/(T/100K) - 5.635 ln (T/100K)$ Standard error about the regression line is 9.71 x 10 ⁻³ T/K Author's Smoothed Data Complier's Eqn. Mol Ratio Mol Fraction Mol Fraction n_1/n_2 x_1 x_1 203.15 0.057 0.855 213.15 1.45 0.592 0.599 263.15 0.466 233.15 0.907 0.476 0.466 233.15 0.907 0.476 0.466 233.15 0.907 0.476 4247 MUTHDARY INFORMATION METHOD/AFFAATUS/FROCEDURE: The bubbler-tube technique described by Gerard, Mincer, and Wyvill (1) was used. For temperatures between 303 and 253 an LBI thermostat con- taining liquid parafin was used. For temperatures between 203.15 K it was used. For comperatures between 303 and 253 an LBI thermostat con- taining liquid parafin was used. For temperatures between aver as obtained from a cylinder, and dried. (2) Butyl methyl ether. Prepared from 1-butanol, sodium, and idodomethane. The ether was rigorously purified and attested. (2) Butyl methyl ether. Prepared from 1-butanol, sodium, and idodomethane. The ether was rigorously purified and attested. $\delta x_1/x_1 = 0.02$ REFIENCES: 1. Gerrard, W. Mincer, A. M. A.; Wyvill, P. L. <i>J. Appl. Chem.</i> 1959, <i>J.</i> 89. | Total P/RPa: 101.325 (1 acm) | (smoothed data calculated by H.L. Clever) |
| $\begin{array}{c c c c c c c c c c c c c c c c c c c $ | | |
| $\begin{array}{c c c c c c c c c c c c c c c c c c c $ | T/K MOI RAU | |
| $\begin{array}{c} 214.15 & 4.11 & 0.804\\ 246.15 & 1.706 & 0.630\\ 251.15 & 1.523 & 0.604 & solubility values\\ 256.65 & 1.312 & 0.567 & solubility values\\ 273.15 & 1.075 & 0.518 & were calculated\\ 283.15 & 0.895 & 0.472\\ 283.15 & 0.689 & 0.476\\ 283.15 & 0.688 & 0.407\\ 296.55 & 0.688 & 0.408\\ 236.15 & 0.688 & 0.408\\ \hline \end{array}$ Smoothed Data: For use between 203.15 and 293.15 K. In $x_1 = 8.308 - 9.080/(T/100K) - 5.635 \ln (T/100K)$ Standard error about the regression line is 9.71 x 10 ⁻³ T/K Author's Smoothed Data Compiler's Eqn. Mol Ratio Mol Fraction Mol Fraction Mol Ratio Mol Fraction Mol Fraction Mol Ratio Mol Fraction Mol Fraction $\frac{n_1/n_2}{723.15} \frac{x_1}{0.857} \frac{21}{0.856}$ $\frac{233.15}{223.15} 1.45 & 0.592 & 0.595\\ 263.15 & 1.45 & 0.592 & 0.595\\ 263.15 & 1.075 & 0.518 & 0.507\\ 233.15 & 1.075 & 0.518 & 0.507\\ 233.15 & 1.075 & 0.518 & 0.507\\ 233.15 & 0.907 & 0.476 & 0.466\\ 233.15 & 0.907 & 0.476 & 0.466\\ 233.15 & 0.907 & 0.476 & 0.466\\ 233.15 & 0.907 & 0.476 & 0.427\\ \hline METHOD/APPARATUS/FROCEDURE: The bubbler-tube technique described by Gerard, Mincer, and Wyvill (1) was used. For temperatures between and annual string enabled the temperature to be maintaing liquid paraffin was used. For temperatures between and annual string enabled the temperature to be maintaing liquid paraffin was used. For temperatures between and water in a vacuum flak was used. For temperatures between and water in a vacuum flak was used. For temperature to be maintaing higuid paraffin was used. For temperatures between and water in a vacuum flak was used. For temperature to be maintaing liquid paraffin was used. For temperature to be maintaing higuid paraffin was used. For temperature was lowered by 10 K and pyridine was carefully added drop-wise to fix the hydrogen chloride as the pyridinium salt. After treatment with water, the chloride is on content was devered by 10 K and pyridine was carefully added drop-wise to fix the hydrogen chloride as the pyridinium salt. After treatment with water, the chloride is on content was devered by 10 K and p$ | | |
| $\begin{array}{c} 246.15 & 1.706 \\ 251.15 & 1.523 & 0.604 \\ 256.65 & 1.312 & 0.567 \\ 273.15 & 1.075 & 0.518 \\ 282.95 & 0.908 & 0.476 \\ 283.15 & 0.895 & 0.476 \\ 283.15 & 0.907 & 0.476 \\ 283.15 & 0.688 & 0.407 \\ 285.15 & 0.688 & 0.408 \\ \hline \\ Smoothed Data: For use between 203.15 and 293.15 K. \\ 1n x_1 = 8.308 - 9.080/(T/100K) - 5.635 ln (T/100K) \\ Standard error about the regression line is 9.71 x 10^{-3}T/K Author's Smoothed Data Compiler's Eqn. Mol Ratio Mol Fraction Mol Fraction Mol Fraction Mol Fraction Mol Fraction 213.15 & 0.685 \\ 213.15 & 0.00 & 0.857 & 0.856 \\ 213.15 & 6.00 & 0.857 & 0.856 \\ 213.15 & 0.00 & 0.857 & 0.856 \\ 213.15 & 0.0907 & 0.476 & 0.466 \\ 293.15 & 0.907 & 0.476 & 0.466 \\ 293.15 & 0.907 & 0.476 & 0.466 \\ 293.15 & 0.907 & 0.476 & 0.466 \\ 293.15 & 0.907 & 0.476 & 0.466 \\ 293.15 & 0.907 & 0.476 & 0.466 \\ 293.15 & 0.907 & 0.476 & 0.466 \\ 293.15 & 0.907 & 0.476 & 0.466 \\ 293.15 & 0.907 & 0.476 & 0.427 \\ \hline \\ $ | | |
| $\begin{array}{c} 256.65 & 1.312 & 0.604 \\ 256.65 & 1.312 & 0.567 & were calculated \\ 273.15 & 1.075 & 0.518 & by the compiler. \\ 282.95 & 0.908 & 0.476 \\ 283.15 & 0.695 & 0.472 \\ 283.15 & 0.685 & 0.407 \\ 296.15 & 0.688 & 0.408 \\ \hline \\ \\ \hline \\ 10 x_1 = 8.308 - 9.080/(T/100K) - 5.635 \ln (T/100K) \\ \hline \\ Standard error about the regression line is 9.71 x 10^{-3} \\ \hline \\ $ | 246.15 1.706 | 0 630 |
| $\begin{array}{c} 273.15 & 1.075 & 0.518 & \text{Were Calculated} \\ 282.95 & 0.908 & 0.476 & \text{by the compiler.} \\ 283.15 & 0.895 & 0.472 \\ 296.15 & 0.688 & 0.407 \\ 296.55 & 0.668 & 0.408 \\ \hline & 296.55 & 0.668 & 0.408 \\ \hline & 296.55 & 0.668 & 0.408 \\ \hline & & & & & & & & & & & & & & & & & &$ | 1 | 0.004 solubility values |
| $\begin{array}{c} 222.95 & 0.908 & 0.476 & \text{By the Complete}.\\ 283.15 & 0.905 & 0.472 \\ 283.15 & 0.907 & 0.476 \\ 296.15 & 0.668 & 0.407 \\ 296.55 & 0.668 & 0.408 \\ \end{array}$ Smoothed Data: For use between 203.15 and 293.15 K. $\ln x_1 = 8.308 - 9.080/(T/100K) - 5.635 \ln (T/100K) \\ \text{Standard error about the regression line is 9.71 x 10^{-3} \\ \hline T/K & Author's Smoothed Data & Compiler's Eqn. \\ \hline Mol Ratio Mol Fraction & Mol Fraction \\ \hline Mol Ratio Mol Fraction \\ \hline Mol Mol Mol Mol Fratio \\ \hline Mol Mol Mol Mol Mol Mol$ | | 0.567 were calculated |
| $\begin{tabular}{l l l l l l l l l l l l l l l l l l l $ | 282.95 0.908 | 0.476 by the compiler. |
| $\begin{array}{c} 296.15 \\ 296.55 \\ 296.55 \\ 0.688 \\ 0.408 \\ 0.408 \\ \hline \end{array}$ Smoothed Data: For use between 203.15 and 293.15 K. In $x_1 = 8.308 - 9.080/(T/100K) - 5.635 ln (T/100K) \\ \hline \\ Standard error about the regression line is 9.71 x 10^{-3} \\ \hline \hline \\ \hline \\ Mol Ratio Mol Fraction Mol Fraction \\ \hline \\ Mol Ratio Mol Fraction Mol Fraction \\ \hline \\ \hline \\ Mol Ratio Mol Fraction \\ \hline \\ Mol Ratio Mol Fraction \\ \hline \\ Mol Fraction \\ \hline \\ \hline \\ 203.15 \\ 21$ | | |
| Smoothed Data: For use between 203.15 and 293.15 K. In $x_1 = 8.308 - 9.080/(T/100K) - 5.635 ln (T/100K) Standard error about the regression line is 9.71 x 10-3 T/K Author's Smoothed Data Compiler's Eqn. Mol Ratio Mol Fraction Mol Fraction n_1/n_2 x_1 x_1203.15 6.00 0.857 0.805213.15 2.45 0.710 0.753233.15 2.45 0.710 0.700243.15 0.649253.15 1.45 0.592 0.599263.15 0.427The bubbler-tube technique describedby Gerrard, Mincer, and Wyvill (1)Was used. For temperatures between303 and 253 an LBI thermostat con-tained within ±1 K. For 273.15 K itwas used.For temperatures below 273.15 K itwas assumed that the loss of solventby entrainment could be ignored.After saturation at a recordedtemperature, the temperature wascovered by 10 K and pyridine wascarefully added drop-wise to fix thehydrogen chloride as the pyridiniumsalt. After treatment with water,the chloride ion content wasdetermined by the Volhard method orStandard error about the regression line is 9.71 x 10-3Taimed with water,the chloride ion content wasGerefully added drop-wise to fix thehydrogen chloride as the pyridiniumsalt. After treatment with water,the chloride ion content wasGerefully added drop-wise to fix thehydrogen chloride was the pyridiniumsalt. After treatment with water,the chloride ion content wasGerefully added drop-wise to fix thehydrogen chloride was the pyridiniumsalt. After treatment with water,the chloride ion content wasGerefully added drop-wise to fix thehydrogen chloride was the pyridiniumsalt. After treatment with water,the chloride ion content wasGerefully added drop-wise to fix thehydrogen chloride was the pyridiniumsalt. After treatment with water,the chloride ion content wasGerefully added drop-wise to fix thehydrogen chloride was the pyridiniumsalt. After treatment with water,the chloride ion content wasGerefully added drop-wise to fix thehydrogen chloride ion content wasGerefully add$ | | |
| $\begin{array}{c c c c c c c c c c c c c c c c c c c $ | | |
| Standard error about the regression line is 9.71×10^{-3} T/K Author's Smoothed DataCompiler's Eqn. Mol FractionMol Ratio Mol FractionAdvision Mol FractionAdvision Mol FractionAdvision Mol FractionMol Ratio Mol FractionMol Ratio Mol FractionMol Ratio Mol FractionMol Ratio Mol FractionAdvision Mol FractionAdvision Mol FractionMol Mol FractionMol Mol FractionMol Mol Fractio | Smoothed Data: For use between 203 | 15 and 293.15 K. |
| Standard error about the regression line is 9.71×10^{-3} T/K Author's Smoothed DataCompiler's Eqn. Mol FractionMol Ratio Mol FractionAdvision Mol FractionAdvision Mol FractionAdvision Mol FractionMol Ratio Mol FractionMol Ratio Mol FractionMol Ratio Mol FractionMol Ratio Mol FractionAdvision Mol FractionAdvision Mol FractionMol Mol FractionMol Mol FractionMol Mol Fractio | $\ln x_1 = 8.308 - 9.08$ | 0/(T/100K) - 5.635 ln (T/100K) |
| T/KAuthor's Smoothed DataCompiler's Eqn. Mol Ratio Mol FractionMol Ratio Mol FractionMol FractionMol Fraction203.156.000.8570.856213.152.450.7100.770243.150.5920.599263.151.0750.5180.507283.150.9070.4760.4427AUXILIARY INFORMATIONMETHOD/APRANUS/FROCEDURE:The bubbler-tube technique described by Gerrard, Mincer, and Wyvill (1)MUNILIARY INFORMATIONMETHOD/APRANUS/FROCEDURE:Courte temperatures between 303 and 253 an LBI thermostat con- taining liquid paraffin was used.For temperatures less than 253 K a diury of ice and water in a vacuum flask was used.For temperatures below 273.15 K it was assumed that the loss of solvent by entrainment could be ignored. After saturation at a recorded temperature, the temperature was lowered by 10 K and pyridine was carefully added drop-wise to fix the hydrogen chloride ion content was determined by the Vollard method orESTIMATED ERROR: $& 1.253$ KISTIMATED ERROCES:1. Gerrard, W.; Mincer, A. M. A.; Wyvill, P. L. J. Appl. Chem. 1959, 9, 89. | Standard error about | the regression line is 9.71 x 10^{-3} |
| Mol Ratio Mol Fraction Mol Fraction $\frac{n_1/n_2}{203.15} \qquad x_1 \qquad $ | | |
| $\begin{array}{c ccccccccccccccccccccccccccccccccccc$ | Mol Ratio Mol | |
| $\begin{array}{cccccccccccccccccccccccccccccccccccc$ | n_1/n_2 | x1 x1 |
| $\begin{array}{c ccccccccccccccccccccccccccccccccccc$ | | |
| $\begin{array}{c} 233.15 & 2.45 & 0.710 & 0.700 \\ 243.15 & 0.649 \\ 253.15 & 1.45 & 0.592 & 0.599 \\ 263.15 & 0.518 & 0.507 \\ 263.15 & 0.907 & 0.476 & 0.466 \\ 293.15 & 0.427 \\ \hline \end{array}$ | | |
| $\begin{array}{c} 253.15 \\ 263.15 \\ 263.15 \\ 263.15 \\ 273.15 \\ 1.075 \\ 283.15 \\ 0.507 \\ 283.15 \\ 0.907 \\ 0.476 \\ 0.466 \\ 293.15 \\ 0.427 \\ \hline \end{array}$ | 233.15 2.45 (| 0.710 0.700 |
| $\begin{array}{c} 263.15 \\ 273.15 \\ 273.15 \\ 283.15 \\ 0.907 \\ 0.476 \\ 0.427 \\ \hline \\ $ | | |
| $\begin{array}{c} 283.15 \\ 293.15 \\ 293.15 \\ \hline \end{array} 0.907 \\ 0.476 \\ 0.427 \\ \hline \end{array} \\ \hline \\$ | 263.15 | 0.552 |
| $\begin{array}{c} \underline{293.15} \\ \hline \\ $ | | |
| AUXILIARY INFORMATIONMETHOD/APPARATUS/PROCEDURE:SOURCE AND PURITY OF MATERIALS:The bubbler-tube technique describedSOURCE AND PURITY OF MATERIALS:by Gerrard, Mincer, and Wyvill (1)Source and purchastwas used.For temperatures between303 and 253 an LBI thermostat con-cylinder, and dried.taining liquid paraffin was used.(2) Butyl methyl ether. PreparedFor temperatures less than 253 Kiodomethane. The ether wasaddition of small pieces of solidiodomethane. The ether wascarbon dioxide and manual stirringrigorously purified and attested.enabled the temperature to be main-iodomethane. The ether wastained within ±1 K. For 273.15 Krigorously purified and attested.For temperatures below 273.15 K itStrike ± 0.5 253 - 303 Kwas assumed that the loss of solvent $\delta T/K = \pm 0.5253 - 303 K$ by entrainment could be ignored. $\delta tr/k = 0.02$ After saturation at a recorded $\delta x_1/x_1 = 0.02$ lowered by 10 K and pyridine wasREFERENCES:carefully added drop-wise to fix theNether treatment with water,hydrogen chloride as the pyridiniumI. After treatment with water,salt. After treatment with water,J. Appl. Chem. 1959, 9, 89. | | |
| The bubbler-tube technique described by Gerrard, Mincer, and Wyvill (1) was used. For temperatures between 303 and 253 an LBI thermostat con- taining liquid paraffin was used. For temperatures less than 253 K addition of small pieces of solid carbon dioxide and manual stirring enabled the temperature to be main- tained within ±1 K. For 273.15 K a slurry of ice and water in a vacuum flask was used. For temperatures below 273.15 K it was assumed that the loss of solvent by entrainment could be ignored. After saturation at a recorded temperature, the temperature was lowered by 10 K and pyridine was carefully added drop-wise to fix the hydrogen chloride as the pyridinium salt. After treatment with water, the chloride ion content was determined by the Volhard method or | | |
| by Gerrard, Mincer, and Wyvill (1) was used. For temperatures between 303 and 253 an LBI thermostat con- taining liquid paraffin was used. For temperatures less than 253 K addition of small pieces of solid carbon dioxide and manual stirring enabled the temperature to be main- tained within ±1 K. For 273.15 K a slurry of ice and water in a vacuum flask was used. For temperatures below 273.15 K it was assumed that the loss of solvent by entrainment could be ignored. After saturation at a recorded temperature, the temperature was lowered by 10 K and pyridine was carefully added drop-wise to fix the hydrogen chloride as the pyridinium salt. After treatment with water, the chloride ion content was determined by the Volhard method or | | SOURCE AND PURITY OF MATERIALS: |
| was used. For temperatures between 303 and 253 an LBI thermostat con- taining liquid paraffin was used. For temperatures less than 253 K addition of small pieces of solid carbon dioxide and manual stirring enabled the temperature to be main- tained within ± 1 K. For 273.15 K a slurry of ice and water in a vacuum flask was used. For temperatures below 273.15 K it was assumed that the loss of solvent by entrainment could be ignored. After saturation at a recorded temperature, the temperature was lowered by 10 K and pyridine was carefully added drop-wise to fix the hydrogen chloride as the pyridinium salt. After treatment with water, the chloride ion content was determined by the Volhard method or xi = tin (2) Butyl methyl ether. Prepared from 1-butanol, sodium, and iodomethane. The ether was rigorously purified and attested. $\xi T/K = \pm 0.5 253 - 303 K$ $\xi T/K = \pm 0.02$ REFERENCES: 1. Gerrard, W.; Mincer, A. M. A.; Wyvill, P. L. J. Appl. Chem. <u>1959</u> , 9, 89. | | |
| taining liquid paraffin was used. For temperatures less than 253 K addition of small pieces of solid carbon dioxide and manual stirring enabled the temperature to be main- tained within ± 1 K. For 273.15 K a slurry of ice and water in a vacuum flask was used. For temperatures below 273.15 K it was assumed that the loss of solvent by entrainment could be ignored. After saturation at a recorded temperature, the temperature was lowered by 10 K and pyridine was carefully added drop-wise to fix the hydrogen chloride as the pyridinium salt. After treatment with water, the chloride ion content was determined by the Volhard method or (2) Butyl methyl ether. Prepared from 1-butanol, sodium, and iodomethane. The ether was rigorously purified and attested. (2) Butyl methyl ether. Prepared from 1-butanol, sodium, and iodomethane. The ether was rigorously purified and attested. $\delta T/K = \pm 0.5 \ 253 - 303 \ K = \pm 1 \ <253 \ K \ \delta x_1/x_1 = 0.02$ REFERENCES: 1. Gerrard, W.; Mincer, A. M. A.; Wyvill, P. L. J. Appl. Chem. <u>1959</u> , 9, 89. | | |
| For temperatures less than 253 K addition of small pieces of solid carbon dioxide and manual stirring enabled the temperature to be main- tained within ±1 K. For 273.15 K a slurry of ice and water in a vacuum flask was used. For temperatures below 273.15 K it was assumed that the loss of solvent by entrainment could be ignored. After saturation at a recorded temperature, the temperature was lowered by 10 K and pyridine was carefully added drop-wise to fix the hydrogen chloride as the pyridinium salt. After treatment with water, the chloride ion content was determined by the Volhard method or For temperatures below 273.15 K it was assumed that the loss of solvent by entrainment could be ignored. After saturation at a recorded temperature, the temperature was lowered by 10 K and pyridine was carefully added drop-wise to fix the hydrogen chloride ion content was determined by the Volhard method or | | (2) Butul mothul ether Prepared |
| addition of small pieces of solid carbon dioxide and manual stirring enabled the temperature to be main- tained within ± 1 K. For 273.15 K a slurry of ice and water in a vacuum flask was used. For temperatures below 273.15 K it was assumed that the loss of solvent by entrainment could be ignored. After saturation at a recorded temperature, the temperature was lowered by 10 K and pyridine was carefully added drop-wise to fix the hydrogen chloride as the pyridinium salt. After treatment with water, the chloride ion content was determined by the Volhard method or | | |
| enabled the temperature to be main- tained within ± 1 K. For 273.15 K a slurry of ice and water in a vacuum flask was used. For temperatures below 273.15 K it was assumed that the loss of solvent by entrainment could be ignored. After saturation at a recorded temperature, the temperature was lowered by 10 K and pyridine was carefully added drop-wise to fix the hydrogen chloride as the pyridinium salt. After treatment with water, the chloride ion content was determined by the Volhard method or | addition of small pieces of solid | |
| tained within ± 1 K. For 273.15 K a slurry of ice and water in a vacuum flask was used. For temperatures below 273.15 K it was assumed that the loss of solvent by entrainment could be ignored. After saturation at a recorded temperature, the temperature was lowered by 10 K and pyridine was carefully added drop-wise to fix the hydrogen chloride as the pyridinium salt. After treatment with water, the chloride ion content was determined by the Volhard method or | | rigorously purified and attested. |
| flask was used. For temperatures below 273.15 K it was assumed that the loss of solvent by entrainment could be ignored. After saturation at a recorded temperature, the temperature was lowered by 10 K and pyridine was carefully added drop-wise to fix the hydrogen chloride as the pyridinium salt. After treatment with water, the chloride ion content was determined by the Volhard method or ESTIMATED ERROR: $\delta T/K = \pm 0.5 253 - 303 K$ $\delta T/K = \pm 1 < 253 K$ $\delta x_1/x_1 = 0.02$ REFERENCES: 1. Gerrard, W.; Mincer, A. M. A.; Wyvill, P. L. J. Appl. Chem. <u>1959</u> , 9, 89. | | |
| For temperatures below 273.15 K it was assumed that the loss of solvent by entrainment could be ignored. After saturation at a recorded temperature, the temperature was lowered by 10 K and pyridine was carefully added drop-wise to fix the hydrogen chloride as the pyridinium salt. After treatment with water, the chloride ion content was determined by the Volhard method or $ESTIMATED ERROR:\delta T/K = \pm 0.5 \ 253 - 303 \ K= \pm 1 \ <253 \ K\delta x_1/x_1 = 0.02$ | | m |
| was assumed that the loss of solvent by entrainment could be ignored. After saturation at a recorded temperature, the temperature was lowered by 10 K and pyridine was carefully added drop-wise to fix the hydrogen chloride as the pyridinium salt. After treatment with water, the chloride ion content was determined by the Volhard method or | | |
| by entrainment could be ignored. After saturation at a recorded temperature, the temperature was lowered by 10 K and pyridine was carefully added drop-wise to fix the hydrogen chloride as the pyridinium salt. After treatment with water, the chloride ion content was determined by the Volhard method or $= \pm 1 < 253 \text{ K}$ $\delta x_1/x_1 = 0.02$ REFERENCES: 1. Gerrard, W.; Mincer, A. M. A.; Wyvill, P. L. J. Appl. Chem. <u>1959</u> , 9, 89. | | |
| After saturation at a recorded temperature, the temperature was lowered by 10 K and pyridine was carefully added drop-wise to fix the hydrogen chloride as the pyridinium salt. After treatment with water, the chloride ion content was determined by the Volhard method or $\delta x_1/x_1 = 0.02$ REFERENCES: 1. Gerrard, W.; Mincer, A. M. A.; Wyvill, P. L. J. Appl. Chem. <u>1959</u> , 9, 89. | | |
| lowered by 10 K and pyridine was carefully added drop-wise to fix the hydrogen chloride as the pyridinium salt. After treatment with water, the chloride ion content was determined by the Volhard method or | After saturation at a recorded | |
| carefully added drop-wise to fix the hydrogen chloride as the pyridinium salt. After treatment with water, the chloride ion content was determined by the Volhard method or | | |
| hydrogen chloride as the pyridinium salt. After treatment with water, the chloride ion content was determined by the Volhard method or | carefully added drop-wise to fix the | |
| the chloride ion content was J. Appl. Chem. <u>1959</u> , 9, 89. determined by the Volhard method or | | |
| determined by the Volhard method or | | |
| by use of an automatic titrimeter. | determined by the Volhard method or | |
| | by use of an automatic titrimeter. | |
| | | |

| OMPONENTS : | | | | EASUREMENT | |
|--|---|---------------------------------|--------------------------|---|---|
| | ogen chlori 7-01-0] | .de; HCl; | Kapoor, K. Sandbach, | P.; Luckc J. A. | ock, R. G.; |
| 2) 1-Met ether | choxybutane ; C ₅ H ₁₂ O; | or butyl methyl [628-28-4] | J. Appl. C 21, 97 - 1 | | ech. <u>1971</u> , |
| (PERIMEN | TAL VALUES | ; : | | | |
| | | ature and pres- le fraction. | | | re and mole t temperature. |
| T/K | Pressure p ₁ /mmHg | Mol Fraction $\frac{x_1}{2}$ | т/к | Pressure p _l /mmHg | Mol Fraction |
| 232.95 239.25 249.65 259.95 | 76 | 0.405 | 233.45 | 53.7 84 133 206.5 | 0.411 0.455 0.494 0.539 |
| 266.45 273.15 279.95 286.25 | 550 | | 243.85 | 142 | 0.455 |
| | 940 67.7 | 0.450 | | 217 343 760 | 0.494 0.538 0.635 |
| 253.75 | 154.2 218 306.5 366.5 | - | 256.35 | 150 250.5 372.5 565 760 | |
| 281.25 290.35 | 692.2 1003 | 0.490 | 270.25 | 273.5 444.5 656 760 | 0.452 0.491 |
| 222.35 230.35 239.35 249.15 257.85 265.05 272.15 281.55 288.55 | 83 122.5 180.5 275 399.2 526 695.5 974 1363 | 0.490 | 286.15 | 760 944 537 760 833 1210 1698 | 0.508 0.535 0.407 0.440 0.450 0.487 0.531 |
| 217.75 225.35 231.35 242.15 253.65 260.45 267.45 272.05 281.95 | 103.2 143 194.5 323.5 511.5 665.5 844.5 1003 1409 | 0.536 | | | |
| | | | | | |
| | | | mole frac | tion solub | age. Variation o ility with temp- HCl pressure. |

| Hydrogen Chionde in | Non-Aqueous Solvents 175 |
|---|--|
| COMPONENTS: | ORIGINAL MEASUREMENTS: |
| <pre>(1) Hydrogen chloride; HCl; [7647-01-0]</pre> | Ionin, M. V.; Shverina, V. G. |
| (2) 1,1'-Oxybisalkanes; $C_4 H_{10}O_7$, | Zh. Obshch. Khim. <u>1965</u> , 35, 209-211. |
| $C_6H_{14}O$, and $C_8H_{18}O$ | J. Gen. Chem. USSR (Engl. Transl.) 1965, 35, 211 - 212. |
| VARIABLES: T/K: 298.15 | PREPARED BY: |
| Total P/kPa: 101.3 (atmospheric |) W. Gerrard |
| EXPERIMENTAL VALUES: | |
| T/K Refractive Solution | Mol Ratio Mol Fraction |
| Index ¹ Density n_{D}^{298} ρ/g cm ⁻³ | $n_1/n_2 x_1$ |
| l,l'-Oxybisethane or diethyle | ether; C ₄ H ₁₀ O; [60-29-7] |
| 298.15 1.3523 0.8133 | 0.802 0.445 |
| 2,2'-Oxybispropane or di-isop [108-20-3] | propyl ether; C ₆ H ₁₄ O; |
| 298.15 1.3660 0.8086 | 0.799 0.444 |
| l,l'-Oxybisbutane or dibutyl [142-96-1] | ether; C ₈ H ₁₈ O; |
| 298.15 1.3966 0.8253 | 0.808 0.447 |
| ¹ Pure solvent refractive index The mole ratio values were calc | |
| AUXILIARY | INFORMATION |
| METHOD/APPARATUS/PROCEDURE: The ether was saturated with hydro- gen chloride at 298.2 K and atmospheric pressure, not specified. An aliquot of the solution was diluted with water, and titrated with alkali. | SOURCE AND PURITY OF MATERIALS: (1) Hydrogen chloride. Prepared from "chemically pure" sodium chloride and sulfuric acid; and was dried by sulfuric acid and anhydrous calcium chloride. (2) 1,1'-Oxybisalkanes. The ethyl and 2-propyl ethers were "pure" grade materials, freed from peroxy compounds, dried with sodium and distilled. The butyl ether was self prepared. |
| | ESTIMATED ERROR: |
| | REFERENCES : |

į

| COMPONENT | `S: | | ORIGINAI | L MEASUREME | INTS : | | |
|--|--|-------------------------------------|--------------------|--|---|--|--|
| (1) Hyd [76 | lrogen chlo 547-01-0] | oride; HCl; | Kapoor, Sand | Kapoor, K. P.; Luckcock, R. G.; Sandbach, J. A. | | | |
| (2) 1-E eth | Sthoxybutan her; C ₆ H ₁₄ C | e or butyl ethyl ; [628-81-9] | J. Appl 21, 97 | J. Appl. Chem. Biotech. <u>1971</u> , 21, 97 - 100. | | | |
| EXPERIM | IENTAL VALU | ES: | | | | | |
| Variati sure at | on of temp constant | erature and pres- mole fraction. | Variati fractic | on of pres | sure and mole ant temperature. | | |
| т/к | Pressure p1/mmHg | Mol Fraction x1 | т/к | Pressure p ₁ /mmHg | Mol Fraction x ₁ | | |
| 243.05 251.05 | 91 132.5 205.7 | 0.430 | 233.45 | 26.1 51.9 92.0 189.2 760 | 0.490 | | |
| 279.35 286.25 293.05 299.25 | 408.5 562.5 743.2 977 | 0.484 | 243.85 | 56.6 102.5 175 336 760 | 0.440 0.490 0.539 0.601 0.685 | | |
| 233.85 242.35 250.15 258.15 265.05 273.15 280.55 | 94.2 144 229.5 326 482 | 0.484 | 256.35 | 123 206.5 334 696 760 | 0.439 0.489 0.538 0.599 0.626 | | |
| 286.55 | | 0.535 | 270.25 | 257 419 638 760 1038 | 0.437 0.487 0.536 0.555 0.596 | | |
| 256.45 265.15 273.15 | 334 510 735 1060 | | 285.65 | 551 760 963 1036 | 0.433 0.470 0.480 0.532 | | |
| 233.05 239.15 247.45 255.15 262.15 268.15 273.15 | 195 266.7 400 565.7 757.8 957 1156 | 0.597 | | | | | |
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| | | | | | | | |
| | | | mole fra | | page. Variation of temperature at | | |

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| COMPONENTS: | ORIGINAL MEASUREMENTS: | | |
| <pre>(1) Hydrogen chloride; HCl; [7647-01-0]</pre> | Kapoor, K. P.; Luckcock, R. G.; Sandbach, J. A. | | |
| (2) Butyl ethyl ether; C ₆ H ₁₄ O; [628-81-9] | J. Appl. Chem. Biotech. <u>1971</u> , 21, 97 - 100. | | |
| | | | |
| VARIABLES: | PREPARED BY: | | |
| T/K: 205.15 - 297.15 | | | |
| Total P/kPa: 101.325 (1 atm) | W. Gerrard | | |
| | (smoothed data calculated by H.L. Clever) | | |
| EXPERIMENTAL VALUES: T/K Mol Rat | | | |
| n1/n2 | ^x 1 | | |
| 205.15 5.75 | 0.852 | | |
| 213.15 4.31 | 0.812 The mole fraction | | |
| 217.65 4.24 | 0.809 solubility values | | |
| 232.15 2.95 | | | |
| 245.95 2.17 | 0.685 by the compiler. | | |
| | 0.683 | | |
| | | | |
| 281.45 1.000 282.15 0.996 | | | |
| 282.15 0.996 285.65 0.919 | | | |
| 297.15 0.716 | | | |
| Smoothed Data: For use between 203.1 | 5 and 283.15 K. | | |
| | | | |
| | 65/(T/100K) - 9.460 ln (T/100K) | | |
| The standard error about the | regression line is 6.90×10^{-3} | | |
| | Data Compiler's Eqn. | | |
| | ction Mol Fraction | | |
| n_{1}/n_{2} x_{1} | <i>x</i> 1 | | |
| 203.15 6.15 0.860 | | | |
| 213.15 | 0.823 | | |
| 223.15 | 0.790 | | |
| 233.15 2.93 0.746 | 0.747 | | |
| 243.15 | 0.698 | | |
| 253.15 1.90 0.655 | | | |
| 263.15 | 0.592 | | |
| 273.15 1.150 0.535 | | | |
| 283.15 0.965 0.491 | 0.489 | | |
| AUXILIARY | INFORMATION | | |
| METHOD APPARATUS/PROCEDURE: | SOURCE AND PURITY OF MATERIALS: | | |
| The bubbler-tube technique described | (1) Hydrogen chloride. A good | | |
| by Gerrard, Mincer, and Wyvill (1) | specimen was obtained from a | | |
| was used. For temperatures between | cylinder, and dried. | | |
| 303 and 253 an LBI thermostat | | | |
| containing liquid paraffin was used. | (2) Butyl ethyl ether. Prepared | | |
| For temperatures less than 253 K | from alcohol, sodium, and | | |
| addition of small pieces of solid | alkyl bromide. The ether was | | |
| carbon dioxide and manual stirring | rigorously purified and attested. | | |
| enabled the temperature to be main- tained with in + 1 K. For 273.15 K | | | |
| a slurry of ice and water in a vacuum | | | |
| flask was used. | | | |
| For temperatures below 273.15 K it | | | |
| was assumed that the loss of solvent | ESTIMATED ERROR: | | |
| by entrainment could be ignored. | $\delta T/K = \pm 0.5 253 - 303 K$ | | |
| After saturation at a recorded | $= \pm 1$ < 253 K | | |
| temperature, the temperature was | $\delta x_1 / x_1 = 0.01$ | | |
| lowered by 10 K and pyridine was | | | |
| carefully added drop-wise to fix the | REFERENCES: | | |
| hydrogen chloride as the pyridinium | 1. Gerrard, W.; Mincer, A. M. A.; | | |
| salt. After treatment with water, | Wyvill, P. L. | | |
| the chloride ion content was | J. Appl. Chem. <u>1959</u> , 9, 89. | | |
| determined by the Volhard method or | | | |
| by use of an automatic titrimeter. | | | |
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| COMPONENTS : | | ORIGINAL MEASUREMENTS: | | | |
|--|--------------------------------|---|---|---|--|
| <pre>(1) Hydrogen chloride; HCl; [76,47-01-0]</pre> | | | Perkin, W. H. | | |
| <pre>(2) 1,1'-Oxybis[3-methylbutane] or diisoamyl ether; C₁₀H₂₂O; [544-01-4]</pre> | | J. (| Chem. Soc. <u>1</u> | <u>894</u> , <i>65</i> , 20 - 28. | |
| VARIABLES: T/K: 273.15 - | 208 15 | PREPAR | ED BY: | | |
| | | | W. Ge | rrard | |
| p/kPa: 101.3 (a | thospheric :) | (smo | othed data cald | culated by H.L. Clever) | |
| EXPERIMENTAL VALUES: | | | | | |
| Temperature t/ C T/K | Hydrogen Chlo Weight per ce | | Mol Ratio | Mol Fraction | |
| | Weighing Tit | ration | n1/n2 | x1 | |
| | | | 1.00 | 0.500 | |
| 0 273.15 5 278.15 | | .70 | 1.00 0.892 | 0.500 0.472 | |
| 9 282.15 | 16.28 16 | .26 | 0.843 | 0.458 | |
| 13 286.15 | 15.05 15 | .40 | 0.791 | 0.442 | |
| 15 288.15 | | .91 | 0.761 0.569 | 0.432 0.362 | |
| 25 298.15 | 11.27 11 | . 30 | 0.505 | 0.302 | |
| the weighing values. The mole ratio and mole fraction the titration weight per cents Smoothed Data: $\ln x_1 = 98.038$ Standard error about the regard | | on val by th -132 ressio Mol Fr 27 0.4 0.4 0.3 r INFORM SOURCE he (1) (2) | ues were cal e compiler. .498/(T/100K n line is 5. action 96 56 97 ATION E AND PURITY OF Hydrogen chl | <pre>7) - 49.990 ln(T/100K) 70 x 10⁻³.</pre> | |
| titrating with alkali. The author states that in the two values is d ization of solvent dur | the different ue to evapor- | | ATED ERROR: | | |
| bubbling process. | | | | | |
| The pressure was not s appears to have been a | | | | | |
| | | REFER | ENCES: | | |
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| nyarogen omoriae m | Non-Aqueous Solvents |
|---|---|
| COMPONENTS: (1) Hydrogen chloride; HCl; [7647-01-0] | ORIGINAL MEASUREMENTS: Matuszak, M. P. U. S. Patent 2,520,947 |
| <pre>(2) 1,1'-Oxybis[3-methyl butane] or diisoamyl ether; C₁₀H₂₂O; [544-01-4]</pre> | |
| VARIABLES: T/K = 297.6 p/kPa = 99.59 (747 mmHg) | PREPARED BY: W. Gerrard |
| EXPERIMENTAL VALUES: | |
| Temperature Pressure HCL A t/°F T/K p/mmHg g HCL | Absorbed ¹ Mol Ratio Mol Fraction per 100 n_1/n_2 x_1 |
| | 0.0 0.435 0.303 |
| ¹ The author's statement was " oxycompound." | HCl absorbed, weight per cent of |
| | |
| AUXILIARY | INFORMATION |
| ME THOD / AP PARATUS / PROCEDURE : | SOURCE AND PURITY OF MATERIALS: |
| No information. | No information. |
| | ESTIMATED ERROR: REFERENCES: |
| | |

| 180 Hydrogen Chloride in | Non-Aqueous Solvents |
|---|---|
| COMPONENTS : | ORIGINAL MEASUREMENTS: |
| <pre>1. Hydrogen chloride; HCl; [7647-01-0]</pre> | Ahmed, W.; Gerrard, W.; Maladkar, V. K. |
| 2. l,l'-Oxybisoctane or Dioctyl ether; C _{l6} H ₃₄ O; [629-82-3] | J. Appl. Chem. <u>1970</u> , 20, 109 - 115. |
| VARIABLES: | PREPARED BY: |
| T/K: 253.15 - 293.15 | W. Gerrard |
| Total P/kPa: 101.325 (1 atm) | (smoothed data calculated by H.L. Clever) |
| EXPERIMENTAL VALUES: | |
| T/K Mol Ra | tio Mol Fraction |
| ⁿ HCl/ ⁿ C ₁ | 6 ^H 34 ^O X _{HCl} |
| 253.15 1.70 | |
| 263.15 1.35 | 0.574 |
| 273.15 1.06 283.15 0.88 | |
| 293.15 0.68 | |
| The mole fraction solubilities were c compiler. | alculated from the mole ratio by the |
| Smoothed Data: ln X _{HCl} = 24.890 - 30 | .734/(T/100) - 14.226 ln (T/100) |
| Standard error about | regression line = 4.85×10^{-3} |
| T/K | Mol Fraction |
| | X _{HC1} |
| 253.15 | 0.629 |
| 263.15 - 273.15 | 0.575 0.519 |
| 283.15 | 0.463 |
| 293.15 | 0.409 |
| | |
| | |
| AUXILIARY | INFORMATION |
| METHOD / APPARATUS / PROCEDURE : | SOURCE AND PURITY OF MATERIALS: |
| Hydrogen chloride was passed into a | 1. Hydrogen chloride. Obtained from |
| known weight of liquid in a bubbler tube at a total pressure measured by | a cylinder containing a good com- mercial specimen. Was dried by |
| a manometer assembly. The absorbed gas was weighed by re-weighing the | passage through concentrated sulfuric acid. |
| bubbler tube. The temperature was | 2. Best obtainable specimen was |
| manually controlled to within 0.2 K. The procedure and apparatus are | suitably purified, dried, and |
| described by Gerrard (1,2). | fractionally distilled, and attested. |
| For temperatures below 268 K, a chemical titration was conducted. | |
| chemical electron was conducted. | |
| | ESTIMATED ERROR: $\delta T/K = 0.2$ |
| | $\delta x/x = 0.01$ |
| | |
| | REFERENCES : |
| | 1. Gerrard W. J. Appl. Chem. Biotechnol. <u>1972</u> , |
| | 22, 623 - 650. |
| | 2. Gerrard, W. "Solubility of Gases and Liquids" Plenum Press, New York, 1976 |
| | |

| COMPONENTS : | ORIGINAL MEASUREMENTS: |
|---|---|
| <pre>(1) Hydrogen chloride; HCl; [7647-01-0]</pre> | O'Brien, S. J. |
| (2) Methoxybenzene or anisole; C ₇ H ₈ O; [100~66-3] | J. Am. Chem. Soc. 1942, 64, 951 - 953. |

EXPERIMENTAL VALUES:

| т/к | Pressure P1/mmHg | Molality m _l /mol kg ⁻¹ | Henry's Constant | Mol Ratio | Mol Fraction |
|--------|---------------------|--|----------------------|-----------|----------------------|
| | ± | | <u>k¹</u> | م ح | |
| 293.15 | 30.3 | 0.0378 | 1.05 | 0.0041 | 0.0041 |
| | 66.7 | 0.0926 | 0.95 | 0.0100 | 0.0099 |
| | 70.7 | 0.100 | 0.93 | 0.0108 | 0.0107 |
| | 82.7 | 0.109 | 0.99 | 0.0118 | 0.0116 |
| | (760 | | 0.97 av. | 0.111 | 0.100) ² |
| 303.15 | 52.7 | 0.059 | 1.18 | 0.00637 | 0.00633 |
| | 66 | 0.073 | 1.21 | 0.00788 | 0.00782 |
| | 85 | 0.092 | 1.22 | 0.00994 | 0.00984 |
| | 168 | 0.180 | 1.23 | 0.0194 | 0.0191 |
| | 181 | 0.200 | 1.19 | 0.0216 | 0.0211 |
| | 408 | 0.448 | 1.20 | 0.0484 | 0.0461 |
| | (760 | | 1.21 av. | 0.0892 | 0.0819) ² |
| 308.15 | 45.9 | 0.0449 | 1.34 | 0.00485 | 0.00483 |
| | 72.0 | 0.0720 | 1.31 | 0.00778 | 0.00772 |
| | 77.8 | 0.0764 | 1.34 | 0.00825 | 0.00762 |
| | 250 | 0.250 | 1.31 | 0.0270 | 0.0263 |
| | 264 | 0.253 | 1.37 | 0.0273 | 0.0266 |
| | 410 | 0.400 | 1.35 | 0.0432 | 0.0414 |
| | (760 | | 1.34 av. | 0.0806 | 0.0746) ² |
| 313.15 | 61.8 | 0.0463 | 1.56 | 0.00500 | 0.00498 |
| | 82.3 | 0.0735 | 1.48 | 0.00793 | 0.00787 |
| | 98.8 | 0.0887 | 1.46 | 0.00958 | 0.00949 |
| | 106 | 0.0929 | 1.61 | 0.0100 | 0.0099 |
| | 216 | 0.179 | 1.59 | 0.0193 | 0.0190 |
| | (760 | | 1.54 av. | 0.0701 | 0.0655) ² |

¹ k/atm mol⁻¹ kg = $(p_1/atm)/(m_1/mol kg^{-1})$

 2 Value calculated by the compiler from the average value of Henry's constant, assuming a linear function of $p_1\ vs.\ m_1$, as the original author appeared to imply.

Note: The molality, m_1 , is essentially a *mole ratio* form. If linear for this, *not* linear for mole fraction, except in the limit of infinite dilution.

| COMPONENTS: | ORIGINAL MEASUREMENTS: |
|---|--|
| (1) Hydrogen chloride; HCl; | O'Brien, S. J. |
| <pre>[7647-01-0] (2) Methoxybenzene or anisole; C₇H₈O; [100-66-3]</pre> | J. Am. Chem. Soc. <u>1942</u> ,64, 951 - 953. |
| -7-8-7 | |
| | |
| VARIABLES: | PREPARED BY: |
| T/K: 293.15 - 313.15 P/kPa: 4.04 - 54.66 | W. Gerrard |
| (30.3 - 410 mmHg) | |
| EXPERIMENTAL VALUES: | |
| | |
| See prec | eeding page. |
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| AUXILIARY | INFORMATION |
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| METHOD/APPARATUS/PROCEDURE: The method and apparatus are those of | SOURCE AND PURITY OF MATERIALS: (1) Hydrogen chloride. Prepared |
| Saylor (1) as modified by O'Brien et | from chemically pure potassium |
| al. (2). The main difference is the | chloride and sulfuric acid. |
| use of a 1 to 2 day instead of a 5 to 7 day equilibration time. | Dried by phosphorus pentoxide. |
| , day equilibration time. | (2) Anisole. Eastman Kodak Co. |
| The apparatus consists of two bulbs | Dried and distilled. |
| which are separated by a tap. The solvent is partially saturated with | |
| the gas, and the solution added to | |
| the lower bulb. The bulbs are | |
| partially evacuated, the tap opened, and the whole apparatus put in a | |
| thermostat from 1 to 2 days. | ESTIMATED ERROR: |
| _ | tm/r = 0.00 |
| The tap is closed. The HCl in the upper bulb is quantitatively removed | $\delta T/K = 0.02$ |
| and titrated with NaOH. The HCl | |
| partial pressure is calculated from | REFERENCES: |
| the bulb volume and the number of moles of HCl assuming ideal gas | 1. Saylor, J. H. J. Am. Chem. Soc. <u>1937</u> , 59, 1712. |
| behavior. A weighed solution sample | |
| is removed from the lower bulb and titrated with NaOH. | 2. O'Brien, S. J.; Kenny, C. L. Zeurcher, R. A. |
| LILLACEU WICH NAUN. | J. Am. Chem. Soc. 1939, 61, 2504. |
| | |

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| COMPONENTS: | OPTOTNAL WEACUPENERS | | |
|--|--|--|--|
| | ORIGINAL MEASUREMENTS: | | |
| <pre>(1) Hydrogen chloride; HCl; [7647-01-0]</pre> | O'Brien, S. J.; King, C. V. | | |
| <pre>(2) Ethoxybenzene or ethyl phenyl ether or phenetole; C₈H₁₀O; [103-73-1]</pre> | J. Am. Chem. Soc. <u>1949</u> , 71, 3632 - 3634. | | |
| VARIABLES: T/K: 283.15 - 298.15 P/kPa: 101.325 (1 atm) | PREPARED BY: W. Gerrard | | |
| EXPERIMENTAL VALUES: | | | |
| T/K Henry's M Constant ¹ k | ol Ratio Mol Fraction $n_1/n_2 \qquad \qquad$ | | |
| 283.15 0.70 ± 0.03 | 0.178 0.151 0.174 ² 0.148 ² | | |
| 293.15 0.90 ± 0.01 | 0.136 0.120 0.136 ² 0.119 ² | | |
| 298.15 1.02 ± 0.04 | 0.120 0.107 | | |
| at pressures below one-ha The Henry's constant value | ents were probably carried out If atm partial pressure of HCL. is are the mean of from 2 to 6 verage deviation of the mean. | | |
| AUXILIARY | INFORMATION | | |
| METHOD / APPARATUS / PROCEDURE : | SOURCE AND PURITY OF MATERIALS: | | |
| The method and apparatus are those of Saylor (1) as modified by O'Brien et | 1 | | |
| al. (2). The main difference is the use of a 1 to 2 day instead of a 5 to 7 day equilibration time. The apparatus consists of two bulbs which are separated by a tap. The solvent is partially saturated with the gas, and the solution is added to the lower bulb. The bulbs are partially evacuated, the tap opened, | chloride and sulfuric acid as in previous work (2). (2) Ethoxybenzene. Eastman Kodak Co. Dried and distilled. | | |
| al. (2). The main difference is the use of a 1 to 2 day instead of a 5 to 7 day equilibration time. The apparatus consists of two bulbs which are separated by a tap. The solvent is partially saturated with the gas, and the solution is added to the lower bulb. The bulbs are | Probably prepared from potassium chloride and sulfuric acid as in previous work (2). (2) Ethoxybenzene. Eastman Kodak Co. Dried and distilled. | | |

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| COMPONENTS: (1) Hydrogen chloride; HCl; [7647-01-0] | ORIGINAL MEASUREMENTS: O'Brien, S. J.; King, C. V. J. Am. Chem. Soc. <u>1949</u> , 71, 3632 - 3634. | | |
|--|--|--|--|
| <pre>(2) Butoxybenzene or butyl phenyl ether; C₁₀H₁₄O; [1126-79-0]</pre> | | | |
| VARIABLES: T/K: 293.15, 298.15 P/kPa: 101.325 (1 atm) | PREPARED BY: W. Gerrard | | |
| EXPERIMENTAL VALUES: | | | |
| T/K Henry's M Constant ¹ k | Nol Ratio Mol Fraction $n_1/n_2 $ | | |
| 293.15 1.21 <u>+</u> 0.05 | 0.124 0.110 | | |
| 298.15 1.37 <u>+</u> 0.04 | 0.111 0.100 0.109 ² 0.0987 ² | | |
| 1 k/atm mol ⁻¹ kg = (p ₁ /at | | | |
| ² Values as recalculated | l by the compiler. | | |
| All of the mole ratio va the compiler. | lues were calculated by | | |
| The experimental measurements were probably carried out at pressures below one-half atm partial pressure of HCl. The Henry's constant values are the mean of from 2 to 6 values followed by the average deviation of the mean. | | | |
| From the slope of log x_1 vs. l/T. The enthalpy of solution is -3.78 kcal mol ⁻¹ (-15.82 kJ mol ⁻¹). | | | |
| | | | |
| AUXILIARY | INFORMATION | | |
| METHOD/APPARATUS/PROCEDURE: The method and apparatus are those of Saylor (1) as modified by O'Brien et al. (2). The main difference is the use of a 1 to 2 day instead of a 5 to 7 day equilibration time. The apparatus consists of two bulbs which are separated by a tap. The solvent is partially saturated with the gas, and the solution is added to the lower bulb. The bulbs are partially evacuated, the tap opened, | SOURCE AND PURITY OF MATERIALS: (1) Hydrogen chloride. Not stated. Probably prepared from potassium chloride and sulfuric acid as in previous work (2). (2) Butoxybenzene. Eastman Kodak Co Dried and distilled. | | |
| and the whole apparatus put in a thermostat from 1 to 2 days. The tap is closed. The HCl in the | ESTIMATED ERROR: | | |
| upper bulb is quantitatively removed and titrated with NaOH. The HCl partial pressure is calculated from the bulb volume and the number of moles of HCl assuming ideal gas behavior. A weighed solution sample is removed from the lower bulb and titrated with NaOH. | <pre>&T/K = 0.02 REFERENCES: 1. Saylor, J. H. J. Am. Chem. Soc. <u>1937</u>, 59, 1712 2. O'Brien, S. J.; Kenny, C. L. Zeurcher, R. A. J. Am. Chem. Soc. <u>1939</u>, 61, 2504</pre> | | |

| nydrogen Chibride III | Non-Aqueous Solvenis 185 | |
|---|---|--|
| <pre>COMPONENTS: (1) Hydrogen chloride; HCl; [7647-01-0] (2) 1,1'-Oxybisbenzene or diphenyl ether; C₁₂H₁₀O; [101-84-8]</pre> | ORIGINAL MEASUREMENTS: O'Brien, S. J.; King, C. V. J. Am. Chem. Soc. <u>1949</u> , 71, 3632 - 3634. | |
| VARIABLES: T/K: 298.15, 303.15 P/kPa: 101.325 (1 atm) | PREPARED BY: W. Gerrard | |
| EXPERIMENTAL VALUES: | | |
| T/K Henry's Constant ¹ k | Mol Ratio Mol Fraction $\frac{n_1}{n_2}$ $\frac{x_1}{x_1}$ | |
| 298.15 3.33 <u>+</u> 0.07 | 0.0520 0.0494 0.0511 ² 0.0486 ² | |
| 303.15 3.52 <u>+</u> 0.01 | 0.0462 0.0442 0.0482 ² 0.0461 ² | |
| ¹ k/atm mol ⁻¹ kg = (p ₁ /a | $tm)/(m_1/mol kg^{-1})$ | |
| ² Values as recalculate | ed by the compiler. | |
| All of the mole ratio w the compiler. | values were calculated by | |
| The experimental measurements were probably carried out at pressures below one-half atm partial pressure of HC1. The Henry's constant values are the mean of from 2 to 6 values followed by the average devia- tion of the mean. From the slope of $\log x_1 vs. 1/T$. The enthalpy of solution is -3.80 kcal mol ⁻¹ (-15.90 kJ mol ⁻¹). | | |
| AUXILIARY | INFORMATION | |
| METHOD/APPARATUS/PROCEDURE: The method and apparatus are those of Saylor (1) as modified by O'Brien <i>et</i> al. (2). The main difference is the use of a 1 to 2 day instead of a 5 to 7 day equilibration time. The apparatus consists of two bulbs which are separated by a tap. The solvent is partially saturated with the gas, and the solution is added to the lower bulb. The bulbs are | (2) 1,1'-Oxybisbenzene. Eastman Kodak Co. Dried and distilled. | |
| partially evacuated, the tap opened, and the whole apparatus put in a thermostat from 1 to 2 days. | ESTIMATED ERROR: | |
| The tap is closed. The HCl in the upper bulb is quantitatively removed and titrated with NaOH. The HCl partial pressure is calculated from the bulb volume and the number of moles of HCl assuming ideal gas behavior. A weighed solution sample is removed from the lower bulb and titrated with NaOH. | δT/K = 0.02 REFERENCES: Saylor, J. H. J. Am. Chem. Soc. <u>1937</u>, 59, 1712. O'Brien, S. J.; Kenny, C. L. Zeurcher, R. A. J. Am. Chem. Soc. <u>1939</u>, 61, 2504. | |

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| ORIGINAL MEASUREMENTS: Matuszak, M. P. | | | | |
|---|--|--|--|--|
| U. S. Patent 2,520,947 September 5, <u>1950</u> Chem. Abstr. <u>1950</u> , 44, 11044g | | | | |
| | | | | |
| PREPARED BY: W. Gerrard | | | | |
| | | | | |
| sorbed ¹ Mol Ratio Mol Fraction per 100 $n_1/n_2 = x_1$ | | | | |
| 63 0.0294 0.0286 | | | | |
| The mole ratio and mole fraction values were calculated by the compiler. | | | | |
| INFORMATION | | | | |
| SOURCE AND PURITY OF MATERIALS: | | | | |
| No information. | | | | |
| ESTIMATED ERROR: REFERENCES: | | | | |
| | | | | |

| MDONENTS . | | | | | |
|--|----------------------|---|----------------------------|--------------------------------|---------------------|
| OMPONENTS : | | ORIGINAL | ORIGINAL MEASUREMENTS: | | |
| Hydrogen chloride; HCl; [7647-01-0] 1,1'Oxybis[2-chloroethane]; C₄H₈Cl₂O; [111-44-4] | | O'Brien, S. J. | | | |
| | | J. Am. Chem. Soc. 1942, 64, 951 - 953. | | | |
| XPERIMENTAL | VALUES. | | | | |
| T/K | Pressure | Molality | Henry's | Mol Ratio | Mol Fraction |
| | p ₁ /mmHg | m ₁ /mol kg ⁻¹ | Constant k ¹ | ⁿ 1 ^{/n} 2 | x1 |
| 293.15 | 23.7 | 0.0419 | 0.75 | 0.0060 | 0.0060 |
| | 53 | 0.090 | 0.78 | 0.0129 | 0.0127 |
| | 103 | 0.168 | 0.81 | 0.0240 | 0.0235 |
| | 109 | 0.182 | 0.79 | 0.0260 | 0.0254 |
| | 116 | 0.198 | 0.78 | 0.0283 | 0.0275 |
| | 122 | 0.202 | 0.80 | 0.0289 | 0.0281 |
| | 186 | 0.305 | 0.80 | 0.0436 | 0.0418 |
| | 287 | 0.481 | 0.79 | 0.0688 | 0.0644 |
| | 533 | 0.794 | 0.88 | 0.114 | 0.102 |
| | (760 | | 0.82 av | . 0.174 | 0.149) ² |
| 298.15 | 6.6 | 0.0091 | 0.95 | 0.00130 | 0.00130 |
| | 38.1 | 0.0572 | 0.88 | 0.00818 | 0.00811 |
| | 54.3 | 0.0758 | 0.94 | 0.01084 | 0.01073 |
| | 68.3 | 0.103 | 0.87 | 0.0147 | 0.0145 |
| | 84 | 0.126 | 0.88 | 0.0180 | 0.0177 |
| | 94 | 0.140 | 0.88 | 0.0200 | 0.0196 |
| | 124 | 0.165 | 0.99 | 0.0236 | 0.0231 |
| | 124 | 0.175 | 0.94 | 0.0250 | 0.0244 |
| | 215 365 | 0.308 0.502 | 0.92 0.96 | 0.0440 0.0718 | 0.0422 |
| | 363 | 0.518 | 0.92 | 0.0741 | 0.0670 0.0690 |
| | 378 | 0.538 | 0.93 | 0.0769 | 0.0714 |
| | 413 | 0.555 | 0.98 | 0.0794 | 0.0735 |
| | 401 | 0.556 | 0.95 | 0.0795 | 0.0737 |
| | 418 | 0.571 | 0.96 | 0.0817 | 0.0755 |
| | (760 | | 0.94 av | . 0.152 | 0.132) ² |
| 303.15 | 17.2 | 0.0224 | 1.00 | 0.00320 | 0.00319 |
| | 25.6 | 0.0292 | 1.15 | 0.00418 | 0.00416 |
| | 260 | 0.343 | 1.00 | 0.0490 | 0.0468 |
| | 283 | 0.366 | 1.02 | 0.0523 | 0.0497 |
| | (760 | | 1.03 av. | | 0.122) ² |
| 313.15 | 70.9 | 0.0711 | 1.31 | 0.0102 | 0.0101 |
| | 160 | 0.165 | 1.28 | 0.0236 | 0.0231 |
| | 177 | 0.166 | 1.41 | 0.0237 | 0.0232 |
| | 307 | 0.265 | 1.52 | 0.0379 | 0.0365 |
| | 307 | 0.291 | 1.37 | 0.0416 | 0.0400 |
| | (760 | | 1.40 av. | | $0.0927)^{2}$ |
| | (700 | | 1.40 aV. | . 0.1021 | 0.0927) |

¹ k/atm mol⁻¹ kg = $(p_1/atm)/(m_1/mol kg^{-1})$

² Value calculated by the compiler from the average value of Henry's constant, assuming a linear function of p_1 vs. m_1 , as the original author appeared to imply.

The compiler calculated the values of mole ratio and mole fraction.

Another name for the solvent is 2,2'-dichloroethyl ether.

Note: Henry's constant. The molality is essentially of a *mole ratio* form. If linear for this, *not* linear for mole fraction, except in the limit of infinite dilution.

| 188 Hydrogen Chloride in F | |
|---|---|
| <pre>COMPONENTS: (1) Hydrogen chloride; HCl; [7647-01-0] (2) 1,1'Oxybis[2-chloroethane]; C₄H₈Cl₂O; [111-44-4]</pre> | ORIGINAL MEASUREMENTS: O'Brien, S. J. J. Am. Chem. Soc. <u>1942</u> , 64, 951 - 953. |
| VARIABLES: T/K: 293.15 - 313.15 P/kPa: 0.88 - 71.06 (6.6 - 533 mmHg) | PREPARED BY: W. Gerrard |
| EXPERIMENTAL VALUES: | eding page |
| | |
| | |
| | |
| | |
| AUXILIARY | INFORMATION |
| METHOD/APPARATUS/PROCEDURE: The method and apparatus are those of Saylor (1) as modified by O'Brien <i>et</i> <i>al.</i> (2). The main difference is the use of a 1 to 2 day instead of a 5 to 7 day equilibration time. | SOURCE AND PURITY OF MATERIALS: (1) Hydrogen chloride. Prepared from chemically pure potassium chloride and sulfuric acid. Dried by phosphorus pentoxide. |
| The apparatus consists of two bulbs which are separated by a tap. The solvent is partially saturated with the gas, and the solution added to the lower bulb. The bulbs are partially evacuated, the tap opened, | <pre>(2) 1,1'-Oxybis[2-chloroethane]. Eastman Kodak Co. Dried and distilled.</pre> |
| and the whole apparatus put in a thermostat from 1 to 2 days. | ESTIMATED ERROR: |
| The tap is closed. The HCl in the upper bulb is quantitatively removed and titrated with NaOH. The HCl partial pressure is calculated from the bulb volume and the number of moles of HCl assuming ideal gas behavior. A weighed solution sample is removed from the lower bulb and titrated with NaOH. | <pre>6T/K = 0.02 REFERENCES: 1. Saylor, J. H. J. Am. Chem. Soc. <u>1937</u>, 59, 1712. 2. O'Brien, S. J.; Kenny, C. L. Zeurcher, R. A. J. Am. Chem. Soc. <u>1939</u>, 61, 2504.</pre> |

| COMPONENTS: | ORIGINAL MEASUREMENTS: | | |
|--|---|--|--|
| <pre>(1) Hydrogen chloride; HCl; [7647-01-0]</pre> | Matuszak, M. P. | | |
| (2) 1,4-Dioxane; C ₄ H ₈ O ₂ ; [123-91-1] | U. S. Patent 2,520,947 September 5, <u>1950</u> Chem. Abstr. <u>1950</u> , 44, 11044g | | |
| | | | |
| VARIABLES: | PREPARED BY: | | |
| T/K = 305.4 p/kPa = 99.59 (747 mmHg) | W. Gerrard | | |
| EXPERIMENTAL VALUES: | | | |
| Temperature Pressure HCl At | bsorbed ¹ Mol Ratio Mol Fraction | | |
| t/°F 7/K n/mmHg g HCl | per 100 $n_1/n_2 x_1$ | | |
| 90 305.4 747 24 | 4.5 0.592 0.372 | | |
| | | | |
| AUXILIARY | INFORMATION | | |
| METHOD /APPARATUS / PROCEDURE : | SOURCE AND PURITY OF MATERIALS: | | |
| No information. | No information. | | |
| | | | |
| | | | |
| | ESTIMATED ERROR: | | |
| | REFERENCES : | | |
| | | | |
| | | | |

| 150 | , | | Non-Aqueous Solvents | | |
|--|---------------------------|--------------------------------------|---|--|--|
| COMPONENTS : | | | ORIGINAL MEASUREMENTS: | | |
| <pre>(1) Hydrogen chloride; HCl; [7647-01-0]</pre> | | | Gerrard, W.; Mincer, A. M. A.; Wyvill, P. L. | | |
| (2) 1,1,1-Triethoxyethane; C ₈ H ₁₈ O ₃ ; [78-39-7] | | 8 ^H 18 ^O 3' | J. Appl. Chem. <u>1960</u> , 10, 115-121. | | |
| | | | | | |
| VARIABLES: | | | PREPARED BY: | | |
| | 9.15 - 314.3 | | W. Gerrard | | |
| Total P/kPa: 10 | 1.325 (1 atm | () | (smoothed data calculated by H.L. Clever) | | |
| | | | | | |
| EXPERIMENTAL VALUES: | | Mol Rati | Nol Exaction | | |
| | T/K | MOT RACE | o Mol Fraction | | |
| | | HC1 ^{/n} C8 ^H 1 | 803 | | |
| | 279.15 | 2.720 | 0.731 | | |
| | 284.35 | 2.366 | 0.703 | | |
| | 290.65 | 1.956 | 0.662 | | |
| | 296.75 304.75 | 1.501 1.053 | 0.600 0.513 | | |
| | 307.35 | 0.915 | 0.478 | | |
| | 314.35 | 0.477* | 0.323 | | |
| | 314.35 | 0.475* | 0.322 | | |
| | *A third mo probably o | | value of 0.441 was error. | | |
| The compiler cal | culated the | mole frac | tion values. | | |
| Cmanthad Datas | 1 | 205 . 427 | 240/(m/100) = 150 682 lm (m/100) | | |
| Smoothed Data: | $111 x_1 = 307.$ | 595 - 427 | $249/(T/100) - 150.683 \ln (T/100)$ | | |
| | Standard err | or about | the regression line is 2.62×10^{-2} | | |
| T/K Mol Fraction ^x 1 | | | | | |
| | | 283.15 293.15 303.15 313.15 | 0.663 | | |
| | | | | | |
| L | | AUXILIARI | INFORMATION | | |
| METHOD APPARATUS/PRO | CEDURE: | SOURCE AND PURITY OF MATERIALS: | | | |
| The liquid component was weighed in a bubbler tube. The amount of gas absorbed was determined by re- | | of gas e- | (1) Hydrogen chloride. Good specimen from a commercial cylinder was dried. | | |
| weighing to constant weight. The total pressure was barometric, very nearly 1 atm (101.325 kPa). | | | <pre>(2) 1,1,1-Triethoxyethane. Carefully purified, and purity rigorously attested.</pre> | | |
| | | | | | |
| Solvent name is ethyl orthoacetate in | | cetate in | USTIMATED EDDODA | | |
| paper, IUPAC name | | | ESTIMATED ERROR: | | |
| orthoacetate. | | | $\delta x_1 / x_1 = 0.012$ | | |
| 1 | | | | | |
| | | | REFERENCES : | | |
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| 1 | | | | | |
|] | | | | | |

| Hydrogen Chloride in Non-Aqueous Solvents 19 | | | | |
|--|--|--|--|--|
| COMPONENTS: | | ORIGINAL MEASUREMENTS: | | |
| <pre>(1) Hydrogen chloride; HCl; 7647-01-0 (2) 1,3-Benzodioxole; C₇H₆O₂; 274-09-9</pre> | | Gerrard, W.; Mincer, A. M. A.; Wyvill, P. L. | | |
| | | J. Appl. Chem. <u>1960</u> , 10, 115 - 121. | | |
| VARIABLES: | | PREPARED BY: | | |
| T/K: 273.15 Total P/kPa: 101.32 | | W. Gerrard | | |
| 10tai 1/kia. 101.52. | , | (smoothed data calculated by H.L. Clever) | | |
| EXPERIMENTAL VALUES: | | Lee | | |
| т/к | Mole Ratio M | ol Fraction | | |
| -, | ⁿ HC1/ ⁿ C7H6 ⁰ 2 | <i>x</i> 1 | | |
| 273.15 | 0.130 | 0.115 | | |
| 273.13 | 0.112 | 0.101 | | |
| 283.75 293.35 | 0.0909 0.0735 | 0.0833 0.0685 | | |
| 304.85 | 0.0571 | 0.0540 | | |
| | | | | |
| - | | ole fraction values. | | |
| Smoothed Data: ln : | $x_1 = -9.511 + 20$ | .056/(T/100 K) | | |
| The s | tandard error ab | out the regression line is 2.73 x 10^{-1} | | |
| | T/K Mol | Fraction | | |
| | | <i>x</i> ₁ | | |
| | 273.15 | 0.114 | | |
| | 283.15 | 0.0882 | | |
| | | 0.0693 0.0553 | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | AUXILIARY | INFORMATION | | |
| METHOD/APPARATUS/PROCEDURE | : | SOURCE AND PURITY OF MATERIALS: | | |
| The liquid component | | (1) Hydrogen chloride. Good specime | | |
| a bubbler tube. The amount of gas absorbed was determined by re- | | from a commercial cylinder was dried. | | |
| weighing to constant weight. The | | | | |
| total pressure was barometric, very nearly 1 atm (101.325 kPa). | | (2) 1,3-Benzodioxole. Carefully purified, and purity rigorously | | |
| | , - | attested. | | |
| | | | | |
| | | | | |
| | | | | |
| Other names for the s | | ESTIMATED ERROR: | | |
| <pre>o-phenylene methylene ether and 1,2-(methylenedioxy)benzene.</pre> | | $\delta x_1/x_1 = 0.025$ | | |
| | | 1 * * | | |
| | | REFERENCES : | | |
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|---|---|--|--|
| COMPONENTS : | ORIGINAL MEASUREMENTS: | | |
| <pre>(1) Hydrogen chloride; HCl; [7647-01-0]</pre> | Gerrard, W.; Mincer, A. M. A.; Wyvill, P. L. | | |
| (2) 2,3-Dihydro-1,4-benzodioxin; C ₈ H ₈ O ₂ ; [493-09-4] | J. Appl. Chem. <u>1960</u> , 10, 115-121. | | |
| | | | |
| VARIABLES: | PREPARED BY: | | |
| T/K: 275.95 - 303.15 | W. Gerrard | | |
| Total P/kPa: 101.325 (1 atm) | | | |
| | (smoothed data calculated by H.L. Clever) | | |
| EXPERIMENTAL VALUES: | | | |
| T/K Mol Rati | o Mol Fraction | | |
| ⁿ HCl ^{/n} C ₈ H | | | |
| 275.95 0.225 | 0.184 | | |
| 284.45 0.178 | 0.151 | | |
| 294.85 0.137 | 0.120 | | |
| 303.15 0.111 | 0.100 | | |
| | | | |
| The compiler calculated the mole fract | tion values. | | |
| Smoothed Data: $\ln x_1 = 6.173 - 1.814$, | /(T/100) - 7.102 ln (T/100) | | |
| Standard error about a | regression line is 2.85 x 10^{-4} | | |
| T/K Ma | ol Fraction | | |
| | <i>x</i> ₁ | | |
| 273.15 | 0.196 | | |
| 273:15 | 0.156 | | |
| 293.15 | 0.124 | | |
| 303.15 | 0.100 | | |
| | | | |
| | | | |
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| | | | |
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| AUXILIARY | INFORMATION | | |
| METHOD APPARATUS/PROCEDURE: | SOURCE AND PURITY OF MATERIALS: | | |
| The liquid component was weighed in | (1) Hydrogen chloride. Good specimen | | |
| a bubbler tube. The amount of gas | from a commercial cylinder was | | |
| absorbed was determined by re- weighing to constant weight. The | dried. | | |
| total pressure was barometric, very | (2) 2,3-Dihydro-1,4-benzodioxin. | | |
| nearly 1 atm (101.325 kPa). | Carefully purified, and purity | | |
| | rigorously attested. | | |
| | | | |
| | | | |
| | | | |
| | | | |
| Solvent name is o-phenylene | ESTIMATED ERROR: | | |
| dimethylene ether in paper, IUPAC | | | |
| name is 1,4-benzodioxan. | $\delta x_1 / x_1 = 0.01$ | | |
| | | | |
| | REFERENCES: | | |
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| nyarogen | | • | | |
|---|---|---|--|--|
| COMPONENTS: | | ORIGINAL MEASUREMENTS: | | |
| <pre>(1) Hydrogen chloride; HCl; [7647-01-0]</pre> | | Gerrard, W.; Mincer, A. M. A.; Wyvill, P. L. | | |
| (2) 3,4-Dihydro-2H-1,2-benzo C ₉ H ₁₀ O ₂ ; [7216-18-4] | dioxepin; | J. Appl. Chem. <u>1960</u> , 10, 115-121. | | |
| VARIABLES: | u | PREPARED BY: | | |
| T/K: 273.15 - 305.1 | .5 | W. Gerrard | | |
| Total P/kPa: 101.325 (1 atm | 1) | (smoothed data calculated by H.L. Clever) | | |
| EXPERIMENTAL VALUES: | | | | |
| | Mol Rat | io Mol Fraction | | |
| | ⁿ HC1 ^{/n} C ₉ H | $10^{\circ}2$ x_1 | | |
| 273.15 | 0.255 | | | |
| 281.05 | 0.197 | | | |
| 286.35 | 0.172 | | | |
| 294.35 305.15 | 0.142 0.108 | 0.0975 | | |
| | | | | |
| The compiler calculated the | mole frac | tion values. | | |
| | | | | |
| Smoothed Data: $\ln x_1 = -8.5$ | | | | |
| Standard err | or about | regression line is 1.19×10^{-3} | | |
| | T/K | Mol Fraction ^x 1 | | |
| | | | | |
| 273.15 283.15 293.15 303.15 | | 0.202 0.158 | | |
| | | 0.126 | | |
| | | | | |
| | 313.15 | 0.0835 | | |
| METHOD APPARATUS/PROCEDURE: The liquid component was wei a bubbler tube. The amount absorbed was determined by r weighing to constant weight. total pressure was barometri | ghed in of gas ce- The | <pre>INFORMATION SOURCE AND PURITY OF MATERIALS: (1) Hydrogen chloride. Good specimen from a commercial cylinder was dried. (2) 3,4-Dihydro-2H-1,2-benzodioxepin.</pre> | | |
| nearly 1 atm (101.325 kPa). | | Carefully purified, and purity rigorously attested. | | |
| Solvent name is o-phenyl tri ether in the paper. | .methylene | ESTIMATED ERROR: $\delta x_1 / x_1 = 0.01$ REFERENCES: | | |
| | | | | |

| 194 Hydrogen Chlonde in | Non-Aqueous Solvents | | | |
|--|---|--|--|--|
| COMPONENTS: | ORIGINAL MEASUREMENTS: | | | |
| <pre>(1) Hydrogen chloride; HCl; [7647-01-0]</pre> | Gerrard, W.; Mincer, A. M. A.; Wyvill, P. L. | | | |
| (2) 2-Methyl-1,4-benzodioxan; C ₉ H ₁₀ O ₂ ; [5966-54-1] | J. Appl. Chem. <u>1960</u> , 10, 115-121. | | | |
| VARIABLES: | PREPARED BY: | | | |
| т/к: 273.15 - 303.45 | | | | |
| Total P/kPa: 101.325 (1 atm) | W. Gerrard (smoothed data calculated by H.L. Clever) | | | |
| EXPERIMENTAL VALUES: | | | | |
| T/K Mol Ra | atio Mol Fraction | | | |
| ⁿ HCl ^{/n} C _c | ^H 10 ^O 2 ^x 1 | | | |
| 273.15 0.43 | 0.305 | | | |
| 274.95 0.41 | | | | |
| 280.85 0.33 | | | | |
| 281.85 0.33 284.35 0.29 | | | | |
| 284.35 0.25 | | | | |
| 294.55 0.20 | | | | |
| 303.45 0.15 | | | | |
| The compiler calculated the mole frac | tion values. | | | |
| Smoothed Data: $\ln x_1 = 55.372 - 67.933/(T/100) - 31.537 \ln (T/100)$ | | | | |
| Standard error about the regression line is 1.77×10^{-3} | | | | |
| | | | | |
| T/K Mol Fraction ^x 1 | | | | |
| 273.15 0.305 | | | | |
| 283.15 0.236 | | | | |
| 293.15 | 0.179 | | | |
| 303.15 0.134 | | | | |
| | | | | |
| AUXILIARY | (INFORMATION | | | |
| METHOD 'APPARATUS / PROCEDURE : | SOURCE AND PURITY OF MATERIALS: | | | |
| The liquid component was weighed in | (1) Hydrogen chloride. Good specimen | | | |
| a bubbler tube. The amount of gas | from a commercial cylinder was | | | |
| absorbed was determined by re- | dried. | | | |
| weighing to constant weight. The total pressure was barometric, very | (2) 2-Mothul-1 (-hongodiovan | | | |
| nearly 1 atm (101.325 kPa) | (2) 2-Methyl-1,4-benzodioxan. Carefully purified, and purity | | | |
| hearing i dow (roiroid Ard) | rigorously attested. | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| Solvent name is o-phenylene mono- | ESTIMATED ERROR: | | | |
| methyl dimethylene ether in paper. | | | | |
| | $\delta x_1 / x_1 = 0.01$ | | | |
| | REFERENCES: | | | |
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| | Non-Aquebus Solvents | | |
|---|---|--|--|
| COMPONENTS : | ORIGINAL MEASUREMENTS: | | |
| <pre>(1) Hydrogen chloride; HCl; [7647-01-0]</pre> | Gerrard, W.; Macklen, E. D. | | |
| (2) Phenol; C ₆ H ₆ O; [108-95-2] | J. Appl. Chem. <u>1959</u> , 9, 85 - 88. | | |
| | | | |
| VARIABLES: | PREPARED BY: | | |
| т/к: 313.55 - 335.85 | W. Gerrard | | |
| Total P/kPa: 101.325 (1 atm) | w. Gerrard (smoothed data calculated by H.L. Clever) | | |
| | (Subscribe alter curculated by n.D. Crever) | | |
| EXPERIMENTAL VALUES: | | | |
| T/K Mol Rati ⁿ HCl/ ⁿ C ₆ H | | | |
| 313.55 0.039 | 0.0375 | | |
| 315.15 0.035 321.35 0.028 | | | |
| 329.35 0.024 | 0.0234 | | |
| 335.85 0.023 | 0.0225 | | |
| The mole fraction values were calcula | ated by the compiler | | |
| | | | |
| | 767.213/(T/100) + 229.285 ln (T/100) | | |
| Standard error about | regression line = 5.32×10^{-4} | | |
| T/K | Mol Fraction | | |
| | ^x HCl | | |
| 313.15 | 0.0377 | | |
| 323.15 | 0.0260 | | |
| 333.15 | 0.0226 | | |
| · | ······································ | | |
| | | | |
| | | | |
| | | | |
| AUXILIARY | INFORMATION | | |
| | | | |
| METHOD/APPARATUS/PROCEDURE: The apparatus and procedure were | SOURCE AND PURITY OF MATERIALS: (1) Hydrogen chloride. Self prepared | | |
| those described by Gerrard and | and dried. | | |
| Macklen (1). The hydrogen chloride was generated in an all glass | (2) Phenol. Purified, distilled, and | | |
| apparatus. The absorption vessel, | attested by physical constants. | | |
| previously weighed, was fitted with a stoppered bubbler tube, and a | | | |
| stoppered outlet tube. Entrained | | | |
| liquid was condensed at 273.15 K, and allowed for. The amount of gas | | | |
| absorbed by a known weight of liquid | | | |
| was determined by weighing. | NOTIVATED EDDAD. | | |
| | ESTIMATED ERROR: | | |
| | $\delta x/x = 0.02$ | | |
| | | | |
| | REFERENCES : | | |
| | 1. Gerrard, W.; Macklen, E. D. | | |
| | J. Appl. Chem. <u>1956</u> , 6, 241. | | |
| | | | |
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| 1 | | | |
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| COMPONENTS: | EVALUATOR: | |
|---|--|--|
| <pre>1. Hydrogen Chloride; HCl; [7647-01-0]</pre> | Peter G. T. Fogg Department of Applied Chemistry and Life Sciences, | |
| 2. Aliphatic Carboxylic Acids | Polytechnic of North London, Holloway, London, N7 8DB, U.K. January 1989 | |

CRITICAL EVALUATION:

The Solubility of Hydrogen Chloride in Aliphatic Carboxylic Acids.

The solubility in acetic acid has been measured at barometric pressure over various temperature ranges by Cupr (1), by Gerrard & Macklen (2), by Ahmed *et al.*(3), by Kitvinenko & Kapova (4), and by Kumar & Gehlawat (5). Mole fraction solubilities for a partial pressure of 101.3 kPa derived from data provided by the last four groups may be fitted to the equation :

 $\ln x_{\rm HC1} = 70.224 - 1056.9/(T/K) - 12.092 \ln(T/K)$

The standard deviation in values of $x_{\rm HC1}$ is 0.0095.

This equation is based upon data for 253.15 K to 353.15 K. The data, published by Cupr, for 298.15 K, but not that for 273.15 K, are in accord with this smoothing equation.

Rodebush & Ewart (6) measured solubilities of hydrogen chloride in acetic acid at 298 K over a pressure range of 1.25 kPa to 12.4 kPa. The data are consistent with data for higher pressures published by other authors.

Gerrard & co-workers (2,3) also measured solubilities over temperature ranges in formic acid, propanoic acid, butanoic acid, hexanoic acid, 2-methyl propanoic acid and 3-methyl butanoic acid. The total pressure was equal to barometric. At 298.15 K there is a general tendency for mole fraction solubilities corrected to a partial pressure of 101.3 kPa to increase with chain length in the case of straight chain acids. Branching tends to lower the solubility. These measurements appear to be self consistent but there are no data by other authors for comparison.

Gerrard & Macklen (2) measured solubilities in chloroacetic acid and trichloroacetic acid over temperature ranges of about 320 K to 340 K at a total pressure of 101.3 kPa. The contribution of these solvents to the total pressure is small in this temperature range and the measured solubilities may be equated with solubilities at a partial pressure of 101.3 kPa. The presence of chlorine lowers the solubilities relative to that in acetic acid itself in this temperature range but the difference in solubilities in the two chlorinated solvents is very small.

Mole fraction solubilities at 323.15 K and a partial pressure of hydrogen chloride of 101.3 kPa.

| Acetic acid | 0.054 | (from recommended equation) |
|----------------------|--------|------------------------------------|
| Chloroacetic acid | 0.0280 | (Gerrard & Macklen - interpolated) |
| Trichloroacetic acid | 0.0288 | |

REFERENCES

| Cupr, V. Rec1. Trav. Chim. Pays-Bas <u>1928</u>, 47, 5 | 5 - 7 | Ζ. |
|--|-------|----|
|--|-------|----|

- 2. Gerrard, W.; Macklen, E. D. J. Appl. Chem. <u>1956</u>, 6, 241 244.
- Ahmed, W.; Gerrard, W.; Maladkar, V. K. J. Appl. Chem. <u>1970</u>, 20, 109 - 115.
- Kitvinenko, V. I.; Kapova, Z. K. Izv. Akad. Nauk. Kaz. SSR, Ser. Khim. <u>1972</u>, 22, 75 - 77.
- 5. Kumar, S.; Gehlawat, J. K. J. Chem. Tech. Biotechnol. <u>1979</u>, 29, 353 - 360.
- Rodebush, W. H.; Ewart, R. H. J. Am. Chem. Soc. <u>1932</u>, 54, 419 423.

| COMPONENTS: | ORIGINAL MEASUREM | ENTS: | |
|--|--|--|--|
| (1) Hydrogen chloride; HCl; | Gerrard, W.; Macki | len, E.D. | |
| [7647-01-0] (2) Aliphatic carboxylic acids | J. Appl. Chem. <u>1956</u> , 6, 241-244 | | |
| VARIABLES: T/K: See below Total P/kPa : 101.325 (1 atm) | PREPARED BY: W. Gerrard | | |
| EXPERIMENTAL VALUES: T/K | Mole ratio Mole [*] Mole ratio fract: MCl ^{/n} acid [*] HCl | ion mole fraction | |
| Formic acid; CH ₂ O ₂ ; 273.15 [64-18-6] 281.25 283.15 | 0.082 0.07 | 0.0838 58 0.0728 | |
| 288.65 293.15 | 0.069 0.064 | | |
| 295.65 303.15 | 0.060 0.056 | 1 | |
| 303.65 313.15 | 0.049 0.046 | | |
| 316.05 323.15 | 0.033 0.03 | | |
| Smoothing equation: ln x _{HCl} = 104.052 Standard error in x _{HCl} about the | - 141.039/(T/100) - regression line = - | - 54.632 ln(T/100) 1.09 × 10 ⁻³ | |
| Acetic acid; C ₂ H ₄ O ₂ ; 283.15 [64-19-7] 284.15 289.15 | 0.189 0.159 0.165 0.142 | 2 | |
| 293.15 300.15 | 0.121 0.108 | | |
| 303.15 312.65 313.15 | 0.074 0.068 | 0.0632 | |
| 323.15 323.25 | 0.035 0.033 | 0.0350 38 | |
| Smoothing equation: ln × _{HCl} = 329.714 Standard error in × _{HCl} about the | - 458.556/(T/100) - regression line = 5 | - 162.979 ln(T/100) 5.96 × 10 ⁻³ | |
| <pre>* calculated by the compiler ** smoothing equation and smoothed v</pre> | lues were calculate | ed by H.L. Clever. | |
| AUXILIARY | NFORMATION | | |
| METHOD/APPARATUS/PROCEDURE: | SOURCE AND PURITY | OF MATERIALS: | |
| Hydrogen chloride was generated in an all-glass apparatus. | <pre>(1) Hydrogen chloride: self- prepared and dried.</pre> | | |
| The all-glass absorption vessel (50 cm^3) comprised an inlet bubbler tube, an outlet tube, and the part holding a weighed amount of liquid. | | grade specimens ed and attested. | |
| Each tube was fitted with a tap, and either a B-19 cone, or a B-19 socket. Entrained liquid was collected and allowed for. Temperature control was within 0.1 K. The amount of gas | ESTIMATED ERROR: $\delta T/K =$ $\delta x_{HC1}/x_{HC1} =$ | | |
| absorbed was determined by weighing. | REFERENCES: | | |
| | | | |

| COMPONENTS: (1) Hydrogen chloride; HCl; [7647-01-0] | ORIGINAL MEASUREMENTS: Gerrard, W.; Macklen, E.D. |
|---|---|
| (2) Aliphatic carboxylic acids | J. Appl. Chem. <u>1956</u> , 6, 241-244 |
| EXPERIMENTAL VALUES: T/K | Mole ratio Mole [*] Smoothed ^{**} HCl ^{/n} acid fraction mole fraction ^x HCl ^x HCl |
| Propanoic acid; C ₃ H ₆ O ₂ ; 273.15 [79-09-4] 278.05 280.15 283.15 290.15 293.15 293.15 296.45 | 0.170 0.145 0.160 0.138 0.135 0.139 0.122 0.117 |
| 303.15 308.15 313.15 315.45 323.15 324.15 | 0.098 0.0892 0.0811 0.084 0.0775 0.068 0.0637 |
| Smoothing equation: ln x _{HCl} = 63.844 Standard error in x _{HCl} about the HCl | - 86.197/(T/100) - 34.017 ln(T/100) regression line = 1.45 × 10 ⁻³ |
| Butanoic acid; C ₄ H ₈ O ₂ ; 282.75 [107-92-6] 283.15 291.05 293.15 294.45 303.15 306.25 313.15 316.95 323.15 | 0.166 0.1420 0.133 0.152 0.1320 0.105 0.105 0.0950 0.0841 |
| Smoothing equation: ln x _{HCl} = -9.216 Standard error in x _{HCl} about the | + 21.107/(T/100) regression line = 3.01 × 10 ⁻³ |
| 2-Methylpropanoic acid; 291.35 C ₄ H ₈ O ₂ ; [79-31-2] 293.15 303.15 303.95 313.15 320.45 323.15 | 0.138 0.1210 0.117 0.119 0.1060 0.0945 0.101 0.0917 0.0754 0.068 0.0637 0.0596 |
| Smoothing equation: ln x _{HCl} = 40.660 Standard error in x _{HCl} about the | - 51.184/(T/100) - 23.565 ln(T/100) regression line = 2.18 × 10 ⁻³ |
| 3-Methylbutanoic acid; 273.15 C ₅ H ₁₀ O ₂ ; [503-74-2] 278.95 283.15 287.55 293.15 301.15 303.15 306.95 313.15 | 0.191 0.200 0.1670 0.150 0.154 0.1330 0.150 0.108 0.0975 0.0925 0.093 0.0851 0.0729 |
| 318.15 323.15 Smoothing equation: ln x _{HCl} = 17.481 Standard error in x _{HCl} about * calculated by the compiler ** smoothing equation and smoothed va | |

| | | T Non-Aqueous Sor | | | |
|---|--|---|---|------------------------|--|
| COMPONENTS : | ORIGINAL MEASURE | ORIGINAL MEASUREMENTS: | | | |
| <pre>(1) Hydrogen chloride; HCl; [7647-01-0]</pre> | | Cupr, V. | | | |
| (2) Acetic acid; ([64-19-7] | (2) Acetic acid; C ₂ H ₄ O ₂ ; [64-19-7] | | him. Pays-E | 3as <u>1928</u> , | |
| VARIABLES: $T/K = 273.15, 298.15$ p/kPa = 101.325 (1 atm) | | PREPARED BY: W | PREPARED BY: W. Gerrard | | |
| EXPERIMENTAL VALUES: | | | · · · · · · · · · · · · · · · · · · · | | |
| <i>T/</i> K | Acetic Acid Hydro | ogen Chloride | Mol Ratio | Mol Fraction | |
| | w_1 /wt % g per | r 100 g solvent | n ₁ /n ₂ | <i>x</i> 1 | |
| 273.15 | | 31.392 25.0 ¹ | 0.4111 | 0.2921 | |
| 298.15 | | 3.349 7.60 | 0.125 | 0.111 | |
| acetic aci ¹ The values acid, sinc | his own plot of g H id for the estimate at 273.15 K are f be acetic acid is r ng point of acetic | e. for a hypothetic normaly a solid | al pure lig at this tem | uid acetic | |
| | AUXILIA | Y INFORMATION | | | |
| METHOD / APPARATUS / PROCE | DURE : | SOURCE AND PURIT | Y OF MATERIAL | S: | |
| The concentration solution of acetic mined by titration free sodium hydrox phenolphalein as i | acid was deter- with carbonate de solution with | (1) Hydrogen prepared | chloride. T from sodium ric acid. | he gas was chloride | |
| liquid in a U-tube were removed for t | was absorbed in the absorber. Samples the estimation of tration with silver | 3 | | | |
| | | ESTIMATED ERROR | : | | |
| | | REFERENCES : | | | |
| | | | | | |
| | | | | | |

| COMPONENTS: | ORIGINAL MEASUREMENTS: | |
|--|--|--|
| | | |
| <pre>(1) Hydrogen chloride; HCl; [7647-01-0]</pre> | Rodebush, W. H.; Ewart, R. H. | |
| (2) Acetic acid; C ₂ H ₄ O ₂ ; [64-19-7] | J. Am. Chem. Soc. <u>1932</u> , 54, 419 - 423. | |
| VARIABLES: | PREPARED BY: | |
| T/K = 298.00 $p_1/kPa = 1.29 - 12.40$ (9.7 - 93.0 mmHg) | W. Gerrard | |
| EXPERIMENTAL VALUES: | | |
| Partial | n Chloride Mol Fraction Pressure mmHg x ₁ | |
| 24.85 298.00 | 9.7 0.00242 9.4 0.00206 15.0 0.00349 17.3 0.00406 28.6 0.00632 31.6 0.00695 46.9 0.0105 50.9 0.0110 52.8 0.0115 58.8 0.0137 93.0 0.0208 | |
| The following approximate results were also given: a 5 wt % solution had $p_1 = 470 \text{ mmHg}$ ($x_1 = 0.0798$, by compiler), and a 3 wt % solution had $p_1 = 300 \text{ mmHg}$ ($x_1 = 0.0484$, by compiler). NOTE: The data recorded in the table should not be extrapolated linearly beyond 100 mmHg. | | |
| AUXILIARY | INFORMATION | |
| METHOD/APPARATUS/PROCEDURE: | SOURCE AND PURITY OF MATERIALS: | |
| A dynamic method was used to determ- ine the vapor pressure of the hydrogen chloride over the solution of acetic acid. A known volume of air was drawn through the solution, and the contents were determined by chemical titrations. Allowance for the pressure due to acetic acid appears to have been 15.6 mmHg, the vapor pressure of pure acetic acid at 25 °C. | Hydrogen chloride. Prepared from c. p. sodium chloride and c. p. 95 % sulfuric acid. Acetic acid. Strictly c. p. acetic acid (99.5 %) was distill- ed, and the middle portion was frozen to give acid (99.7 %). | |
| | ESTIMATED ERROR: $\delta T/K = \pm 0.02$ | |
| | REFERENCES : | |
| | | |

| COMPONENTS: (1) Hydrogen chloride; HCl; [7647-01-0] (2) Acetic acid; C ₂ H ₄ O ₂ ; [64-19-7] VARIABLES: T/K: 303 - 333 Total P/kPa: 101 EXPERIMENTAL VALUES: ORIGINAL MEASUREMENTS: Kumar, S.; Gehlawat, J J. Chem. Tech. Biotech 29, 353 - 360. PREPARED BY: W. Gerrard H. L. Clever | | |
|--|--|--|
| $[7647-01-0]$ J. Chem. Tech. Biotech (2) Acetic acid; $C_2H_4O_2$; $[64-19-7]$ J. Chem. Tech. Biotech 29 , $353 - 360$. VARIABLES: PREPARED BY: T/K: $303 - 333$ Total P/kPa: 101 | | |
| (2) Acetic acid; $C_2H_4O_2$; [64-19-7] VARIABLES: T/K: 303 - 333 Total P/kPa: 101 J. Chem. Tech. Biotech 29, 353 - 360. PREPARED BY: W. Gerrard H. L. Clever | ol. <u>1979</u> , | |
| T/K: 303 - 333 Total P/kPa: 101 W. Gerrard H. L. Clever | | |
| Total P/kPa: 101 H. L. Clever | ······································ | |
| EXPERIMENTAL VALUES: | | |
| | | |
| T/K Estimated Hydrogen Estimated Estin HCl Pressure Chloride Mol Ratio Mol Concentration | | |
| | 1 | |
| 313 97 0.96 1.37 0.080 0 | 102 074 0495 | |
| | 033 | |
| | | |
| AUXILIARY INFORMATION | | |
| METHOD/APPARATUS/PROCEDURE: The gas was bubbled through the solvent at atmospheric pressure. The increase of weight on the take up of HCl by the acetic acid was determined.(2) Acetic acid. Analy | Analytical | |
| | | |
| ESTIMATED ERROR: $\delta c/c = 0.15$ (au | hors) | |
| REFERENCES: | | |
| 1 | | |

| COMPONENTS : | ORIGINAL MEASUREMENTS: | |
|--|--|--|
| <pre>1. Hydrogen chloride; HCl; [7647-01-0]</pre> | Ahmed, W.; Gerrard, W.; Maladkar, V. K. | |
| 2. Acetic Acid; C ₂ H ₄ O ₂ ; | J. Appl. Chem. 1970, 20, 109 - 115 | |
| [64-19-7] | $5. \text{ Appl. Chem. } \frac{1970}{1970}, 20, 109 - 113$ | |
| | | |
| | | |
| VARIABLES: | PREPARED BY: | |
| T/K: 253.15 - 293.15 Total P/kPa: 101.325 (1 atm) | W. Gerrard | |
| | (smoothed data calculated by H.L. Clever) | |
| EXPERIMENTAL VALUES: | | |
| T/K MOL R | atio Mol Fraction | |
| ⁿ HCl/ ⁿ C ₂ H ₄ O ₂ ^X HCl | | |
| | 2 ⁿ 4 ^o 2 | |
| 253.15 0.65 | | |
| 263.15 0.46 273.15 0.29 | | |
| 283.15 0.21 | 0.174 | |
| 293.15 0.15 | 0.130 | |
| The mole fraction solubilities were calculated from the mole ratio by the compiler. | | |
| - | .426/(T/100) - 21.778 ln (T/100) | |
| | regression line 8.82 x 10^{-3} | |
| | 109103310H 11HE 0.02 X 10 | |
| | Mol Fraction | |
| | x _{HC1} | |
| 253.15 | 0.398 | |
| 253.15 | 0.305 | |
| 273.15 | 0.231 | |
| 283.15 . 293.15 | 0.174 0.130 | |
| 298.15 | 0.112 | |
| | | |
| | | |
| AUXILIARY | INFORMATION | |
| | | |
| METHOD/APPARATUS/PROCEDURE: | SOURCE AND PURITY OF MATERIALS: | |
| Hydrogen chloride was passed into a known weight of liquid in a bubbler | Hydrogen chloride. Obtained from a cylinder containing a | |
| tube at a total pressure measured by | good commercial specimen. Was | |
| a manometer assembly. The absorbed | dried by passage through con- centrated sulfuric acid. | |
| gas was weighed by re-weighing the bubbler tube. The temperature was | | |
| manually controlled to within 0.2 K. | 2. Acetic Acid. Best obtainable specimen was suitably purified, | |
| The procedure and apparatus are described by Gerrard (1, 2). | dried, and fractionally dis- | |
| described by seriard (1, 2). | tilled, and attested. | |
| | | |
| | ESTIMATED ERROR: | |
| | $\delta T/K = 0.2$ | |
| | $\delta x/x = 0.025$ | |
| | | |
| | REFERENCES : | |
| | 1. Gerrard, W. | |
| | J. Appl. Chem. Biotechnol. <u>1972</u> , | |
| | 22, 623 - 650. | |
| | 2. Gerrard, N. "Solubility of Gases and Liquids" | |
| | Plenum Press, New York, 1976 | |
| L | l | |

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| | Non-Aqueous Solvents 203 | |
|--|---|--|
| COMPONENTS : | ORIGINAL MEASUREMENTS: | |
| <pre>(1) Hydrogen chloride; HCl; [7647-01-0]</pre> | Kitvinenko, V. I.; Kapova, Z. K. | |
| (2) Acetic acid; C ₂ H ₄ O ₂ ; [64-19-7] | Izv. Akad. Nauk. Kaz. SSR, Ser. Khim. <u>1972</u> , 22, 75 - 77. | |
| VARIABLES: T/K = 293.15 - 353.15 p/kPa = 101.325 (1 atm) | PREPARED BY: | |
| EXPERIMENTAL VALUES: | I | |
| Chloride $w_1/\text{wt }$ 293.15 8.21 313.15 4.75 333.15 2.83 353.15 1.29 ¹ The mole fraction val compiler assuming the w values were for a total ² The mole fraction val compiler for a hydroger of one atm. The acetic calculated as $p_2 = p_2^{\circ}(0)$ liquid acetic acid vapo | wes were calculated by the chloride partial pressure acid vapor pressure was $1 - x_1$) where p_2 is the pure r pressure. Ogen chloride in aqueous acetic | |
| AUXILIARY | INFORMATION | |
| METHOD/APPARATUS/PROCEDURE: | SOURCE AND PURITY OF MATERIALS: | |
| It was stated that the apparatus of Cupr (1) was used. The concentration of HCl was deter- mined as weight % at successive intervals of time until a constant | Hydrogen chloride. The gas was prepared from sodium chloride and sulfuric acid. Dried by sulfuric acid. Acetic acid. Stated to be of 99.8 per cent purity. | |
| value was obtained. | | |
| value was obtained. | ESTIMATED ERROR: | |

| 204 Hydrogen Chioride in i | Von-Aqueous Solvents | | |
|---|--|--|--|
| COMPONENTS : | ORIGINAL MEASUREMENTS: | | |
| <pre>1. Hydrogen chloride; HCl; [7647-01-0]</pre> | Ahmed, W.; Gerrard, W.; Maladkar, V. K. | | |
| 2. Hexanoic Acid; C ₆ H ₁₂ O ₂ ; | J. Appl. Chem. <u>1970</u> , 20, 109 - 115. | | |
| [142-62-1] | | | |
| | | | |
| VARIABLES: | PREPARED BY: | | |
| T/K: 213.15 - 293.15 Total P/kPa: 101.325 (1 atm) | W. Gerrard | | |
| TOTAL P/KPA: 101.325 (1 aum) | (smoothed data calculated by H.L. Clever) | | |
| EXPERIMENTAL VALUES: T/K MOL Rat | io Mol Fraction | | |
| EXPERIMENTAL VALUES: T/K Mol Rat nHCl/nC6H | ^H 12 ^O 2 ^X HC1 | | |
| 213.15 1.68 | 0.627 | | |
| 223.15 1.32 233.15 1.04 | 0.569 0.510 | | |
| 243.15 0.75 | 0.429 | | |
| 253.15 0.53 | 0.346 | | |
| 263.15 0.38 273.15 0.27 | 0.275 0.213 | | |
| 283.15 0.20 | 0.167 | | |
| 293.15 0.19 | 0.160 | | |
| The mole fraction solubilities were ca compiler. | alculated from the mole ratio by the | | |
| | 458/(T/100) - 18.135 ln (T/100) | | |
| Standard error about a | regression line = 1.73×10^{-2} | | |
| | Aol Fraction | | |
| | X _{HC1} | | |
| 213.15 | 0.647 | | |
| 223.15 | 0.569 0.489 | | |
| 243.15 | 0.412 | | |
| 253.15 | 0.342 | | |
| 263.15 273.15 | 0.280 0.226 | | |
| 283.15 | 0.182 | | |
| 293.15 | 0.145 | | |
| | INFORMATION | | |
| ME THOD /APPARATUS / PROCEDURE : | | | |
| Hydrogen chloride was passed into a | SOURCE AND PURITY OF MATERIALS: 1. Hydrogen chloride. Obtained from | | |
| known weight of liquid in a bubbler | a cylinder containing a good com- | | |
| tube at a total pressure measured by | mercial specimen. Was dried by | | |
| a manometer assembly. The absorbed gas was weighed by re-weighing the | passage through concentrated sulfuric acid. | | |
| bubbler tube. The temperature was | Sulfulic actu. | | |
| manually controlled to within 0.2 K. | 2. Hexanoic Acid. Best obtainable | | |
| The procedure and apparatus are described by Gerrard (1,2). | specimen was suitably purified, dried, and fractionally dis- | | |
| - | tilled, and attested. | | |
| For temperatures below 268 K, a chemical titration was performed. | | | |
| | ESTIMATED ERROR: | | |
| | $\delta T/K = 0.2$ | | |
| | $\delta X/X = 0.03$ | | |
| | | | |
| | REFERENCES : | | |
| | 1. Gerrard, W. | | |
| 1 | J. Appl. Chem. Biotechnol. <u>1972</u> , | | |
| | 22, 623 - 650. | | |
| | 2. Gerrard, W. | | |
| | "Solubility of Gases and Liquids" Plenum Press, New York, 1976 | | |
| | 11055, New 101K, 1770 | | |

Hydrogen Chloride in Non-Aqueous Solvents

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| ingulogen chionae | in Non-Aqueous Solvents |
|---|---|
| COMPONENTS: | ORIGINAL MEASUREMENTS: |
| (1) Hydrogen chloride; HCl; | Gerrard, W.; Macklen, E. D. |
| [7647-01-0] | J. Appl. Chem. <u>1956</u> , 6, 241-244. |
| (2) Trichloroacetic acid; | |
| C ₂ HCl ₃ O ₂ ; [76-03-9] | |
| | |
| VARIABLES: | PREPARED BY: |
| T/K: 323.65 - 339.85 | W. Gerrard |
| Total P/kPa: 101.325 (1 atm) | (smoothed data calculated by H.L. Clever) |
| EXPERIMENTAL VALUES: | |
| T/K Mole F | Ratio Mole Fraction |
| ⁿ HCl/ ⁿ C ₂ | |
| | |
| 323.65 0.02 329.55 0.02 | |
| 335.35 0.01 | 0.0177 |
| 339.85 0.01 | 15 0.0148 |
| The mole fraction solubility values | were calculated by the compiler. |
| | |
| Ĩ | L0.324/(T/100) - 46.522 ln (T/100) |
| Standard error abou | it regression line = 1.09×10^{-4} |
| т/к | Mole Fraction |
| | <i>x</i> 1 |
| 323.15 | 0.0288 |
| 333.15 343.15 | 0.0194 0.0129 |
| | |
| AUXILIA | ARY INFORMATION |
| METHOD /APPARATUS / PROCEDURE : | SOURCE AND PURITY OF MATERIALS: |
| Hydrogen chloride was generated in all-glass apparatus. | an (1) Hydrogen chloride. Self pre- pared and dried. |
| The all glass absorption vessel (50 cm^3) comprised an inlet bubbler tub an outlet tube, and the part holdin a weighed amount of liquid. Each tube was fitted with a tap, and either a B-19 cone, or a B-19 socke Entrained liquid was collected and allowed for. Temperature control w within 0.1 K. The amount of gas | pe, grade specimen was distilled and attested. et. was |
| absorbed was determined by weighing | 9. ESTIMATED ERROR: |
| | $\delta T/K = 0.1$ $\delta x_1/x_1 = 0.005$ |
| | REFERENCES : |
| | |
| | |
| | |
| | |
| | |
| | |

| COMPONENTS: | | EVALUATOR: | |
|-------------|--|---|--|
| 1. | Hydrogen Chloride; HCl; [7647-01-0] | Peter G. T. Fogg Department of Applied Chemistry and Life Sciences, | |
| 2. | Esters of Carboxylic Acids and of Carbonic Acid | Polytechnic of North London, Holloway, London, N7 8DB, U.K. | |
| | | January 1989 | |

CRITICAL EVALUATION:

The Solubility of Hydrogen Chloride in Esters of Carboxylic Acids and of Carbonic Acid.

Gerrard & Macklen (1) have measured the solubility of hydrogen chloride in various alkanoic esters over temperature ranges at a total pressure equal to barometric pressure. Mole fraction solubilities are high relative to reference values given by the Raoult's law equation (0.0214 at 298.15 K). If the variation of mole fraction solubilities approximates to the Margules equation then mole fraction solubilities at a partial pressure of 101.3 kPa will be close to mole fraction solubilities at a total pressure of 101.3 kPa even though pure solvents have appreciable vapor pressures at the temperatures of measurement.

Table 1. Mole fraction solubilities of hydrogen chloride in alkyl esters of carboxylic acids at 298.15 K and total pressure of 1.013 bar.

| Ester & | Gerrard Macklen•(1) | Ionen & Shverina (2) | Chesterman (3) | Cook (4) |
|------------------------|------------------------|-------------------------|-------------------|-------------|
| athul formato | 0.170 | | | |
| ethyl formate | | 0 350 | 0 () | |
| methyl acetate | 0.302 | 0.250 | 0.63 | |
| ethyl acetate | 0.314 | 0.240 | 0.39 | |
| 1-methylethyl acetate | 0.343 | 0.240 | | |
| propyl acetate | 0.328 | 0.243 | | |
| 2-methylpropyl acetate | 0.338 | | | |
| 1-methylpropyl acetate | 0.343 | | | |
| butyl acetate | 0.331 | 0.244 | | |
| pentyl acetate | 0.333 | | | |
| octyl acetate | 0.334 | | | |
| phenyl acetate | 0.190 | | | |
| benzyl acetate | 0.243 | | | |
| ethyl benzeneacetate | 0.261 | | | |
| ethyl propanoate | 0.315 | | | |
| ethyl butanoate | 0.324 | | | |
| propyl butanoate | | | | 0.293 |

Gerrard's measurements indicate that mole fraction solubilities in straight chain alkyl acetates increase with chain length. The solubility in propyl butanoate from an extrapolation of measurements by Cook does not fit into the pattern. Solubilities in non-linear alkyl acetates are greater than in linear acetates having the same carbon number. Solubility also increases with carbon number in the series ethyl formate to ethyl butanoate. Mole fraction solubility in phenyl acetate is less than in methyl acetate but is greater in benzyl acetate and ethyl benzeneacetate.

Solubilities at 298.15 K and a total pressure of 1.013 bar were also reported by Ionen & Shverina (2) for methyl, ethyl, propyl, 1-methylethyl and butyl acetates. The values of mole fraction solubilities are appreciably less than those reported by Gerrard. Mole fraction solubilities in methyl acetate and ethyl acetate from data published by Chesterman (3) for the same conditions are, on the contrary, appreciably greater than Gerrard's values.

The measurements reported by Gerrard & Macklen extend over a much wider range of temperatures than those reported by other workers. Their data are self consistent for each compound. Nevertheless, in view of the discrepancies between data from different sources, further measurements on these systems are required.

| COMPO | NENTS : | EVALUATOR: |
|-------|--|---|
| 1. | Hydrogen Chlorıde; HCl; [7647-01-0] | Peter G. T. Fogg Department of Applied Chemistry and Life Sciences, |
| 2. | Esters of Carboxylic Acids and of Carbonıc Acid | Polytechnic of North London, Holloway, London, N7 8DB, U.K. |
| | | January 1989 |

CRITICAL EVALUATION:

Gerrard and co-workers (1,5) have also measured solubilities in various chlorinated esters and in the ethyl ester of bromoacetic acid over temperature ranges at a total pressure of 1.013 bar. The presence of halogen lowers the mole fraction solubility of hydrogen chloride. As mav be seen in Table 2, solubilities in the various chlorinated derivatives of ethyl acetate are less than in ethyl acetate itself. The greater the number of chlorine atoms the lower the solubility. Solubilities in derivatives of chlorinated acetic acid are less than in derivatives of 2-chlorinated Solubility in the ethyl ester of bromoacetic acid is less than ethanols. in the ethyl ester of chloroacetic acid. Solubility in the ethyl ester of 3-chloropropionic acid is less than in ethyl propionate. Solubility in the ethyl and in the 1-propyl ester of chloroformic acid is less than in ethyl formate. In general the data for this class of compounds is self-consistent and likely to be reliable although later measurements of the solubility in ethyl and propyl chloroformate (5) are not in agreement with earlier measurements (1) in the same laboratory.

Table 2 Mole fraction solubilities of hydrogen chloride in chlorinated esters at 298.15 K and total pressure of 1.013 bar.

| Ester | × _{HCl} at 298.15 К | Reference |
|------------------------------|------------------------------|-----------|
| (ethyl formate) | 0.170 | (1) |
| ethyl chloroformate | 0.0526 | (1) |
| eenyr eniororormate | 0.0666 | (5) |
| 1-propyl chloroformate | 0.0582 | (1) |
| | 0.0794 | (5) |
| hexyl chloroformate | 0.0943 | (5) |
| butyl chloroformate | 0.0822 | (5) |
| | | (-) |
| (ethyl acetate) | 0.314 | (1) |
| ethyl chloroacetate | 0.157 | (6) |
| ethyl bromoacetate | 0.172 | (1) |
| ethyl dichloroacetate | 0.108 | (1) |
| ethyl trichloroacetate | 0.0653 | (1) |
| 2-chloroethyl acetate | 0.209 | (1) |
| 2,2,2-trichloroethyl acetate | 0.153 | (1) |
| | | |
| (phenyl acetate) | 0.190 | (1) |
| phenyl chloroacetate | 0.150 | (5) |
| ethyl propanoate | 0.315 | (1) |
| ethyl 3-chloropropanoate | 0.227 | (6) |

Gerrard et al.(5) measured solubilities in four esters of carbonic acid at a total pressure of 1.013 bar over temperature ranges. Solubilities are high relative to the reference line corresponding to the Raoult's law equation. Under the conditions of the experiments the mole fraction solubility at a total pressure of 1.013 bar will differ from the mole fraction solubility at a partial pressure by less than 2%. Mole fraction solubilities in the different esters are close to each other in the overlap of the temperature ranges. Solubility of hydrogen chloride in ethyl 2-chloroethyl carbonate was also measured by these authors under the same conditions. As in the case of ethers and esters of carboxylic acids, the presence of the chlorine atom lowers the mole fraction solubility of this gas. Interpolated mole fraction solubilities at 298.15 K and a total pressure of 1.013 bar are as follows:

| • | | |
|---|-------------------------------|-------|
| | diethyl carbonate | 0.254 |
| | dibutyl carbonate | 0.271 |
| | diisobutyl carbonate | 0.284 |
| | diisopentyl carbonate | 0.271 |
| | ethyl 2-chloroethyl carbonate | 0.202 |
| | | |

| COMPON | ENTS: | EVALUATOR: | | |
|---|---|---|----------------|-------------|
| 1. | Hydrogen Chloride; HCl; | Peter G. T. Fogg | . | |
| _ | [7647-01-0] | Department of Applied C and Life Sciences, | | тy |
| 2. | Esters of Carboxylic Acids and of Carbonic Acid | Polytechnic of North Lo Holloway, London, N7 8D | | κ. |
| | | January 1989 | | |
| CRITIC | AL EVALUATION: | | | <u> </u> |
| lıkel | lata for these esters of carbonic by to be reliable but confirmatio prements is not possible. | | | |
| Cook (4) measured solubilities in several esters of unsaturated acids and of unsaturated alcohols over short temperature ranges at a total pressure equal to barometric. Under the conditions of the experiments solubilities at a partial pressure of 1.013 bar are likely to be close to the measured solubilities. Mole fraction solubilities are high relative to the reference line based upon the Raoult's law equation. Values for ethyl crotonate are close to values for crotyl acetate and to values for ethyl butanoate. Values for allyl acetate, propionate and butanoate are lower but close to each other. For the solvents in this group mole fraction solubility is lowest in propargyl butyrate. No measurements by other authors are available for comparison and the reliability of these measurements cannot be judged. Table 3 Mole fraction solubilities of hydrogen chloride in unsaturated | | | | |
| Este | esters at 283.15 K and a par | tial pressure of 1.013 ba | | ref. |
| | | | *нсі | |
| | open-2-ol acetate (allyl acetate ten-1-ol acetate (crotyl acetate | | 0.354 0.403 | (4) (4) |
| Prop | ionic acid, 2-propenyl ester (al. | lyl propanoate) C ₆ H ₁₀ O ₂ | 0.361 | (4) |
| | tenoic acid, ethyl ester (<i>ethyl o</i> noic acid, 2-propynyl ester (<i>pro</i> | | | (4) (4) |
| Buta | noic acid, 2-propenyl ester (all pyl acetate) | y1 butanoate) C7H12O2 C5H10O2 | | (4) |
| (Eth | yl butanoate) | $C_6H_{12}O_2$ | 0.398 | (1) |
| (Prc | pyl butanoate) | C7H14O2 | 0.410 | (4) |
| REFER | ENCES | | | |
| 1. | Gerrard, W.; Macklen, E. D. J. | Appl. Chem. <u>1956</u> , 6, 241 | - 244. | |
| 2. | Ionin, M. V.; Shverina, V. G. 2 209 - 211; J. Gen. Chem. USSR | Zh. Obshch. Khim. <u>1965</u> , 3 | | |
| 3. | Chesterman, D. R. J. Chem. Soc. | | | |
| 4. | Cook, T. M. Thesis, <u>1966</u> , Unive | ersity of London. | | |
| 5. | Gerrard, W.; Mincer, A. M. A.; V 9, 89 - 93; <u>1960</u> , 10, 115 - 12 ⁻ | | hem. <u>19</u> | <u>59</u> , |
| 6. | Gerrard, W.; Macklen, E. D. J. | Appl. Chem. <u>1959</u> , 9, 85 | - 88. | : |
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Hydrogen Chloride in Non-Aqueous Solvents

| CONDONIENTEC | ODICINAL MEACUDEMENTS. | | | | |
|--|--|--------|--|--|--|
| COMPONENTS: | ORIGINAL MEASUREMENTS: | l | | | |
| <pre>(1) Hydrogen chloride; HCl; [7647-01-0]</pre> | Gerrard, W.; Macklen, E.D. J. Appl. Chem. <u>1956</u> , 6, 241-244 | | | | |
| (2) Esters of aliphatic carboxylic acids. | 5. App1. Chem. <u>1956</u> , 0, 241-244 | | | | |
| VARIABLES: | PREPARED BY: | | | | |
| T/K: See below Total P/kPa : 101.325 (1 atm) | W. Gerrard | | | | |
| EXPERIMENTAL VALUES: | Mole ratio Mole* Smoothed** HCl ^{/n} ester fraction mole fraction | - 1 | | | |
| | HCl *HCl *HCl | | | | |
| { | | - | | | |
| Formic acid, ethyl ester, 273.15 (ethyl formate); C ₃ H ₆ O ₂ ; 281.25 | 0.287 | | | | |
| [109-94-4] 283.15 | 0.275 | | | | |
| 288.35 | 0.316 0.240 0.210 | | | | |
| 293.15 | | | | | |
| 301.75 | 0.170 0.145 | | | | |
| 303.15 | | | | | |
| 306.65 313.15 | | | | | |
| | | . [| | | |
| Smoothing equation: ln x _{HCl} = 381.135 Standard error in x _{HCl} about the | - 523.963/(T/100) - 189.640 ln(T/100 regression line = 4.81 × 10 ⁻³ |)) | | | |
| Acetic acid, methyl ester, 273.15 | 0.423 | 1 | | | |
| (methyl acetate); C ₂ H ₆ O ₂ ; 274.75 | | | | | |
| [79-20-9] 562 279.75 283.15 | | | | | |
| 287.85 | | ĺ | | | |
| 292.15 | | | | | |
| 293.15 296.45 | | | | | |
| 299.45 | 0.420 0.296 | | | | |
| 303.15 303.55 | | | | | |
| | Smoothing equation: $\ln x_{HCl} = 71.059 - 94.752/(T/100) - 37.051 \ln(T/100)$ Standard error in x_{HCl} about the regression line = 9.97 × 10 ⁻⁴ | | | | |
| * calculated by the compiler ** smoothing equation and smoothed v | alues were calculated by H.L. Clever | | | | |
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| | | -+ | | | |
| | INFORMATION | | | | |
| METHOD/APPARATUS/PROCEDURE: | SOURCE AND PURITY OF MATERIALS: | | | | |
| Hydrogen chloride was generated in an all-glass apparatus. | (1) Hydrogen chloride: self- prepared and dried. | | | | |
| The all-glass absorption vessel (50 cm ³) comprised an inlet bubbler tube, an outlet tube, and the part holding a weighed amount of liquid. | (2) Esters: high grade specimens were distilled and attested. | | | | |
| Each tube was fitted with a tap, and either a B-19 cone, or a B-19 socket. Entrained liquid was collected and | ESTIMATED ERROR: $\delta T/K = \pm 0.1$ $\delta *_{HC1}/*_{HC1} = \pm 0.02$ | | | | |
| allowed for. Temperature control was within 0.1 K. The amount of gas absorbed was determined by weighing. | REFERENCES: | ┥ | | | |
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| COMPONENTS: | ODICINAL | MEA CUIDEMENING . | |
|---|---|-------------------------------------|---------------------------------|
| | | | |
| <pre>(1) Hydrogen chloride; HCl; [7647-01-0]</pre> | Gerrard, W.; Macklen, E.D. J. Appl. Chem. <u>1956</u> , 6, 241-244 | | |
| (2) Esters of aliphatic carboxylic acids. | J. App1. | Chem. <u>1956</u> , 6, | 241-244 |
| EXPERIMENTAL VALUES: T/K | Mole ratio | o Mole* fraction mo | Smoothed** |
| | HC1'"ester | ×HCl | ^x HCl |
| Acetic acid, ethyl ester, 273.15 (ethyl acetate); C,H ₀ O ₂ ; 278.05 | 0.700 | 0.412 | 0.418 |
| (ethyl acetate); C ₄ H ₈ O ₂ ; 278.05 [141-78-6] 282.85 | 0.638 | 0.389 | |
| 283.15 | | 0.004 | 0.390 |
| 288.25 | 0.573 | 0.364 | 0.342 |
| 293.55 | 0.510 | 0.338 | 0.542 |
| 301.85 | 0.416 | 0.294 | |
| 303.15 | 0.266 | 0.000 | 0.284 |
| 306.45 - 313.15 | 0.366 | 0.268 | 0.225 |
| 317.95 | 0.246 | 0.197 | 0.225 |
| 323.15 | | | 0.171 |
| Smoothing equations in y = 100 875 | 140 726 | | 2 1-(m/100) |
| Smoothing equation: ln x _{HCl} = 109.975 Standard error in x _{HCl} about the | regression | /(T/100) - 55.76 n line = 3.89 × | 10 ⁻³ |
| Acetic acid, propyl ester; 273.15 | | | 0.430 |
| $C_{5}H_{10}O_{2}$; [109-60-4] 278.81 | 0.720 | 0.419 | |
| | 0.677 | 0.406 | 0.402 |
| 283.15 285.65 | 0.633 | 0.388 | 0.402 |
| 293.15 | | | 0.355 |
| 293.95 | | 0.349 | |
| 298.25 303.15 | 0.483 | 0.326 | 0 200 |
| 303.13 | 0.386 | 0.278 | 0.299 |
| 313.15 | | ••• | 0.241 |
| 319.56 | 0.257 | 0.204 | |
| 323.15 | | | 0.187 |
| Smoothing equation: $\ln x_{HC1} = 100.477$ Standard error in x_{HC1} about the | - 136.692, regression | /(T/100) - 51.03 n line = 2.98 × | 0 ln(T/100) 10 ⁻³ |
| | 0.728 | 0.421 | 0.446 |
| ester; C ₅ H ₁₀ O ₂ ; [108-21-4] 283.15 289.55 | 0.633 | 0.388 | 0.416 |
| 293.15 | 0.035 | 0.000 | 0.372 |
| 293.75 | 0.576 | 0.365 | |
| 301.95 | 0.469 | 0.319 | 0.210 |
| 303.15 307.35 | 0.400 | 0.286 | 0.310 |
| 313.15 | | | 0.243 |
| 321.45 | 0.233 | 0.189 | 0.400 |
| 323.15 | | | 0.180 |
| Smoothing equation: ln x _{HCl} = 141.452 Standard error in x _{HCl} about the | - 194.592/ regression | /(T/100) - 70.72 h line = 4.38 × | 0 ln(T/100) 10 ⁻³ |
| * calculated by the compiler | | | |
| ** smoothing equation and smoothed va | alues were | calculated by H | .L. Clever |
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Hydrogen Chloride in Non-Aqueous Solvents

| COMPONENTS: (1) Hydrogen chloride; HCl; | | ORIGINAL MEASUREMENTS: | | |
|---|------------------|---|-----------------------------|-------------------------------------|
| [7647-01-0] | | Gerrard, W.; Macklen, E.D. J. Appl. Chem. <u>1956</u> , 6, 241-244 | | |
| (2) Esters of aliphatic can acids. | CDOXYIIC | J. Appl. (| Snem. <u>1956</u> , | 0, 241-244 |
| EXPERIMENTAL VALUES: | т/к | Mole ratio | Mole* | Smoothed** |
| | | HCl $/n$ ester | fraction | |
| | • | | ^x HCl | ^x HCl |
| Acetic acid, 2-methylpropyl | 273.15 | 0 770 | 0.426 | 0.447 |
| ester; C ₆ H ₁₂ O ₂ ; [110-19-0] | 279.25 | 0.772 | 0.436 | 0.419 |
| | 287.45 293.15 | 0.654 | 0.395 | 0.368 |
| | 293.65 303.15 | 0.565 | 0.361 | 0.306 |
| | 303.65 308.05 | 0.442 0.383 | 0.307 0.277 | i |
| | 313.15 | | | 0.243 |
| | 317.35 323.15 | 0.276 | 0.216 | 0.185 |
| Smoothing equation: In x | = 111.201 | - 151.463/ | (T/100) - 56 | .283 ln(T/100) |
| Smoothing equation: ln × _{HCl} Standard error in × _{HCl} | about the | regression | line = 4.63 | $\times 10^{-3}$ |
| Acetic acid, 1-methylpropyl | 273.15 | 0 010 | 0 450 | 0.457 |
| ester; C ₆ H ₁₂ O ₂ ; [105-46-4] | 277.25 283.15 | 0.818 | 0.450 | 0.425 |
| | 288.85 293.15 | 0.649 | 0.394 | 0.374 |
| | 294.55 303.05 | 0.564 0.459 | 0.361 0.315 | |
| | 303.15 | | | 0.312 |
| | 308.65 313.15 | 0.392 | 0.282 | 0.249 |
| | 317.85 323.15 | 0.280 | 0.219 | 0.192 |
| Smoothing equation: ln × _{HCl} | = 102.632 | - 139.384/ | (T/100) - 52 | .133 ln(T/100) |
| Standard error in xHCl | about the | regression | line = 4.96 | × 10 ⁻³ |
| Acetic acid, butyl ester; C ₆ H ₁₂ O ₂ ; [123-86-4] | 273.15 277.95 | 0.741 | 0.426 | 0.436 |
| 6.12.2, [123-00-4] | 283.15 | | | 0.405 |
| | 283.85 292.85 | 0.665 0.556 | 0.399 0.357 | |
| | 293.15 | | 0.318 | 0.358 |
| | 300.65 303.15 | 0.467 | | 0.303 |
| | 312.65 313.15 | 0.337 | 0.252 | 0.247 |
| | 318.15 323.15 | 0.279 | 0.218 | 0.195 |
| Creathing acustions la . | | 100 700// | | |
| Smoothing equation: ln x _{HCl} Standard error in x _{HCl} | about the | regression | 1100 = 3.24 | 501 ln(T/100) × 10 ⁻³ |
| Acetic acid, octyl ester; | 273.15 | 0 7 4 7 | 0 400 | 0.434 |
| C ₁₀ H ₂₀ O ₂ ; [112-14-1] | 277.55 | 0.747 | 0.428 | 0.408 |
| | 288.85 293.15 | 0.610 | 0.379 | 0.361 |
| | 295.35 303.15 | 0.533 | 0.348 | 0.305 |
| | 303.35 | 0.440 | 0.306 | 0.303 |
| | 310.75 313.15 | 0.356 | 0.263 | 0.246 |
| | 320.75 323.15 | 0.255 | 0.203 | 0.192 |
| Smoothing equation: ln x _{HCl} Standard error in x _{HCl} | = 100.796 | - 137.289/(| (T/100) - 51 line = 3.63 | .121 ln(T/100) |
| Standard error in x_{HCl}^{HCl} about the regression line = 3.63 × 10 ⁻³ * calculated by the compiler ** smoothing equation and smoothed values were calculated by H.L. Clever | | | | |
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| CONDONENTE | 1 OPTOTNAL | MEASUREMENTS: | • |
|--|--------------------------------------|---------------------------------|--------------------------------------|
| COMPONENTS: (1) Hydrogen chloride; HCl; | 1 | W.; Macklen, | |
| <pre>[7647-01-0] (2) Esters of aliphatic carboxylic</pre> | J. Appl. | Chem. <u>1956</u> , 6 | 5, 241-244 |
| EXPERIMENTAL VALUES: T/K | Mole ratio | o Mole* | Smoothed** |
| | ⁿ HCl ^{/n} ester | | |
| Acetic acid, phenyl ester, 273.1 | | | 0.275 |
| (phenyl acetate); C ₈ H ₈ O ₂ ; 277.0 [122-79-2] 283.1 | | 0.268 | 0.248 |
| 283.4 293.1 | | 0.244 | 0.211 |
| 291.5 | 5 0.275 | 0.216 | |
| 300.5 303.1 | 5 | 0.182 | 0.170 |
| 309.9 313.1 | | 0.145 | 0.132 |
| 315.1 323.1 | | 0.124 | 0.115 |
| | | | |
| Smoothing equation: $\ln x_{HC1} = 103.44$ Standard error in x_{HC1} about th | 9 - 139.930 e regressio | 7(T/100) - 53 n line = 2.24 | $\times 10^{-3}$ |
| Acetic acid, phenylmethyl 273.1 ester, (benzyl acetate); 277.9 | 5 5 0.489 | 0.328 | 0.341 |
| $C_{9^{H}10}O_{2}; [140-11-4] 283.1 284.1$ | 5 | 0.304 | 0.309 |
| 289.3 | 5 0.392 | 0.282 | |
| 293.1 297.6 | | 0.246 | 0.266 |
| 303.1 304.1 | | 0.216 | 0.220 |
| 313.1 315.4 | 5 | 0.165 | 0.175 |
| 323.1 | | 0.105 | 0.135 |
| Smoothing equation: $\ln x_{HC1} = 90.759$ Standard error in x_{HC1} about th | – 122.460/ e regressio | (T/100) - 46.7 n line = 1.10 | 776 ln(T/100) × 10 ⁻³ |
| Propanoic acid, ethyl ester, 273.1 | | 0.400 | 0.417 |
| (ethyl propionate); C ₅ H ₁₀ O ₂ ; 280.1 [105-37-3] 283.1 | 5 | 0.406 | 0.390 |
| 283.4 287.4 | | 0.391 0.372 | |
| 293.1 293.9 | | 0.339 | 0.343 |
| 301.4 | 5 0.429 | 0.300 | 0 386 |
| 303.1 311.6 | 5 0.315 | 0.240 | 0.286 |
| 313.1 319.3 | | 0.194 | 0.228 |
| 323.1 | 5 | | 0.174 |
| Smoothing equation: $\ln x_{HC1} = 108.52$ Standard error in x_{HC1} about th | 5 - 147.853 e regressio | /(T/100) - 55 n line = 2.52 | .005 ln(T/100) × 10 ⁻³ |
| Butanoic acid, ethyl ester, 273.1 | | | 0.428 |
| (ethyl butyrate); C ₆ H ₁₂ O ₂ ; 279.2 [105-54-4] 283.1 | | 0.414 | 0.398 |
| 283.3 293.1 | 5 0.652 | 0.395 | 0.351 |
| 298.5 | 6 0.472 | 0.321 | |
| 303.1 306.1 | 5 0.391 | 0.281 | 0.296 |
| 313.1 313.7 | | 0.237 | 0.240 |
| 318.5 | 5 0.267 | 0.211 | 0 1 9 9 |
| 323.1 | | $(\pi/100) = 47$ | 0.188 |
| Smoothing equation: $\ln x_{HC1} = 93.226 - 126.530/(T/100) - 47.522 \ln(T/100)$ Standard error in x _{HC1} about the regression line = 2.03 × 10 ⁻³ * calculated by the complier | | | |
| <pre>* calculated by the complier ** smoothing equation and smoothed</pre> | values were | calculated by | H.L. Clever. |

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| COMPONENTS: | ORIGINAL MEASUREMENTS: |
|--|--|
| <pre>(1) Hydrogen chloride; HCl; [7647-01-0]</pre> | Chesterman, D. R. |
| (2) Esters | J. Chem. Soc. <u>1935</u> , 906 - 910. |
| | |
| | |
| VARIABLES: | PREPARED BY: |
| T/K: 298.15 Total P/kPa: 101 (∿1 atm) | W. Gerrard |
| EXPERIMENTAL VALUES: | |
| T/K Observed So Pressure g HCl p/mmHg | lubility Mol Fraction g^{-1} Solution x_1 |
| Acetic acid, methyl este C ₃ H ₆ O ₂ ; [79-20-9] | r or methyl acetate; |
| 298.15 760 | 0.46 0.63 |
| Acetic acid, ethyl ester C ₄ H ₈ O ₂ ; [141-78-6] | or ethyl acetate; |
| 298.15 765 | 0.21 0.39 |
| | |
| AUXILIARY | INFORMATION |
| | |
| METHOD/APPARATUS/PROCEDURE: The apparatus was that used for the conductivity. A sample of the saturated solution was removed, weighed, the hydrogen chloride was reacted with excess standard base which was back titrated with a standard acid solution. | <pre>SOURCE AND PURITY OF MATERIALS: (1) Hydrogen chloride. Prepared from conc. sulfuric acid and pure sodium chloride. Passed through sulfuric acid and over P₂O₅. (2) Methyl acetate. Was stated to be the purest obtainable. Dried with phosphorus pentoxide, b.p./°C (760 mmHg) = 57.3 - 57.8. Ethyl acetate. Was stated to be the purest obtainable. Dried with P₂O₅, b.p./°C (765 mmHg) = 76.8 - 77.2.</pre> |

| COMPONENTS: (1) Hydrogen chloride; HCl; | ORIGINAL MEASUREMENTS: Ionin, M. V.; Shverina, V. G. | | |
|--|---|--|--|
| [7647-01-0] | Zh. Obshch. Khim. <u>1965</u> , 35, 209-211. | | |
| (2) Acetic acid, alkane esters; $C_3H_6O_2$ and $C_4H_8O_2$ | J. Gen. Chem. USSR (Engl. Transl.) <u>1965</u> , 35, 211 - 212. | | |
| VARIABLES: | PREPARED BY: | | |
| T/K: 298.15 Total P/kPa: 101.3 (atmospheric) | W. Gerrard | | |
| EXPERIMENTAL VALUES: | | | |
| T/K Refractive Solution M Index ¹ Density ${}^{n_{298}}$ $\rho/g \text{ cm}^{-3}$ | Nol Ratio Mol Fraction n_1/n_2 x_1 | | |
| Acetic acid, methyl ester; C3H6 | 0 ₂ ; [79-20-9] | | |
| 298.15 1.36184 0.96322 | 0.333 0.2500 | | |
| Acetic acid, ethyl ester; C ₄ H ₈ C | 2; [141-78-6] | | |
| 298.15 1.37248 0.92652 | 0.316 0.2400 | | |
| | | | |
| AUXILIARY | INFORMATION | | |
| METHOD/APPARATUS/PROCEDURE: | SOURCE AND PURITY OF MATERIALS: | | |
| The ester was saturated with hydrogen chloride at 298.2 K and atmospheric pressure, not specified. An aliquot of the solution was diluted with water and titrated with alkali. | (1) Hydrogen chloride. Prepared from pure sodium chloride and sulfuric acid, and dried by sulfuric acid and calcium chloride. (2) Acetic acid, alkane esters. Stated to be "pure". | | |
| | ESTIMATED ERROR: | | |
| | | | |
| | REFERENCES : | | |

| COMPONENTS: (1) Hydrogen chloride; HCl; [7647-01-0] | ORIGINAL MEASUREMENTS: Ionin, M. V.; Shverina, V. G. |
|--|---|
| | Zh. Obshch. Khim. <u>1965</u> , 35, 209-211. |
| <pre>(2) Acetic acid, alkane esters; C₅H₁₀O₂ and C₆H₁₂O₂</pre> | J. Gen. Chem. USSR (Engl. Transl.) 1965, 35, 211 - 212. |
| VARIABLES: | PREPARED BY: |
| T/K: 298.15 Total P/kPa: 101.3 (atmospheric) | W. Gerrard |
| EXPERIMENTAL VALUES: | ······································ |
| T/K Refractive Solution Index Density n_{D}^{298} $\rho/g \text{ cm}^{-3}$ | Mol Ratio Mol Fraction ⁿ 1 ^{/n} 2 ^x 1 |
| Acetic acid, propyl ester; C ₅ H | 10 ⁰ 2; [109-60-4] |
| 298.15 1.38310 0.92210 | 0.321 0.2429 |
| Acetic acid, 1-methyl ethyl es | ter; C ₅ H ₁₀ O ₂ ; [108-21-4] |
| 298.15 1.37668 0.93304 | 0.317 0.2405 |
| Acetic acid, butyl ester; C ₆ H ₁ | 2 ⁰ 2; [123-86-4] |
| 298.15 1.39361 0.90420 | 0.323 0.2441 |
| | |
| AUXILIARY | INFORMATION |
| METHOD/APPARATUS/PROCEDURE: | SOURCE AND PURITY OF MATERIALS: |
| The ester was saturated with hydrogen chloride at 298.2 K and atmospheric pressure, not specified. An aliquot of the solution was diluted with water and titrated with alkali. | Hydrogen chloride. Prepared from pure sodium chloride and sulfuric acid, and dried by sulfuric acid and calcium chloride. Acetic acid, alkane esters. Stated to be "pure". |
| | ESTIMATED ERROR: |
| | |
| | REFERENCES: |
| | |

| Hydrogen Chloride | in Non-Aqueous Solvents 217 |
|--|--|
| COMPONENTS : | ORIGINAL MEASUREMENTS: |
| <pre>(1) Hydrogen chloride; HCl; [7647-01-0]</pre> | Gerrard, W.; Macklen, E. D. |
| <pre>(2) Acetic acid pentyl ester or n-amyl acetate; C₇H₁₄O₂;</pre> | J. Appl. Chem. <u>1959</u> , 9, 85 - 88. |
| [628-63-7] | |
| VARIABLES: | PREPARED BY: |
| T/K: 279.85 - 314.75 Total P/kPa: 101.325 (1 atm) | W. Gerrard |
| | (smoothed data calculated by H.L. Clever) |
| EXPERIMENTAL VALUES: | ······ |
| T/K Mol | Ratio Mol Fraction |
| | C7 ^H 14 ^O 2 ^x HC1 |
| | 723 0.420 |
| | 687 0.407 |
| 288.35 0. | 615 0.381 |
| 294.15 0. | 545 0.353 |
| | 476 0.322 |
| | 407 0.289 318 0.241 |
| | |
| The mole fraction values were calcu | lated by the compiler. |
| Smoothed Data: $\ln x_{\rm HC1} = 84.774 - 100$ | 114.771/(T/100) - 43.344 ln (T/100) |
| | - |
| Standard error abou | t regression line = 1.90×10^{-3} |
| T/K | Mol Fraction |
| | ^ж нС1 |
| 283.15 | 0.418 |
| 293.15 | |
| 303.15 | 0.315 |
| 313.15 | 0.258 |
| | |
| | |
| A11X11 T A | RY INFORMATION |
| | |
| METHOD/APPARATUS/PROCEDURE: | SOURCE AND PURITY OF MATERIALS: |
| The apparatus and procedure were those described by Gerrard and | (1) Hydrogen chloride. Self prepared and dried. |
| Macklen (1). The hydrogen chloride | |
| was generated in an all glass | (2) Acetic acid pentyl ester or |
| apparatus. The absorption vessel, | n-amyl acetate. Purified, |
| previously weighed, was fitted with | |
| a stoppered bubbler tube, and a | physical constants. |
| stoppered outlet tube. Entrained liquid was condensed at 273.15 K, | |
| and allowed for. The amount of gas | |
| absorbed by a known weight of liquid | |
| was determined by weighing. | |
| | ESTIMATED ERROR: |
| | $\delta x/x = 0.01$ |
| | |
| | REFERENCES : |
| | 1. Gerrard, W.; Macklen, E. D. |
| | J. Appl. Chem. <u>1956</u> , 6, 241. |
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| | <u></u> |

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| 210 Hydrogen Chloride In | | | | |
|--|--|--|--|--|
| COMPONENTS: | ORIGINAL MEASUREMENTS: | | | |
| <pre>(1) Hydrogen chloride; HCl; [7647-01-0]</pre> | Gerrard, W.; Macklen, E. D. | | | |
| (2) Benzeneacetic acid, ethyl ester; C ₁₀ ^H ₁₂ O ₂ ; [101-97-3] | J. Appl. Chem. <u>1959</u> , 9, 85 - 88. | | | |
| | | | | |
| VARIABLES: | PREPARED BY: | | | |
| T/K: 273.15 - 320.65 Total P/kPa: 101.325 (1 atm) | W. Gerrard (smoothed data calculated by H.L. Clever) | | | |
| EXPERIMENTAL VALUES: | I | | | |
| | | | | |
| T/K Mol Ra nHCl/ ⁿ Cl | | | | |
| 273.15 0.5 | | | | |
| 281.95 0.5 | | | | |
| 291.05 0.4 | 14 0.293 | | | |
| 303.05 0.3 | | | | |
| 308.65 0.2 | | | | |
| 314.45 0.2 320.65 0.1 | | | | |
| | | | | |
| The mole fraction values were calcula | ted by the compiler. | | | |
| | 38.964/(T/100) - 52.600 ln (T/100) | | | |
| Standard error about | regression line = 4.87×10^{-3} | | | |
| т/к | Mol Fraction | | | |
| | ^x HCl | | | |
| 273.15 283.15 | 0.367 0.334 | | | |
| 203.15 | 0.287 | | | |
| 303.15 | 0.235 | | | |
| 313.15 | 0.184 | | | |
| 323.15 | 0.138 | | | |
| | | | | |
| | INFORMATION | | | |
| METHOD / APPARATUS / PROCEDURE : | SOURCE AND PURITY OF MATERIALS: | | | |
| The apparatus and procedure were those described by Gerrard and | (1) Hydrogen chloride. Self prepared and dried. | | | |
| Macklen (1). The hydrogen chloride | | | | |
| was generated in an all glass | (2) Benzeneacetic acid, ethyl ester. | | | |
| apparatus. The absorption vessel, | Purified, distilled, and | | | |
| previously weighed, was fitted with a stoppered bubbler tube, and a | attested by physical constants. | | | |
| stoppered outlet tube. Entrained | | | | |
| liquid was condensed at 273.15 K, | | | | |
| and allowed for. The amount of gas | | | | |
| absorbed by a known weight of liquid | | | | |
| was determined by weighing. | FOTIMATED EDDOD. | | | |
| | ESTIMATED ERROR: | | | |
| | $\delta x/x = 0.02$ | | | |
| | | | | |
| | REFERENCES : | | | |
| | 1. Gerrard, W.; Macklen, E. D. J. Appl. Chem. <u>1956</u> , 6, 241. | | | |
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| COMPONENTS: (1) Hydrogen chloride; HCl; [7647-01-0] | ORIGINAL MEASUREMENTS: Cook, T. M. | | | |
|--|--|--|--|--|
| (2) Esters of carboxylic acids | Thesis, <u>1966</u> , University of London. | | | |
| VARIABLES: | PREPARED BY: | | | |
| T/K: See below Total P/kPa : 101.325 (1 atm) | W. Gerrard | | | |
| EXPERIMENTAL VALUES: | | | | |
| т/к | Mole ratio Mole* Smoothed** ⁿ HCl ^{/n} borate fraction mole fraction ^x HCl ^x HCl | | | |
| 1. December 2 2 | 25 0 (52 0 205 | | | |
| | 35 0.652 0.395 35 0.617 0.382 | | | |
| | 95 0.576 0.365 | | | |
| 283. | 15 0.549 0.354 0.361 | | | |
| 291. | 35 0.455 0.313 | | | |
| 293. | 15 0.301 | | | |
| Smoothing equation: ln x _{HCl} = -6.36 Standard error in x _{HCl} about t | 3 + 15.130/(T/100) he regression line = 5.49 ×10 ⁻³ | | | |
| 2-Buten-1-ol acetate, 279. | 65 0.760 0.432 | | | |
| (crotyl acetate); C _c H ₁₀ O ₂ ; 281. | 15 0.706 0.414 | | | |
| [628-08-0] 810 2 283. | 15 0.668 0.400 0.403 45 0.640 0.390 | | | |
| | | | | |
| 293. | 15 0.341 | | | |
| Smoothing equation: $\ln x_{HC1} = -5.781 + 13.796/(T/100)$ Standard error in x_{HC1} about the regression line = 4.42 × 10 ⁻³ | | | | |
| * calculated by the compiler ** smoothing equation and smoothed values were calculated by H.L. Clever | | | | |
| AUXILIARY INFORMATION | | | | |
| METHOD/APPARATUS/PROCEDURE: The data were cited by Gerrard (1). | | | | |
| Hydrogen chloride was passed into a bubbler tube containing a weighed amount of solvent at the specified temperature until the increase in weight was constant at the barometric pressure (2). | | | | |
| SOURCE AND PURITY OF MATERIALS: | | | | |
| | | | | |
| B.Pt.(1 atm)°/ | C Refractive Index Density | | | |
| 1-propen-2-ol acetate 102-103.5 | $n^{21} - 1.4051$ $d^{20} - 0.901$ | | | |
| 2-buten-1-ol acetate 131-132.5 | $n_{1}^{2} = 1.4197$ $d_{1}^{2} = 0.911$ | | | |
| propanoic acid, 121.5-123 | $n_D^{23.5} = 1.4060$ $d^2 = 0.899$ | | | |
| 2-propenyl ester | - | | | |
| 2-butenoic acid, 48 | $n_D^{23} = 1.4237$ $d^{20} = 0.919$ | | | |
| ethyl ester butanoic acid, 155-156 | $n_{D}^{21.5} = 1.4213$ $d^{20}_{4} = 0.947$ | | | |
| butanoic acid, 155-156 2-propynyl ester | $m_{\rm D} = 1.4215$ $a_4 = 0.547$ | | | |
| butanoic acid, 113-114 | $n_D^{25} = 1.4133$ $d^{20}_4 = 0.895$ | | | |
| 2-propenyl ester | Ъ | | | |
| butanoic acid, 143.5-145 propyl ester | $n_D^{3^2} = 1.3953$ $d^{2^0}_4 = 0.8695$ | | | |
| ESTIMATED ERROR: $\delta x_{HCl}/x_{HCl} = \pm 0.005$ | | | | |
| REFERENCES: | | | | |
| Gerrard, W. J. Chim. Phys. <u>1964</u> Solubility of Gases in Liquids, | , <i>61</i> , 73; Plenum Press, New York, <u>1976</u> . , W.K. J. <i>Appl. Chem.</i> 1970, 20, 109. | | | |
| | | | | |

| COMPONENTS: (1) Hydrogen chloride; HCl; [7647-01-0] | ORIGINAL ME Cook, T. M. | CASUREMENTS: | | |
|--|---------------------------------------|--|----------|--|
| (2) Esters of carboxylic acids | | Thesis, <u>1966</u> , University of London. | | |
| EXPERIMENTAL VALUES: | [| | | |
| | 'K Mole ratio | Mole* Smoo | thed** | |
| | ⁿ HCl ^{/n} borate | fraction mole f | | |
| | | ^x HCl ^x H | C1 | |
| Propanoic acid, 2-propenyl 27 | .15 | 0. | 435 | |
| | .55 0.592 | 0.372 | | |
| | 0.564 | | 361 | |
| • | 5.25 0.520 8.15 | 0.342 0. | 304 | |
| Smoothing equation: $\ln x = -6.0$ | 97 ± 14 381/(m/1 | 001 | | |
| Smoothing equation: $\ln x_{HC1} = -6.0$ Standard error in x_{HC1} about | the regression 1 | $ine = 3.14 \times 10^{-4}$ | | |
| | 8.15 | | 479 | |
| (ethyl crotonate); C ₆ H ₁₀ O ₂ ; 27 [°] | .55 0.806 | 0.446 | | |
| [10544-63-5] 28 | .95 0.710 | 0.415 | 410 | |
| | 8.15 0.700 8.15 0.699 | 0.412 0. 0.411 | 410 | |
| 289 | .15 0.610 | 0.379 | | |
| | 3.15 | | 362 | |
| | 1.15 | | 326 | |
| Smoothing equation: $\ln x_{HC1} = -32$. Standard error in x_{HC1} about | 423 + 49.458/(T/ the regression 1 | 100) + 13.513 ln(ine = 2.11×10^{-3} | T/100) | |
| | 3.15 | | 333 | |
| | .05 0.379 2.55 0.362 | 0.275 0.266 | | |
| | 3.15 0.356 | | 263 | |
| 284 | .75 0.344 | 0.256 | | |
| | 6.85 0.327 8.15 | 0.246 | 225 | |
| | | | | |
| Smoothing equation: ln × _{HCl} = -10 [°] Standard error in × _{HCl} about | .987 + 155.955/(the regression 1 | T/100) + 49.552 1 ine = 5.79 × 10 ⁻⁴ | n(T/100) | |
| , | .15 | | 438 | |
| | .65 0.696 .35 0.585 | 0.410 0.369 | | |
| | 0.573 | | 363 | |
| | .15 0.551 | 0.355 | | |
| | 0.35 0.542 0.55 0.523 | 0.351 0.343 | | |
| | .15 0.569 | 0.319 | | |
| 293 | 1.15 | 0. | 313 | |
| Smoothing equation: ln × _{HCl} ≈ -54 Standard error in × _{HCl} about | 106 + 80.510/(T/ the regression 1 | 100) + 23.691 ln(ine = 3.97×10^{-3} | т/100) | |
| Butanoic acid, propyl ester; 28 | .15 0.778 | 0.438 | | |
| $C_{7}H_{14}O_{7}; [105-66-8]$ 283 | 0.694 | 0.410 0. | 412 | |
| 283 | .15 0.692 .25 0.662 | 0.409 0.398 | | |
| | .25 0.584 | 0.369 | | |
| | .15 | | 327 | |
| Smoothing equation: $\ln x_{HC1} = -7.6$ Standard error in x_{HC1} about | 53 + 19.157/(T/1 the regression l | 00) ine = 3.98×10^{-3} | | |
| <pre>* calculated by the compiler ** smoothing equation and smoother</pre> | , | | Clever | |
| | | - | | |
| | | | | |

| COMPONENTS: | ORIGINAL M | EASUREMENTS: | |
|---|---|---|--------------|
| (1) Hydrogen chloride; HCl; | | .; Macklen, E.D. | |
| [7647-01-0] | | hem. <u>1956</u> , 6, 241-2 | 244 |
| (2) Halogenated esters | 0. <i>App1</i> . 0 | <i>nem</i> , <u>1990</u> , 0, 241-2 | |
| VARIABLES: | PREPARED B | | |
| T/K: See below Total P/kPa : 101.325 (1 atm) | w. G | errard | |
| EXPERIMENTAL VALUES: | /K Mole ratio ⁿ HCl ^{/n} ester | Mole* Smoot fraction mole fr | hed** |
| | HCI' ester | ^x HCl ^x HC | 21 |
| Carbonochloridic acid, ethyl 27 | 3.15 | 0 | 0908 |
| ester, (ethyl chloroformate); 27 | 7.25 0.098 | 0.0893 | 0,000 |
| | 1.45 0.088 3.15 | 0.0809 | 0794 |
| | 8.75 0.074 | 0.0689 | 0620 |
| 29 | 3.55 0.064 | 0.0602 | 0020 |
| | 1.05 0.050 3.15 | 0.0476 | 0437 |
| 30 | 6.75 0.041 | 0.0394 | |
| | 3.15 8.25 0.022 | 0.0215 | 0282 |
| 32 | 3.15 | 0. | 0169 |
| Smoothing equation: ln x _{HCl} = 204 Standard error in x _{HCl} about | .296 - 279.047/(the regression | T/100) - 104.032 ln line = 1.65 × 10 ⁻³ | (T/100) |
| Carbonochloridic acid, propyl 27 | 3.15 | | 0959 |
| • • • • • | 9.55 0.099 2.55 0.092 | 0.0901 0.0842 | |
| [109-61-5] 28 | 3.15 3.15 | | 0841 0672 |
| 29 | 3.35 0.071 | 0.0663 | |
| | 3.15 4.05 0.051 | 0. 0.0485 | 0494 |
| | 3.15 | | 0339 |
| | 7.45 0.029 3.15 | | 0219 |
| <pre>Smoothing equation: ln x_{HCl} = 166.569 - 227.164/(T/100) - 85.335 ln(T/100) Standard error in x_{HCl} about the regression line = 1.01 × 10⁻³ * calculated by the compiler ** smoothing equation and smoothed values were calculated by H.L. Clever</pre> | | | |
| | | | |
| AUXILI | ARY INFORMATION | | |
| METHOD/APPARATUS/PROCEDURE: | SOURCE AND | PURITY OF MATERIAL | s: |
| Hydrogen chloride was generated in an all-glass apparatus. | | gen chloride: self- red and dried. | |
| The all-glass absorption vessel (50 cm ³) comprised an inlet bubble tube, an outlet tube, and the par- holding a weighed amount of liquid | er sampl t attes | esters: high grade es were distilled a ted. | nd |
| Each tube was fitted with a tap, a | and ESTIMATED | | |
| either a B-19 cone, or a B-19 soci Entrained liquid was collected and | $\delta x_{\rm HCl}/$ | $\delta T/K = \pm 0.1$ | |
| allowed for. Temperature control was within 0.1 K. The amount of g | | | |
| absorbed was determined by weighin | ng. | • | |
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| COMPONENTS: | <u> </u> | ORIGINAL | MEASUREMENTS: | · · · · · · · · · · · · · · · · · · · |
|--|------------------|---------------------------------------|---------------------------------|---------------------------------------|
| (1) Hydrogen chloride; HCl; | | Gerrard. | W.; Macklen, H | ε. D. |
| [7647-01-0] | | | | |
| (2) Halogenated esters | | J. Appl. (| Chem. <u>1956</u> , 6 | , 241-244 |
| | | | | |
| EXPERIMENTAL VALUES: | <u></u> . | í | ···· | |
| | T/K | Mole ratio HCl ^{/n} ester | | Smoothed** nole fraction |
| | - 1 | AC1' ester | ^x HCl | ^x HCl |
| | | <u> </u> | | |
| Dichloroacetic acid, ethyl ester, (<i>ethyl</i> | 273.15 278.95 | 0.180 | 0.153 | 0.165 |
| dichloroacetate); C ₄ H ₆ O ₂ Cl ₂ ; | 282.65 | 0.169 | 0.145 | |
| [535-15-9] | 283.15 286.35 | 0.158 | 0.136 | 0.144 |
| | 293.15 | 0.130 | 0.150 | 0.120 |
| | 294.15 | 0.134 | 0.118 | |
| | 301.95 303.15 | 0.108 | 0.0975 | 0.0960 |
| | 312.45 | 0.083 | 0.0766 | |
| | 313.15 320.95 | 0.063 | 0.0593 | 0.0743 |
| | 323.15 | 0.005 | 0.0393 | 0.0559 |
| Smoothing equation: In x | 87 315 | 117 286/0 | T/100) - 45.95 | $57 \ln(\pi/100)$ |
| Smoothing equation: ln x _{HCl} = Standard error in x _{HCl} ab | out the | regression | line = 8.51 | < 10 ⁻⁴ |
| | 202 15 | | | 0.0992 |
| Trichloroacetic acid,ethyl ester, (<i>ethyl</i> | 283.15 283.65 | 0.108 | 0.0975 | 0.0992 |
| trichloroacetate); C ₄ H ₅ O ₂ Cl ₃ ; | 293.15 | | | 0.0749 |
| [515-84-4] | 295.25 | 0.077 | 0.0715 | 0.0570 |
| | 303.85 | 0.058 | 0.0548 | |
| | 312.55 | 0.047 | 0.0449 | 0.0437 |
| | 323.15 | | | 0.0338 |
| | 324.05 | 0.034 | 0.0329 | 0 0000 |
| | 333.15 | | | 0.0262 |
| Smoothing equation: ln x _{HCl} = Standard error in x _{HCl} ab | 8.760 - | 3.701/(T/1 | 00) - 9.381 lr line = 1.07 > | (T/100) |
| Standard error in X _{HCl} at | out the | regression | ine = 1.07 | K 10 |
| Bromoacetic acid, ethyl ester, | 280.15 | 0.312 | 0.238 | 0.000 |
| (ethyl bromoacetate); C ₄ H ₇ O ₂ Br; [105-36-2] | 283.15 287.25 | 0.269 | 0.212 | 0.228 |
| 4.7-22, (103-30-2) | 293.15 | | | 0.193 |
| | 296.15 301.75 | 0.218 0.187 | 0.179 0.158 | |
| | 303.15 | 0.,0/ | 0.100 | 0.151 |
| | 307.75 | 0.155 | 0.134 | 0 110 |
| | 313.15 320.35 | 0.092 | 0.0842 | 0.110 |
| | 323.15 | | | 0.0760 |
| | 333.15 | | | 0.0496 |
| Smoothing equation: $\ln x_{HC1} =$ | 158.684 | - 217.218/ | (T/100) - 80.1 | $76 \ln(T/100)$ |
| Standard error in xHCl ab | out the | regression | $\pm 1ne = 2.92 >$ | < 10 ° |
| * calculated by the compiler | | - | | |
| ** smoothing equation and smo | othed va | alues were o | calculated by | H.L. Clever |
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| COMPONENTS: | ORIGINAL MEASUREMENTS: |
|--|---|
| <pre>(1) Hydrogen chloride; HCl; [7647-01-0]</pre> | Gerrard, W.; Macklen, E.D. |
| (2) Halogenated esters | J. Appl. Chem. <u>1956</u> , 6, 241-244 |
| EXPERIMENTAL VALUES: T/K | Mole ratio Mole* Smoothed** HCl ^{/n} ester fraction mole fraction |
| 2-Chloroethanol acetate, 273.15 (2-chloroethyl acetate); 279.95 C.H_O_Cl: [542-58-5] 283.15 | 0.306 0.405 0.288 0.276 |
| C ₄ H ₇ O ₂ Cl; [542-58-5] 283.15 290.15 293.15 300.25 | 0.325 0.245 0.233 |
| 300.25 303.15 306.45 | 0.186 |
| 313.15 313.45 | |
| Smoothing equation: ln x _{HCl} = 119.619 Standard error in x _{HCl} about the | - 162.125/(T/100) - 61.153 ln(T/100) regression line = 1.47 × 10 ⁻³ |
| 2,2,2-Trichloroethanol 283.05 acetate, C ₄ H ₅ O ₂ Cl ₃ ; [625-24-1] 283.15 | 0.253 0.202 0.203 |
| 291.05 293.15 | 0.214 0.176 0.167 |
| 299.85 303.15 305.75 | 0.140 |
| 312.45 313.15 | 0.136 0.120 0.118 |
| 316.65 323.15 | 0.126 0.112 0.101 |
| Smoothing equation: $\ln x_{HC1} = -7.243$ Standard error in x_{HC1} about the | + 15.993/(T/100) regression line = 2.02 × 10 ⁻³ |
| * calculated by the compiler ** smoothing equation and smoothed v | alues were calculated by H.L. Clever |
| | |

| COMPONENTS: | ORIGINAL MEASUREMENTS: |
|--|--|
| 1. Hydrogen Chloride; HCl; | 1 |
| [7647-01-0] | Gerrard, W.; Mincer, A. M. A.; Wyvill, P. L. |
| 2. Carbonochloridic acid ethyl ester or Ethyl chloroformate; C ₃ H ₅ O ₂ Cl; [541-41-3] | J. Appl. Chem. <u>1959</u> , 9, 89 - 93. |
| VARIABLES: | PREPARED BY: |
| T/K: 273.15 - 300.35 | |
| Total P/kPa: 101.325 (1 atm) | W. Gerrard (smoothed data calculated by H.L. Clever) |
| | (shoothed data calculated by h.L. clevel) |
| EXPERIMENTAL VALUES:T/K Mol Rat | io Mol Fraction |
| $\frac{n_{\rm HC1}/n_{\rm C_3H}}{2}$ | 5 ⁰ 2 ^{C1} XHC1 |
| 273.15 0.16 | 9 0.145 |
| 277.75 0.14 | |
| 282.85 0.11 289.35 0.09 | |
| 300.35 0.06 | |
| Smoothed Data: $\ln X_{HC1} = -11.217 + 2$ | 5.368/(m/100) |
| | |
| | Regression Line = 4.30×10^{-4} |
| T/K | Mol Fraction |
| | x _{HC1} |
| | 0.145 |
| 273.15 283.15 | 0.145 0.105 |
| 293.15 | 0.0770 |
| 303.15 | 0.0579 |
| The mole fraction values were | calculated by the compiler. |
| | INFORMATION |
| METHOD APPARATUS/PROCEDURE: | SOURCE AND PURITY OF MATERIALS: |
| The solvent was weighed in a bubbler tube. The amount of gas absorbed was determined by reweighing to constant weight. The total pressure | Hydrogen Chloride. Good specimen from a commercial cylinder was dried. |
| was barometric, very nearly 1 atm (101.325 kPa). | Carbonochloridic acid ethyl ester. Carefully purified, and purity rigorously attested. |
| | |
| 1 | ESTIMATED ERROR: |
| | $\delta x_{1}/x_{1} = 0.01$ |
| | REFERENCES : |
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| COMPONENTS: | ORIGINAL MEASUREMENTS: |
|--|---|
| <pre>(1) Hydrogen chloride; HCl; [7647-01-0]</pre> | Gerrard, W.; Mincer, A. M. A.; Wyvill, P. L. |
| <pre>(2) Carbonochloridic acid propyl ester or 1-propyl chloroformate; C4^H7^{ClO}2; [109-61-5]</pre> | J. Appl. Chem. <u>1960</u> , 10, 115-121. |
| VARIABLES: | PREPARED BY: |
| T/K: 274.15 - 302.35 | W. Gerrard |
| Total P/kPa: 101.325 (1 atm) | (smoothed data calculated by H.L. Clever) |
| EXPERIMENTAL VALUES: | - L |
| T/K Mol Ra | |
| ⁿ HCl ^{/n} C ₄ H | ⁴ 7 ^{c10} 2 ^x 1 |
| 274.15 0.179 | |
| 282.95 0.139 | 0.122 |
| 292.75 0.10 302.35 0.076 | |
| | |
| The compiler calculated the mole frac | ction values. |
| Smoothed Data: $\ln x_1 = -10.1355 + 22$ | 2.665/(T/100) |
| ± | the regression line is 2.57×10^{-3} |
| T/K | Mol Fraction x1 |
| | |
| 273.15 283.15 | 0.159 0.119 |
| 293.15 | 0.0904 |
| 303.15 | 0.0700 |
| | |
| AUXILIARY | (INFORMATION |
| METHOD 'APPARATUS / PROCEDURE : | SOURCE AND PURITY OF MATERIALS: |
| The liquid component was weighed in a bubbler tube. The amount of gas absorbed was determined by re- weighing to constant weight. The total pressure was barometric, very nearly 1 atm (101.325 kPa). | Hydrogen chloride. Good specimen from a commercial cylinder was dried. Carbonochloridic acid propyl ester. Carefully purified, and purity rigorously attested. |
| | ESTIMATED ERROR: $\delta x_1 / x_1 = 0.015$ REFERENCES: |
| | |

| riyurugen cinu | | m-Aqueous Solvents |
|---|---|---|
| COMPONENTS : | 0 | RIGINAL MEASUREMENTS: |
| (1) Hydrogen chloride; HCl; | G | errard, W.; Macklen, E. D. |
| <pre>[7647-01-0] (2) Chloroacetic acid ethyl est C₄H₇ClO₂; [105-39-5]</pre> | er; | 7. Appl. Chem. 1959, 9, 85 – 88. |
| VARIABLES: | P | REPARED BY: |
| T/K: 280.45 - 316.35 Total P/kPa: 101.325 (1 atm) | | W. Gerrard (smoothed data calculated by H.L. Clever) |
| EXPERIMENTAL VALUES: | | |
| | -1 | |
| | ol Ratio ./ ⁿ C4 ^H 7Cl | |
| 280.45 | 0.290 | 0.225 |
| 284.05 | 0.269 | 0.212 |
| 290.25 | 0.232 | 0.188 |
| 297.95 | 0.186 | 0.157 |
| 303.85 312.15 | 0.158 0.114 | 0.136 |
| 312.15 316.35 | 0.094 | 0.102 0.0859 |
| | 89 - 215 | ad by the compiler. $0.066/(T/100) - 80.101 \ln (T/100)$ Egression line = 1.94×10^{-3} |
| , | T/K Mo | l Fraction |
| | I/K MO | |
| | | ^x HC1 |
| 29 30 31 | 3.15 3.15 3.15 | 0.215 0.178 0.137 0.0977 0.0660 |
| AUXILIARY INFORMATION METHOD/APPARATUS/PROCEDURE: The apparatus and procedure were those described by Gerrard and Macklen (1). The hydrogen chloride was generated in an all glass apparatus. The absorption vessel, previously weighed, was fitted with a stoppered bubbler tube, and a stoppered outlet tube. Entrained liquid was condensed at 273.15 K, and allowed for. The amount of gas absorbed by a known weight of liquid | | |
| was determined by weighing. | E | ESTIMATED ERROR: |
| | | $\delta x/x = 0.02$ |
| | | REFERENCES : |
| | | . Gerrard, W.; Macklen, E. D. J. Appl. Chem. <u>1956</u> , 6, 241. |
| | | |

| nyarogon onionae i | n Non-Aqueous Solvents 227 |
|--|--|
| COMPONENTS: | ORIGINAL MEASUREMENTS: |
| <pre>(1) Hydrogen chloride; HCl; [7647-01-0]</pre> | Gerrard, W.; Mincer, A. M. A.; Wyvill, P. L. |
| <pre>(2) Carbonochloridic acid butyl ester or butyl chloroformate; C₅H₉ClO₂; [592-34-7]</pre> | J. Appl. Chem. <u>1960</u> , 10, 115-121. |
| VARIABLES: | PREPARED BY: |
| T/K: 273.15 - 313.15 Total P/kPa: 101.325 (1 atm) | W. Gerrard (smoothed data calculated by H.L. Clever) |
| EXPERIMENTAL VALUES: | ······································ |
| | Ratio Mol Fraction C5 ^H 9 ^{ClO} 2 |
| 283.15 0. 291.75 0. 298.75 0. 303.15 0. | 192 0.161 140 0.123 110 0.0991 0885 0.0813 0761 0.0707 0551 0.0522 |
| The compiler calculated the mole fra | action values. |
| - | |
| - | .462/(T/100) - 31.280 ln (T/100) t the regression line is 1.08×10^{-3} |
| | |
| T/K | Mol Fraction ^x 1 |
| 273.15 | |
| 283.15 293.15 | 0.125 |
| 303.15 | 0.0709 |
| 313.15 | 0.0523 |
| | |
| AUXILIA | RY INFORMATION |
| METHOD /APPARATUS / PROCEDURE : | SOURCE AND PURITY OF MATERIALS: |
| The liquid component was weighed in a bubbler tube. The amount of gas absorbed was determined by re- weighing to constant weight. The total pressure was barometric, very nearly 1 atm (101.325 kPa). | Hydrogen chloride. Good specimen from a commercial cylinder was dried. |
| | ESTIMATED ERROR: |
| | $\delta x_1 / x_1 = 0.005$ |
| | REFERENCES: |
| | |
| | |

| COMPONENTS: | | ORIGINAL MEASUREMENTS: |
|---|--|---|
| <pre>(1) Hydrogen chloride; HCl; [7647-01-0]</pre> | | Gerrard, W.; Macklen, E. D. |
| <pre>(2) 3-Chloropropanoic acid, ester; C₅H₉ClO₂; [623-7</pre> | ethyl 1-2] | J. Appl. Chem. <u>1959</u> , 9, 85 - 88. |
| | | |
| VARIABLES: T/K: 273.15 - 320. | 15 | PREPARED BY: |
| Total P/kPa: 101.325 (1 at | | W. Gerrard (smoothed data calculated by H.L. Clever) |
| EXPERIMENTAL VALUES: | | |
| | | |
| T/K | Mol Rat ⁿ HC1/ ⁿ C ₅ H | |
| 273.15 | 0.496 | 0.332 |
| 284.05 | 0.403 | 0.287 |
| 296.05 | 0.309 | 0.236 |
| 302.95 | 0.261 | 0.207 |
| 306.75 312.55 | 0.232 0.190 | 0.188 0.160 |
| 312.33 | 0.147 | 0.128 |
| The mole fraction values we | | ted by the compiler. |
| Smoothed Data: $\ln x_{HC1} = 1$ | 03.162 - 1 | 39.249/(T/100) - 53.037 ln (T/100) |
| Standard er | ror about | regression line = 3.49×10^{-3} |
| | <u></u> | |
| | T/K | Mol Fraction |
| | | ^x HCl |
| | 273.15 | 0.329 |
| | 283.15 | 0.296 |
| | 293.15 | 0.251 |
| | 303.15 | 0.203 |
| | 313.15 323.15 | 0.158 0.118 |
| | | |
| | AUXILIARY | INFORMATION |
| METHOD /APPARATUS / PROCEDURE : | | SOURCE AND PURITY OF MATERIALS: |
| The apparatus and procedure | were | (1) Hydrogen chloride. Self prepared |
| those described by Gerrard | and | and dried. |
| Macklen (1). The hydrogen | chloride | |
| was generated in an all gla | | (2) 3-Chloropropanoic acid, ethyl ester Purified, distilled, and |
| apparatus. The absorption previously weighed, was fit | | attested by physical constants. |
| a stoppered bubbler tube, a | | |
| stoppered outlet tube. Ent | rained | |
| liquid was condensed at 273 | .15 K, | |
| and allowed for. The amoun | | |
| absorbed by a known weight was determined by weighing. | | |
| and determined by weighing. | | ESTIMATED ERROR: |
| | | |
| | | $\delta x/x = 0.01$ |
| | | REFERENCES : |
| | | 1. Gerrard, W.; Macklen, E. D. |
| | | J. Appl. Chem. <u>1956</u> , 6, 241. |
| | | 1 |
| | | |
| | | |
| | | 1 |

| Hydrogen Chloride in I | Non-Aqueous Solvents 229 |
|--|--|
| COMPONENTS : | ORIGINAL MEASUREMENTS: |
| <pre>(1) Hydrogen chloride; HCl; [7647-01-0]</pre> | Gerrard, W.; Mincer, A. M. A.; Wyvill, P. L. |
| <pre>(2) Carbonochloridic acid hexyl ester or hexyl chloroformate; C₇H₁₃ClO₂; [6092-54-2]</pre> | J. Appl. Chem. <u>1960</u> , 10, 115-121. |
| VARIABLES: | PREPARED BY: |
| T/K: 273.15 - 317.85 Total P/kPa: 101.325 (1 atm) | W. Gerrard (smoothed data calculated by H.L. Clever) |
| EXPERIMENTAL VALUES: | |
| T/K Mol Ra nHCl ^{/n} C ₇ H 273.15 0.21 279.15 0.17 284.55 0.15 292.35 0.12 299.85 0.10 300.75 0.09 308.45 0.07 317.85 0.06 The compiler calculated the mole frac Smoothed Data: $\ln x_1 = -0.622 + 8.28$ Standard error about | $\begin{array}{c} x \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\$ |
| AUXILIARY | INFORMATION |
| METHOD / APPARATUS / PROCEDURE : | SOURCE AND PURITY OF MATERIALS: |
| The liquid component was weighed in a bubbler tube. The amount of gas absorbed was determined by re- weighing to constant weight. The total pressure was barometric, very nearly 1 atm (101.325 kPa). | <pre>(1) Hydrogen chloride. Good specimen from a commercial cylinder was dried. (2) Carbonochloridic acid hexyl ester. Carefully purified, and purity rigorously attested. ESTIMATED ERROR:</pre> |

| zso nydrogen | | Non-Aqueous Solvenis |
|--|------------------------|--|
| COMPONENTS : | | ORIGINAL MEASUREMENTS: |
| <pre>(1) Hydrogen chloride; HCl; [7647-01-0]</pre> | | Gerrard, W.; Mincer, A. M. A.; Wyvill, P. L. |
| <pre>(2) Chloroacetic acid, pheny or phenyl chloroacetate C₈H₇O₂; [620-73-5]</pre> | l ester ; | J. Appl. Chem. <u>1960</u> , 10, 115-121. |
| VARIABLES: | ······ | PREPARED BY: |
| T/K: 311.15 - 323. | | W. Gerrard |
| Total P/kPa: 101.325 (1 at | m) | (smoothed data calculated by H.L. Clever) |
| | | |
| EXPERIMENTAL VALUES: | | |
| T/K | Mol Rat | tio Mol Fraction 3 ^H 7 ^O 2 ^x l |
| 311.15 | | |
| 314.65 | | |
| 319.15 323.85 | | |
| | | |
| The compiler calculated the | mole frac | tion values. |
| Smoothed Data: $\ln x_1 = -17$ | .026 + 45. | 1045/(T/100K) |
| ↓ | | - |
| Standard er | ror about | the regression line is 4.81 x 10^{-3} |
| | T/K | Mol Fraction ^x 1 |
| | 303.15 | 0.1168 |
| | 313.15 323.15 | 0.0726 0.0465 |
| | | |
| | AUXILIARY | / INFORMATION |
| METHOD APPARATUS/PROCEDURE: | | SOURCE AND PURITY OF MATERIALS: |
| The liquid component was we a bubbler tube. The amount absorbed was determined by weighing to constant weight total pressure was barometr nearly 1 atm (101.325 kPa). | of gas re- . The | (1) Hydrogen chloride. Good specimer from a commercial cylinder was dried. (2) Chloroacetic acid, phenyl ester. Carefully purified, and purity rigorously attested. |
| | | ESTIMATED ERROR: |
| | | $\delta x_1 / x_1 = 0.025$ |
| | | REFERENCES: |
| | | |

| nydrogen chionde in r | Voli-Aqueous Solvents 231 |
|---|---|
| COMPONENTS : | ORIGINAL MEASUREMENTS: |
| <pre>1. Hydrogen Chloride; HCl; [7647-01-0]</pre> | Gerrard, W.; Mincer, A. M. A.; Wyvill, P. L. |
| Carbonic acid diethyl ester or diethyl carbonate; C₅H₁₀O₃; | J. Appl. Chem. <u>1959</u> , 9, 89 - 93. |
| [105-58-8] | |
| VARIABLES: | |
| Т/К: 198.15 - 317.15 | PREPARED BY: W. Gerrard |
| Total P/kPa: 101.325 (1 atm) | |
| | (smoothed data calculated by H.L. Clever) |
| EXPERIMENTAL VALUES: T/K MOL H | Ratio Mol Fraction |
| | C5 ^H 10 ^O 3 XHC1 |
| | 463 0.882 |
| | 0.797 |
| | 0.660 The mole fraction |
| 1 | 577 0.404 values were cal- 561 0.359 culated by the |
| | 520 0.342 compiler. |
| | 441 0.306 |
| 300.65 0.3 | 323 0.244 |
| | 300 0.231 222 0.182 |
| | 222 0.182 190 0.160 |
| | |
| Smoothed Data: $\ln x_1 = -58.8547 + 84.9$ -18.7608 (T/100 | |
| Ctordand amon shout th | |
| | ne regression line = 7.69×10^{-3} |
| T/K Mol Fraction | T/K Mol Fraction |
| <i>x</i> 1 | <u>x1</u> |
| 193.15 0.937 | 263.15 0.469 |
| 203.15 0.848 | 273.15 0.405 |
| 213.15 0.778 | 283.15 0.342 |
| 223.15 0.716 233.15 0.656 | 293.15 0.282 303.15 0.228 |
| 243.15 0.596 | 313.15 0.179 |
| 253.15 0.533 | 323.15 0.138 |
| AUXILIARY | INFORMATION |
| METHOD /APPARATUS / PROCEDURE : | SOURCE AND PURITY OF MATERIALS: |
| The solvent was weighed in a bubbler | 1. Hydrogen Chloride. Good specimen |
| tube. The amount of gas absorbed at | from a commercial cylinder was |
| temperatures above 273 K was deter- | dried. |
| mined by reweighing to constant | |
| weight. The total pressure was barometric, very nearly 1 atm | 2. Carbonic acid diethyl ester. Carefully purified, and purity |
| (101.325 kPa). | rigorously attested. |
| For determinations below 273 K, a | |
| chemical titration was carried out. | |
| After the maximum absorption at the | |
| stated temperature, the bubbler tube | |
| was attached to a flask containing 1 dm ³ of water, and allowed to warm | ESTIMATED ERROR: |
| slowly (12 hours) to room temperature. | fm/r = 0 holow 070 r |
| The contents of the bubbler tube were | $\delta T/K = 2$ below 273 K $\delta X_1/X_1 = 0.015$ |
| then added to the water, and the | |
| total chloride ion was determined by the Volhard method. | DEPERTNERS. |
| | REFERENCES : |
| A low temperature, Teddington type YM thermostat was used for tempera- | |
| tures below 273 K, the control being | |
| within ± 2 K. | |
| | |
| | |
| | |

| COMPONENTS : | ORIGINAL MEASUREMENTS: |
|---|--|
| <pre>1. Hydrogen Chloride; HCl; [7647-01-0]</pre> | Gerrard, W.; Mincer, A. M. A.; Wyvill, P. L. |
| 2. Carbonic acid dibutyl ester; C ₉ H ₁₈ O ₃ ; [542-52-9] | J. Appl. Chem. <u>1959</u> , 9, 89 - 93. |
| | |
| VARIABLES: | PREPARED BY: |
| T/K: 273.15 - 317.15 Total P/kPa: 101.325 (1 atm) | W. Gerrard (smoothed data calculated by H.L. Clever) |
| EXPERIMENTAL VALUES: | |
| T/K Mol Rat | |
| ⁿ HCl/ ⁿ C ₉ H | H ₁₈ O ₃ ^X HC1 |
| 273.15 0.719 | 0.418 |
| 279.85 0.605 | |
| | |
| 297.15 0.386 | |
| 306.35 0.299 317.15 0.209 | |
| | 0.175 |
| Smoothed Data: $\ln X_{HC1} = 68.788 - 90.$ | 168/(T/100) - 36.478 ln (T/100) |
| | - |
| Standard Error About F | Regression Line = 3.59×10^{-3} |
| T/K M | 101 Fraction |
| | XHCI |
| | |
| 273.15 | 0.416 |
| 283.15 | 0.359 |
| 293.15 | 0.300 |
| 303.15 | 0.244 |
| 313.15 | 0.193 |
| 323.15 | 0.149 |
| The mole fraction values were | calculated by the compiler. |
| AUXILIARY | INFORMATION |
| METHOD /APPARATUS / PROCEDURE : | SOURCE AND PURITY OF MATERIALS: |
| The solvent was weighed in a bubbler tube. The amount of gas (1) absorbed was determined by reweighing to | Hydrogen Chloride. Good specimen from a commercial cylinder was dried. |
| constant weight. The total pressure was barometric, very nearly 1 atm (101.325 kPa). | Carbonic acid dibutyl ester. Carefully purified, and purity rigorously attested. |
| | |
| | ESTIMATED ERROR: $\delta x_1 / x_1 = 0.01$ |
| | |
| Other solvent name Dibutyl carbonate | REFERENCES : |
| | |

| nyarogen Chioriae in | Non-Aqueous Solvents 233 |
|--|--|
| COMPONENTS: | ORIGINAL MEASUREMENTS: |
| <pre>1. Hydrogen Chloride; HCl; [7647-01-0]</pre> | Gerrard, W.; Mincer, A. M. A.; Wyvill, P. L. |
| <pre>2. Carbonic acid bis (2-methyl propyl) ester; C₉H₁₈O₃; [539-92-4]</pre> | J. Appl. Chem. <u>1959</u> , 9, 89 - 93. |
| VARIABLES: | PREPARED BY: |
| T/K: 273.15 - 315.05 Total P/kPa: 101.325 (1 atm) | W. Gerrard (smoothed data calculated by H.L. Clever) |
| EXPERIMENTAL VALUES: | |
| T/K Mol Rati <u> hCl/ⁿC9^H1</u> | |
| 273.15 0.740 | 0.425 |
| 282.55 0.595 294.55 0.435 | 0.373 0.303 |
| 302.75 0.350 | 0.259 |
| 315.05 0.246 | 0.197 |
| Smoothed Data: ln X = 61.946 - 80 | .958/(T/100) - 33.002 ln (T/100) |
| | |
| Standard Error About | Regression Line = 6.90×10^{-4} |
| | Mol Fraction |
| 2, x | x _{HCl} |
| | |
| 273.15 | 0.425 |
| 283.15 | 0.370 |
| 293.15 303.15 | 0.312 0.256 |
| 313.15 | 0.206 |
| 323.15 | 0.163 |
| The mole fraction values were | calculated by the compiler. |
| AUXILIARY | INFORMATION |
| METHOD/APPARATUS/PROCEDURE: | SOURCE AND PURITY OF MATERIALS: |
| The solvent was weighed in a bubbler tube. The amount of gas absorbed was determined by reweighing to constant | Hydrogen Chloride. Good specimen from a commercial cylinder was dried. |
| weight. The total pressure was | |
| barometric, very nearly l atm (101.325 kPa). | Carbonic acid bis (2-methy1 propy1) ester. Carefully purified, and purity rigorously attested. |
| | |
| | ESTIMATED ERROR: |
| | $\delta x_1 / x_1 = 0.01$ |
| Other solvent name Diisobutyl carbonate | REFERENCES : |
| | |
| | |
| | |

| | · |
|--|---|
| COMPONENTS : | ORIGINAL MEASUREMENTS: |
| <pre>(1) Hydrogen chloride; HCl; [7647-01-0]</pre> | Gerrard, W.; Mincer, A. M. A.; Wyvill, P. L. |
| <pre>(2) 3-Methyl-l-butanol carbonate (2:1); C₁₁H₂₂O₃ or</pre> | J. Appl. Chem. <u>1960</u> , 10, 115-121. |
| (CH ₃ CH (CH ₃) CH ₂ CH ₂ O) ₂ CO; [2050-95- | 5] |
| VARIABLES: | PREPARED BY: |
| T/K: 273.15 - 315.65 Total P/kPa: 101.325 (1 atm) | W. Gerrard (smoothed data calculated by H.L. Clever) |
| EXPERIMENTAL VALUES: | |
| T/K Mol Rat ⁿ HCl ^{/n} C ₁₁ | io Mol Fraction ^H 22 ^O 3 ^x 1 |
| 273.15 0.730 | 0.422 |
| 280.65 0.599 | 0.375 |
| 287.15 0.496 296.75 0.391 | |
| 296.75 0.391 306.15 0.307 | |
| 315.65 0.225 | |
| | |
| The compiler calculated the mole fraction values. | |
| Smoothed Data: $\ln x_1 = 36.511 - 44$. | 397/(T/100) - 20.987 ln (T/100) |
| Standard error about | the regression line is 7.00×10^{-3} |
| | |
| T/K | Mol Fraction x. |
| | <u> </u> |
| 273.15 283.15 | 0.435 0.363 |
| | 0.300 |
| 313.15 | 0.244 |
| 323.15 | 0.197 |
| | |
| | |
| AUXILIAR | Y INFORMATION |
| METHOD /APPARATUS / PROCEDURE : | COUDCE AND DUDITY OF MATERIALC. |
| The liquid component was weighed in | SOURCE AND PURITY OF MATERIALS: (1) Hydrogen chloride. Good specimen |
| a bubbler tube. The amount of gas | from a commercial cylinder was |
| absorbed was determined by re- | dried. |
| weighing to constant weight. The total pressure was barometric, very | (2) 3-Methyl-l-butanol carbonate. |
| nearly 1 atm (101.325 kPa). | Carefully purified, and purity |
| - | rigorously attested. |
| | |
| | |
| | |
| Solvent name is isopentyl carbonate | ESTIMATED ERROR: |
| in paper, IUPAC name is diisopentyl carbonate. | |
| curbonale. | $\delta x_1/x_1 = 0.02$ |
| | |
| | REFERENCES: |
| | |
| | |
| | |
| | |
| | 1 |

| Hydrogen Chionae m | Non-Aqueous Solvents 235 |
|--|---|
| COMPONENTS: | ORIGINAL MEASUREMENTS: |
| <pre>(1) Hydrogen chloride; HCl; [7647-01-0]</pre> | Gerrard, W.; Mincer, A. M. A.; Wyvill, P. L. |
| <pre>(2) Carbonic acid 2-chloroethyl ethyl ester or ethyl 2-chloroethyl carbonate; C₅H₉ClO₃; [50780-47-7]</pre> | J. Appl. Chem. <u>1960</u> , 10, 115-121. |
| VARIABLES: | PREPARED BY: |
| т/к: 273.15 - 320.15 | W. Gerrard |
| Total P/kPa: 101.325 (1 atm) | (smoothed data calculated by H.L. Clever) |
| EXPERIMENTAL VALUES: | io Mol Fraction |
| ⁿ HCl ^{/n} C ₅ H | x_{10} |
| | |
| 273.15 0.490 280.15 0.408 | |
| 287.15 0.338 | |
| 293.15 0.292 | |
| 299.05 0.247 | |
| 305.45 0.206 316.25 0.143 | |
| 320.15 0.122 | |
| The compiler calculated the mole frac | |
| - | 037/(T/100) - 44.727 ln (T/100) |
| Standard error about | the regression line is 3.10 x 10^{-3} |
| | Mol Fraction |
| | x_1 |
| 273.15 | 0.325 |
| 283.15 | 0.277 |
| 293.15 | 0.226 |
| 303.15 313.15 | 0.178 0.136 |
| 323.15 | 0.101 |
| | INFORMATION |
| | |
| METHOD/APPARATUS/PROCEDURE: | SOURCE AND PURITY OF MATERIALS: |
| The liquid component was weighed in | (1) Hydrogen chloride. Good specimen |
| a bubbler tube. The amount of gas absorbed was determined by re- | from a commercial cylinder was dried. |
| weighing to constant weight. The | difea. |
| total pressure was barometric, very | (2) Carbonic acid 2-chloroethyl ethyl |
| nearly 1 atm (101.325 kPa). | ester. Carefully purified, and |
| | purity rigorously attested. |
| | |
| | |
| | |
| | UCTIMATED EDDOD. |
| | ESTIMATED ERROR: |
| | $\delta x_1 / x_1 = 0.015$ |
| | |
| | REFERENCES : |
| | |
| | |
| | |
| | |
| | |
| | |
| | |

| COMPONENTS : | | EVALUATOR: |
|--------------|--|--|
| 1. | Hydrogen Chloride; HCl; [7647-01-0] | Peter G. T. Fogg Department of Applied Chemistry and Life Sciences, |
| 2. | Halogenated Alkanes and Halogenated Alkenes | Polytechnic of North London, Holloway, London, N7 8DB, U.K. January 1989 |
| | | |

CRITICAL EVALUATION:

The Solubility of Hydrogen Chloride in Halogenated Alkanes and in Halogenated Alkenes.

The solubility of hydrogen chloride in tetrachloromethane has been measured by various authors (1-4) at a total pressure equal to barometric, and over pressure ranges below 101.3 kPa by Hamai (5), by Howland *et al.* (6) and by Khodeeva & Rozovskii (7). The single measurement reported by Chesterman (8) is out of line with all other measurements and should be rejected. Data published by Khodeeva & Rozovskii are self-consistent except that there is an error in the reporting of constants associated with the Krichevskii-Il'inskaya equation. Data for 303.15 K and below are out of line with measurements by other authors. The evaluator considers that they are likely to be unreliable.

Mole fraction solubilities at a partial pressure of 101.3 kPa as given by other authors or as calculated from solubilities at partial pressures close to 101.3 kPa may be represented by the equation :

 $\ln x_{\rm HCl} = -206.48 + 9800.3/(T/K) + 29.732 \ln (T/K)$

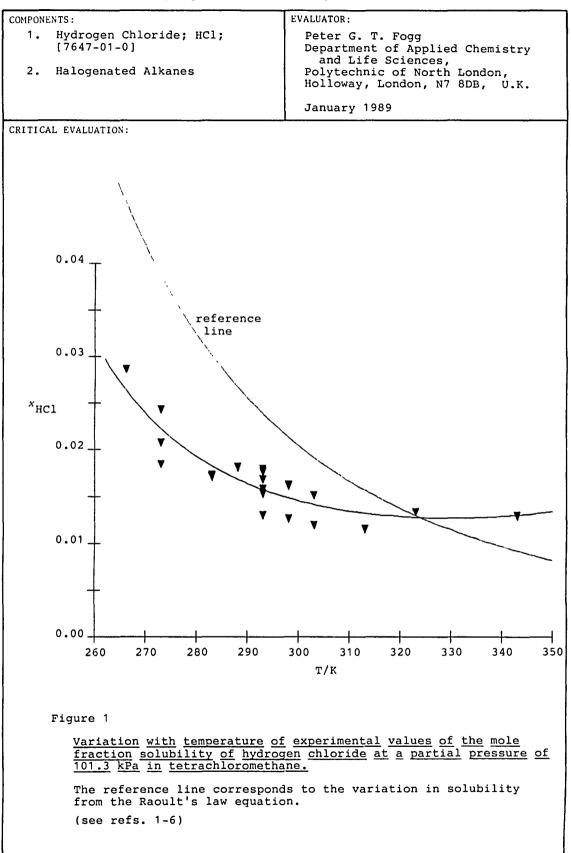
The standard deviation in values of x_{HC1} is 0.0018.

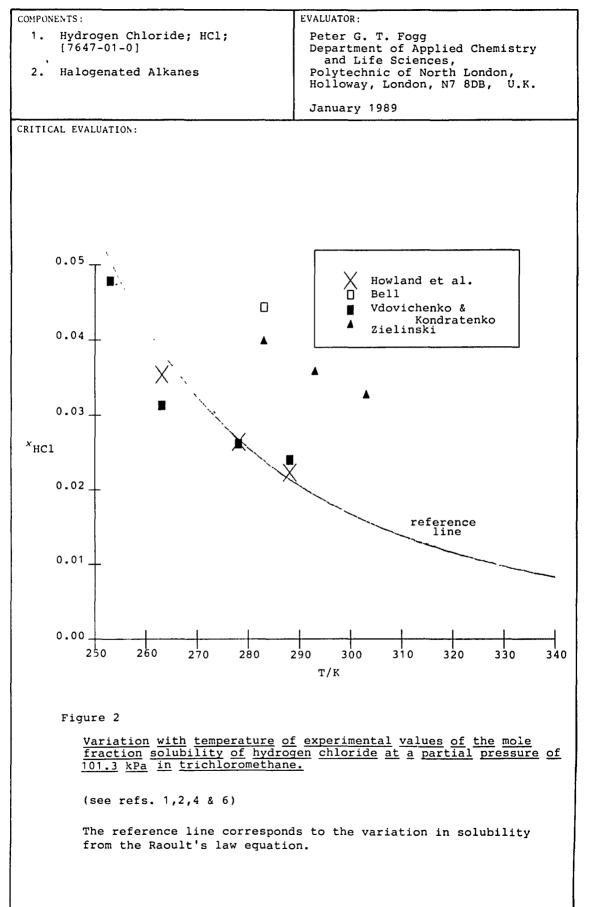
This equation is based upon data for the temperature range 266.15 K to 343.15 K. There is appreciable scatter of data as may be seen in fig 1. Values fall below a reference line based upon the Raoult's law equation, except at temperatures greater than about 320 K.

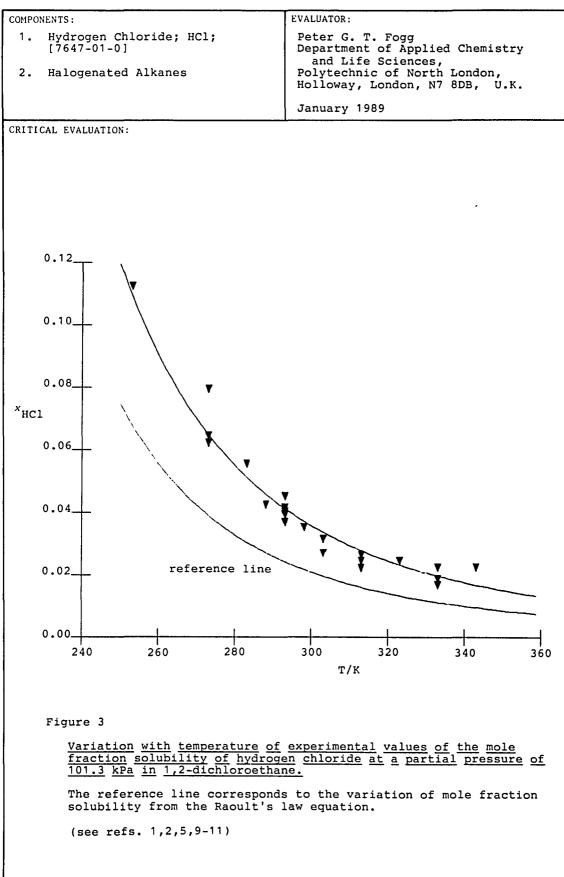
Solubility in trichloromethane was measured by Bell (1), by Howland *et al.*(6), by Zielinski (2) and by Vdovichenko & Kondratenko (4). Mole fraction solubilities for a partial pressure of 101.3 kPa show appreciable scatter (see fig 2) with a general tendency for values to be greater than corresponding ones for dissolution in tetrachloromethane.

The mole fraction solubility in dichloromethane at a total pressure equal to barometric pressure was measured by Vdovichenko & Kondratenko (4) at temperatures of 263.15 K, 273.15 K and 298.15 K. Values corrected to a partial pressure of 101.3 kPa for the two lower temperatures lie above the corresponding values for tetrachloromethane and below the values for trichloromethane calculated from data given by these two authors. The vapor pressure of dichloromethane at 298.15 K (> 420 mmHg) is too high for reliable estimation of the solubility corresponding to a partial pressure of 101.3 kPa at this temperature.

Solubilities in 1,2-dichloroethane have been measured by various workers. Bell (1), Zielinski (2) and also Abdullaev *et al.*(9) made measurements at a total pressure equal to barometric at 293.15 K, 293.15 - 313.15 K and 273.15 - 353.15 K respectively. Hamai (5) made measurements over pressure ranges at 288.15 - 298.15 K. Hannaert *et al.*(10) made measurements in the temperature range 273.15 - 333.15 K. Detailed results were not published but data were given for an equation for the variation in mole fraction solubility at a total pressure of 101.3 kPa over this temperature range. Treger *et al.*(11) made measurements over the temperature range 253 - 333 K but they also did not publish detailed results. Data were given for an equation for the variation in mole ratio solubility at a partial pressure of 101.3 kPa over this temperature range. The evaluator has calculated mole fraction solubilities at a partial pressure of 101.3 kPa from the data that have been published, making allowance for the partial pressure of the solvent where necessary. Values at 20 K intervals were estimated from the equation given by Hannaert *et al.* and that from Treger's measurements. Correction of the solubility at 353.15 K given by Abdullaev *et al.* was considered to be unreliable because the vapor pressure of the pure solvent is about 90 kPa at this temperature and this data point was disregarded. Other data points for a partial pressure of 101.3 kPa fall into a very consistent pattern (see fig 3). The variation in mole fraction solubility at a partial pressure of 101.3 kPa may be







COMPONENTS. EVALUATOR: 1. Hydrogen Chloride; HCl;
[7647-01-0] Peter G. T. Fogg Department of Applied Chemistry and Life Sciences, 2. Halogenated Alkanes and Polytechnic of North London, Halogenated Alkenes Holloway, London, N7 8DB, U.K. January 1989 CRITICAL EVALUATION: represented by the equation: $\ln x_{\rm HC1} = -9.355 + 1808/(T/K)$ The standard deviation in values of x_{HC1} is 0.004. This equation is based upon measurements in the range 253.15 - 343.15 K Danov & Golubev (12) measured the solubility in 1,1-dichloroethane over a pressure range at 204.55 K to 242.65 K. No other data for solubility in this solvent are available for comparison but the mole fraction solubilities fit an equation which is closely similar to the one given above for the 1,2 isomer. 1.e. $\ln x_{\rm HC1} = -8.729 + 1646/(T/K)$ The standard deviation in values of x_{HC1} is 0.005. Solubility in 1,1,2-trichloroethane was measured by Hamai (5) and by Treger et al.(11) over a pressure and temperature range. Individual solubility values have not been published by Treger et al. but data have been given for an equation for the variation with temperature of mole fraction solubility at a partial pressure of 101.3 kPa. There is a gross discrepancy between Hamai's measurements and those of Treger *et al.* The mole fraction solubility at a partial pressure of 101.3 kPa and 293.15 from Hamai's measurements is 0.0310 whereas the value from Treger's data is 0.0507. There is a similar difference between the two sets of data at 285.15 K and 288.15 K. Data published by Hamai are in better accord with the pattern of solubilities in other chlorinated ethanes (see fig 4). Treger $et \ al.$ published data for dissolution in trichloroethene but no other measurements of the solubility in this compound are available for comparison. Solubility in 1,1,2,2-tetrachloroethane was measured by Bell (1) and by Zielinski (2) at barometric pressure and 293.15 K and 293.15 - 313.15 K respectively. Hamai (5) measured solubilities over a pressure range at 288.15 -298.15 K. Treger (11) reported data for an equation for the variation of mole fraction solubility with temperatures in the range 253 - 333 K. The values of the mole fraction solubility at a partial pressure of 101.3 kPa at 293.15 K from the four sets of data all lie between 0.0265 and 0.0289. Solubilities at higher temperatures from Zielinski's data are high compared with other values. Mole fraction solubilities for a partial pressure of 101.3 kPa based upon all the data may be fitted to the equation : $\ln x_{\rm HC1} = -7.939 + 1281.7/(T/K)$ The standard deviation in values of x_{HC1} is 0.002. This equation is based upon data for the temperature range 253 - 333 K. Solubility in pentachloroethane was measured by Bell (1) at 293.15 K at barometric pressure and by Hamai (5) at 285.15 - 293.15 K over a pressure range. The mole fraction solubility for a partial pressure at 293.15 K from Bell's measurement is 0.0214 which is close to the value of 0.0225 from data published by Hamaı. Solubilities in 1-chloroalkanes with 4,6,8,12 & 16 carbon atoms have been measured at different temperatures or over different temperature ranges between 197 K and 433 K (13 - 16). All measurements were made at barometric pressure except those carried out by Scher *et al.*(13) for 1-chlorohexadecane over a pressure range of 51 to 99 kPa. The mole fraction solubility at a partial pressure of 101.3 kPa and 313.15 K estimated from Scher's measurements is 0.0362. This is close to the value of 0.0369 for the same solvent published by Fernandes & Sharma (14). All mole fraction solubilities for 1-chloroalkanes from the available data lie above the reference line corresponding to the Raoult's law equation. Values may

COMPONENTS.

- Hydrogen Chloride; HCl; [7647-01-0]
- Halogenated Alkanes and Halogenated Alkenes

EVALUATOR:

Peter G. T. Fogg Department of Applied Chemistry and Life Sciences, Polytechnic of North London, Holloway, London, N7 8DB, U.K.

January 1989

CRITICAL EVALUATION:

be represented approximately by the equation:

 $\ln x_{HC1} = -10.53 + 2213/(T/K)$

The standard deviation in values of x_{HC1} is 0.011.

This equation is based upon data in the temperature range 243 K to 433 K for the five compounds mentioned above. It must be considered a general guide to the behaviour of these compounds. Solubilities in individual solvents are scattered around the values of $x_{\rm HCl}$ calculated from the equation with no general relationship between "this scatter and the chain length of the solvent.

Hamai (4) measured the solubility in 1,2-dibromoethane over a pressure range at 288.15 K to 298.15 K. Bell (1) measured the solubility at 293.15 K and barometric pressure. Bell's value of the mole fraction solubility, corrected to a partial pressure of gas of 101.3 kPa, is 0.0348 and very close to the value of 0.0344 by extrapolation of Hamai's measurements. Bell also measured solubilities in bromoethane, tribromomethane and in 1,1,2,2-tetrabromoethane. No other measurements of the solubilities in these solvents are available for comparison.

The solubility in 1-bromooctane was measured by Gerrard *et al.* (15) at a total pressure of 101.3 kPa at temperatures from 273.15 K to 317.15 K. Measurements in the temperature range 243.15 K to 273.15 K were made by Ahmad *et al.* (16) in the same laboratory. The two values for the mole fraction solubility at 273.15 K differ by 8%. The two sets of values for the mole fraction solubility at a total pressure of 101.3 bar may be fitted to the equation:

 $\ln x_{\rm HCl} = -96.877 + 5655.9/(T/K) + 13.156 \ln(T/K)$

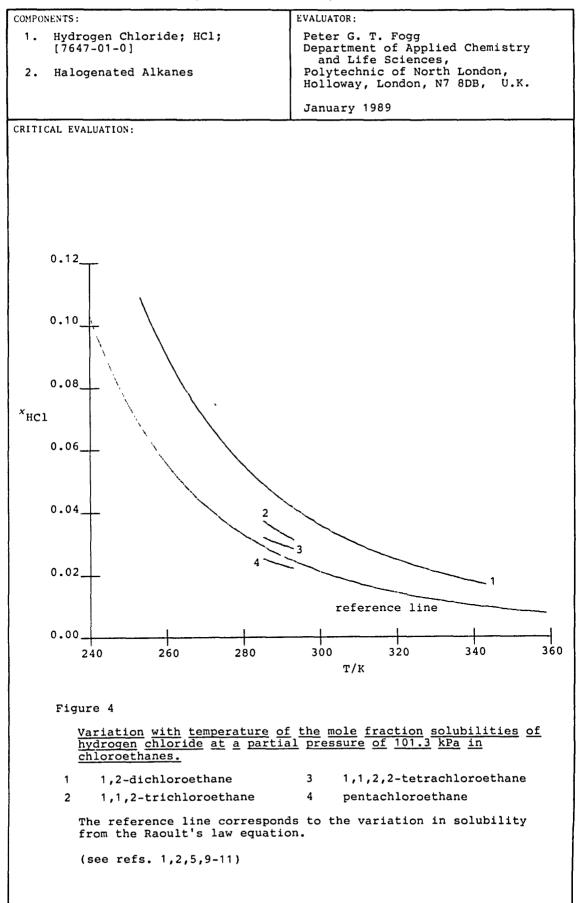
The standard deviation in values of x_{HC1} is 0.003.

Gerrard *et al.* also reported solubilities over temperature ranges in 1-bromobutane and 1-bromohexane at a total pressure of 101.3 kPa. Gerrard's data indicate that, corrected to a partial pressure of 101.3 kPa, mole fraction solubility increases with chain length from 1-bromobutane to 1-bromooctane, at temperatures at which comparison can be made (273.15 K - 298.15 K). However, the value for HCl in bromoethane at 293.15 K from Bell's measurement is 0.1019 and larger than the corresponding solubility in 1-bromooctane (0.058).

Ahmed et al. also measured the solubility in 1-iodooctane. The data indicate that the mole fraction solubility is higher than that in 1-bromooctane under the same conditions of measurement. No other measurements are available for comparison.

The solubility in chloroethene was measured by Danov & Golubev (12) at pressures to 133.3 kPa from 204.55 K to 242.65 K. An equation for Henry's constant for dissolution in this solvent at temperatures from 213.15 K to 243.15 K has been published by Hannaert *et al.*(10) Mole fraction solubilities estimated from this equation are lower than those from Danov's measurements. The mole fraction solubility for a partial pressure of hydrogen chloride of 93.3 kPa at 242.15 K is 0.1382. The value from Hannaert's equation is 0.1006. The extensive data presented by Danov are self consistent and likely to be more reliable than solubilities estimated from Hannaert's equation.

The solubility in trichloroethene was measured by Abdullaev *et al.*(9) at barometric pressure from 273.15 K to 353.15 K. Bell (1) measured the solubility at barometric pressure and 293.15 K. Data presented by Treger *et al.*(11) are ambiguous and cannot be compared with data from other authors. The mole fraction solubility at 293.15 K and a partial pressure of 101.3 kPa given by Bell is 0.0206. This is very close to the value of 0.0205 obtained by correcting Abdullaev's data for this temperature to a partial pressure of 101.3 kPa and adds support to data for other temperatures.



| COMPONENTS: | | EVALUATOR: | |
|-------------|--|---|--|
| 1. | Hydrogen Chloride; HCl; [7647-01-0] | Peter G. T. Fogg Department of Applied Chemistry and Life Sciences, | |
| 2. | Halogenated Alkanes and Halogenated Alkenes | Polytechnic of North London, Holloway, London, N7 8DB, U.K. | |
| 1 | | January 1989 | |

CRITICAL EVALUATION:

Curda & Holas (3) measured the solubility in tetrachloroethene at barometric pressure from 293.15 K to 363.15 K. The mole fraction solubility at 293.15 K corrected to a partial pressure of 101.3 kPa from these data is 0.0160. This is in good agreement with the value of 0.0163 given by Bell.

Danov & Golubev (12) measured the solubility in (E)-1,2-dichloroethene at pressures to 133.3 kPa in the range 225.15 K to 256.25 K. The measurements are self consistent but no other data for this system are available for comparison.

The solubility in 3-chloro-1-propene was measured by Cook (17) at barometric pressure from 268.95 K to 283.15 K. The interpolated value of the mole fraction solubility at 273.15 K is 0.0468. This is in sharp contrast to the value of 0.0609 from data published by Curda & Holas (3). Measurements on this system need to be repeated.

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- 12. Danov, S. M.; Golubev, Yu. D. Khim. Prom_st. (Moscow) 1968, 44 (2), 116 120.
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- Ahmed, W.; Gerrard, W.; Maladkar, V. K. J. Appl. Chem. <u>1970</u>, 20, 109 - 115.

17. Cook, T. M. Thesis 1966, University of London.

| 1 1 | | ORIGINAL MEASUREMENTS: | | |
|---|----------|--|--|--|
| (1) Hydrogen chloride; HCl; | | Vdovichenko, V. T.; | | |
| [7647-01-0] | | Kondratenko, V. I. | | |
| | | | | |
| (2) Dichloromethane; CH ₂ Cl ₂ ; | | Khim. Prom. <u>1967</u> , 43, 290 - 291. | | |
| [75-09-2] 2 2 | | | | |
| 1 | | | | |
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| WADTADIEC. | | | | |
| VARIABLES: $T/K = 263.15 - 298.11$ | 5 | PREPARED BY: W. Gerrard | | |
| p / kPa = 101.325 (1 atm) | | HT BOLLEL | | |
| | , | (smoothed data calculated by H.L. Clever) | | |
| | | | | |
| EXPERIMENTAL VALUES: | | Mol Fraction | | |
| | 1/10 1 | | | |
| | | <u> </u> | | |
| 26 | 3.15 | 0.031 | | |
| 27: | 3.15 | 0.018 | | |
| 29 | 8.15 | 0.013 | | |
| | | | | |
| The mole fraction values appear | to he | for a total pressure of 1 atm | | |
| more records varues appear | | Tot a court propert of t dome | | |
| Smoothed Data: For use between | 263.15 | 5 and 298.15 K. | | |
| | | | | |
| $\ln x_{1} = -347.20$ | + 482 | .95/(T/100 K) + 165.57 ln (T/100 K) | | |
| | | | | |
| | T/K | Mol Fraction | | |
| | | <i>x</i> ₁ | | |
| | <u> </u> | | | |
| 20 | 68.15 | 0.023 | | |
| | 78.15 | 0.015 0.013 | | |
| | 98.15 | 0.013 | | |
| 2: | 90.13 | 0.013 | | |
| | | | | |
| | XILIARY | INFORMATION | | |
| | | | | |
| METHOD/APPARATUS/PROCEDURE: Solubility determined at atmospheric pressure by the method described by Strepikheev and Babkin (1). | | SOURCE AND PURITY OF MATERIALS: (1) Hydrogen chloride. Obtained from chemically pure sodium chloride and concentrated sulfuric acid, dried by calcium chloride and filtered through glass wool. (2) Dichloromethane. B.p. (1 atm)/°C = 40.0 - 40.3; density, ρ²₄° = 1.3260; refractive index, n²_D° = 1.4245. | | |
| | | ESTIMATED ERROR: | | |
| | | REFERENCES: 1. Strepikheev, Yu. A.; Babkin, B. M. Khim. Prom. <u>1963</u> , (1), 38. | | |
| | | | | |

| COMPONENTS: (1) Hydrogen chloride; HCl; [7647-01-0] | ORIGINAL MEASUREMENTS: Bell, R. P. |
|---|---|
| (2) Chloromethanes | J. Chem. Soc. <u>1931</u> , 1371 - 1382. |
| | |
| | |
| VARIABLES: T/K: 293.15 | PREPARED BY: |
| P/kPa: 101.325 (1 atm) | W. Gerrard |
| EXPERIMENTAL VALUES: | |
| T/K Partition Coefficien ^C 1,2 ^{/C} 1,5 | |
| Trichloromethane [67-66-3] | 2; CHCl ₃ ; |
| 293.15 13.80 | 0.0444 |
| Tetrachlorometha [56-23-5] | ane; CCl ₄ ; |
| 293.15 4.54 | 0.0181 |
| The ideal gas concer | ntration at $p_1 = 1$ atm |
| | n/V = p/RT = 0.0417. |
| $13 c_{1,g}/mot am = 1$ | 1/V = p/RI = 0.0417. |
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| AUXILIARY | INFORMATION |
| | |
| METHOD/APPARATUS/PROCEDURE: | SOURCE AND PURITY OF MATERIALS: |
| The apparatus consisted of a 50 cm bulb extended at the top as a graduated tube, and sealed at the bottom to a capillary U-tube. The liquid was saturated with gas at | (1) Hydrogen chloride. Prepared by dropping pure concentrated hydrochloric acid into pure sulfuric acid. |
| atmospheric pressure. The gas was | (2) Chloromethanes. Good specimens |
| displaced from the saturated solu- tion by a current of dry CO, free air, | were dried over calcium chloride, and distilled. Boiling points |
| absorbed in water, and titrated | are given in paper. |
| with a solution of NaOH. | |
| The solubility, c/mol dm ⁻³ , was | |
| converted to a partition coefficient by dividing by the ideal gas con- | ESTIMATED ERROR: |
| centration of HCl in the gas phase. | $\delta T/K = 0.01$ |
| The mole fraction solubility was | $\delta c/c = 0.01$ |
| calculated on the assumption that | |
| the density of the solution obeys | REFERENCES: |
| the ideal mixture law. | |
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| COMPONENTS: | ORIGINAL MEASUREMENTS: | | |
|--|--|--|--|
| <pre>(1) Hydrogen chloride; HCl; [7647-01-0]</pre> | Chesterman, D. R. | | |
| [/04/-01-0] | J. Chem. Soc. 1935, 906 - 910. | | |
| (2) Chloromethanes | , | | |
| | | | |
| | | | |
| | | | |
| VARIABLES: T/K: 298.15 | PREPARED BY: | | |
| Total P/kPa: 101 (~1 atm) | W. Gerrard | | |
| | | | |
| EXPERIMENTAL VALUES: | | | |
| T/K Observed So | lubility Mol Fraction | | |
| Pressure g HCl o p/mmHg | x_1^{-1} Solution x_1 | | |
| Trichloromethane or chlor | roform; CHCl ₃ ; [67-66-3] | | |
| 298.15 730 | 0.004 0.013 | | |
| Tetrachloromethane or can CCl ₄ ; [56-23-5] | rbon tetrachloride; | | |
| 298.15 765 | 0.001 0.004 | | |
| | | | |
| | | | |
| | | | |
| AUXILIARY | INFORMATION | | |
| METHOD/APPARATUS/PROCEDURE: | SOURCE AND PURITY OF MATERIALS: | | |
| The apparatus was that used for the conductivity. A sample of the saturated solution was removed, weighed, the hydrogen chloride was reacted with excess base which was back titrated with a standard acid solution. | Hydrogen chloride. Prepared from conc. sulfuric acid and pure sodium chloride. Passed through sulfuric acid and over P2⁰5. Trichloromethane. Was stated to be the purest obtainable. Freed from acetone and alcohol, | | |
| | and dried with phosphorus pentoxide, b.p./°C (729 mmHg) = 59.5 - 59.8. | | |
| | Tetrachloromethane. Was stated to be the purest obtainable. Dried with P_2O_5 ; b.p./°C (760 mmHg) = 77 - 77.5. | | |
| | REFERENCES : | | |
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| COMPONENTS : | ORIGINAL MEASUREMENTS: | |
|--|--|--|
| <pre>(1) Hydrogen chloride; HCl; [7647-01-0]</pre> | Howland, J. J.; Miller, D. R. Willard, J. E. | |
| <pre>(2) Trichloromethane or chloroform; CHCl₃; [67-66-3]</pre> | J. Am. Chem. Soc. <u>1941</u> , 63, 2807 - 2811. | |
| VARIABLES: T/K: 273.15 - 298.15 P/kPa: 22.80 - 81.33 (171 - 610 mmHg) | PREPARED BY: W. Gerrard | |
| EXPERIMENTAL VALUES: | | |
| T/K Pressure Range Number o p ₁ /mmHg Determination | · · · · | |
| 273.15 308 - 581 3 | 4.66 <u>+</u> 0.03 0.0354 | |
| 288.15 171 - 587 5 | 3.48 ± 0.02 0.0264 | |
| 298.15 194 - 610 5 | 2.93 ± 0.02 0.0223 | |
| ¹ Henry's constant, K/(mmHg) ⁻¹ = $x_1/(1)$ | P./mmHg). | |
| calculated by the compiler. | | |
| AUXILIARY | INFORMATION | |
| METHOD/APPARATUS/PROCEDURE: A mercury manometer was attached to an absorption bulb. The solvent was added to the bulb, and the vapor pressure was determined. This pres- sure, p_2° , was used to calculate the gas partial pressure, p_1 , from the total pressure, p_t , measured by the manometer: $p_1 = p_t - p_2^{\circ}(1 - x_1)$. | SOURCE AND PURITY OF MATERIALS: (1) Hydrogen chloride. Prepared by dropping sulfuric acid onto sodium chloride. The gas was passed through glass wool and calcium chloride. (2) Trichloromethane. Merck and Co. Technical grade, purified and distilled. | |
| The amount of gas absorbed in a measured weight of solution with- drawn as a sample, was determined by a chemical titration. | ESTIMATED ERROR: 6K/K = 0.01 | |
| The heat of solution was determined to be -3.00 ± 0.30 kcal mol ⁻¹ (-12.55 kJ mol ⁻¹). | REFERENCES: | |

| COMPONENTS : | | /] | | ORIGINAL MEASUREMENTS: | | | |
|--|----------------------------------|-------------------------------------|--|---|---|---|--|
| [764] | ogen chlor 7-01-0] | | | Zielinski, A. Z. Przem. Chem. <u>1958</u> , 37, 338 - 339. | | | |
| | hlorometha 3; [67-66- | | oroform; | | | | |
| VARIABLES: | <u></u> | <u> </u> | | PREPARED BY: | | <u></u> | |
| | T/K = 293. kPa = 53.1 (398 | 15 - 313. 4 - 83.35 .6 - 625. | 15 2 mmHg) | W. Gerrard | | | |
| EXPERIMENTAL | . VALUES: | | | ······································ | | | |
| T/K | Hydrogen Chloride Pressure | HCl | CHCl ₃ | - Coefficient $S/cm^{3}(STP)q^{-1}$ | Mol Ratio n ₁ /n ₂ | Mol Fraction x_1 | |
| <u> </u> | p ₁ /mmHg | n_1/mmol | n ₂ /mmol | atm ⁻¹ | | | |
| 293.15 | 625.2 625.2 | 2.841 3.175 | 84.6 93.2 | 7.67 7.77 | 0.0336 0.0341 | 0.0325 0.0329 0.0398 ¹ | |
| 303.15 | 529.4 529.4 | 3.102 2.690 | ? 105.4 | 6.92 6.88 | ? 0.0255 | ? 0.0249 0.0357 ¹ | |
| 313.15 | 398.6 398.6 | 1.719 1.793 | 99.1 102.6 | 6.21 6.26 | 0.0173 0.0175 | 0.0170 0.0172 0.0326 ¹ | |
| | | | | essure to be the ce solvent vapor | | | |
| | <u> </u> | | AUXILIARY | INFORMATION | | | |
| METHOD /APPA | RATUS / PROCED | URE : | | SOURCE AND PURITY O | OF MATERIALS: | | |
| METHOD/APPARATUS/PROCEDURE: Hydrogen chloride was absorbed by the liquid in an absorption vessel described by Bichowsky and Storch (1). The amount absorbed was deter- mined by a chemical titration. | | | | May be assumed factory purity. | | tis- | |
| To calculate the volume of HCl absorbed by one gram of liquid, at 760 mmHg, 22.42 dm ³ mol ⁻¹ was taken as the molar volume of HCl at 273.15 K and 1 atm. The volume based on the real density of HCl under these conditions is (compiler) 22.247 dm ³ mol ⁻¹ . | | | | | | | |
| | | | | ESTIMATED ERROR: | | | |
| | | | REFERENCES: 1. Bichowsky, F. R. V.; Storch, H. J. Am. Chem. Soc. <u>1915</u> , 37, 2695. | | | | |
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| والمستحي فيتحدد المسابقة المتحاد المستجل الشاري ومستحد والمتحد والمتحد والمتحد والمتحد والمحد و | |
|--|--|
| COMPONENTS : | ORIGINAL MEASUREMENTS: |
| (1) Hydrogen chloride; HCl; | Vdovichenko, V. T.; |
| [7647-01-0] | Kondratenko, V. I. |
| | |
| (2) Trichloromethane or chloroform; | Khim. Prom. <u>1967</u> , 43, 290 - 291. |
| CHCl ₃ ; [67-66-3] | |
| | j j |
| | |
| | |
| VARIABLES: | PREPARED BY: |
| T/K = 263.15 - 298.15 | W. Gerrard |
| p / kPa = 101.325 (1 atm) | (smoothed data calculated by H.L. Clever) |
| | - |
| EXPERIMENTAL VALUES: | |
| = T/K | ol Fraction |
| | |
| | |
| 263.15 | 0.046 |
| 273.15 | 0.029 |
| 288.15 | 0.022 |
| 298.15 | 0.018 |
| ······································ | |
| The mole fraction values appear to be | for a total pressure of 1 atm. |
| | |
| Smoothed Data: For use between 263.1 | 5 and 298.15 K. |
| | |
| $\ln x_1 = -152.60 + 215$ | 5.59/(T/100 K) + 69.842 ln (T/100 K) |
| The standard error about the | regression line is 2.04×10^{-3} . |
| | regression line is 2.04 x 10 |
| | lol Fraction |
| | |
| | |
| 268.15 | 0.0365 |
| 278.15 | 0.026 |
| 288.15 | 0.021 |
| 298.15 | 0.0185 |
| | |
| | |
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| h | |
| AUXILIARY | INFORMATION |
| | COUDCE AND DUDITY OF MATERIALS |
| METHOD/APPARATUS/PROCEDURE: | SOURCE AND PURITY OF MATERIALS: |
| Solubility determined at atmospheric | (1) Hydrogen chloride. Obtained |
| pressure by the method described by | from chemically pure sodium |
| Strepikheev and Babkin (1). | chloride and concentrated |
| | sulfuric acid, dried by calcium |
| 1 | |
| | chloride and filtered through |
| | chloride and filtered through glass wool. |
| | glass wool. |
| | <pre>glass wool. (2) Chloroform. B.p. (l atm)/°C =</pre> |
| | <pre>glass wool. (2) Chloroform. B.p. (l atm)/°C = 61.1 - 61.2; density,</pre> |
| | <pre>glass wool. (2) Chloroform. B.p. (l atm)/°C = 61.1 - 61.2; density, ρ²⁰ = 1.4892; refractive</pre> |
| | <pre>glass wool. (2) Chloroform. B.p. (l atm)/°C =</pre> |
| | glass wool. (2) Chloroform. B.p. (1 atm)/°C = 61.1 - 61.2; density, $\rho_4^{20} = 1.4892$; refractive index, $n_D^{20} = 1.4464$. |
| | <pre>glass wool. (2) Chloroform. B.p. (1 atm)/°C = 61.1 - 61.2; density, ρ²⁰ = 1.4892; refractive</pre> |
| | glass wool. (2) Chloroform. B.p. (1 atm)/°C = 61.1 - 61.2; density, $\rho_4^{20} = 1.4892$; refractive index, $n_D^{20} = 1.4464$. |
| | glass wool. (2) Chloroform. B.p. (1 atm)/°C = 61.1 - 61.2; density, $\rho_4^{20} = 1.4892$; refractive index, $n_D^{20} = 1.4464$. |
| | glass wool. (2) Chloroform. B.p. (1 atm)/°C = 61.1 - 61.2; density, $\rho_4^{20} = 1.4892$; refractive index, $n_D^{20} = 1.4464$. |
| | glass wool. (2) Chloroform. B.p. $(1 \text{ atm})/^{\circ}C = 61.1 - 61.2$; density, $\rho_{+}^{20} = 1.4892$; refractive index, $n_{D}^{20} = 1.4464$. ESTIMATED ERROR: |
| | glass wool. (2) Chloroform. B.p. (1 atm)/°C = 61.1 - 61.2; density, $\rho_4^{20} = 1.4892$; refractive index, $n_D^{20} = 1.4464$. |
| | glass wool. (2) Chloroform. B.p. $(1 \text{ atm})/^{\circ}C = 61.1 - 61.2$; density, $\rho_{+}^{20} = 1.4892$; refractive index, $n_{D}^{20} = 1.4464$. ESTIMATED ERROR: |
| | glass wool. (2) Chloroform. B.p. $(1 \text{ atm})/^{\circ}C = 61.1 - 61.2$; density, $\rho_{4}^{20} = 1.4892$; refractive index, $n_{D}^{20} = 1.4464$. ESTIMATED ERROR: REFERENCES: |
| | glass wool. (2) Chloroform. B.p. $(1 \text{ atm})/^{\circ}C = 61.1 - 61.2; \text{ density}, \rho_{4}^{20} = 1.4892; \text{ refractive index}, n_{D}^{20} = 1.4464.$ ESTIMATED ERROR: REFERENCES: 1. Strepikheev, Yu. A.; |
| | glass wool. (2) Chloroform. B.p. $(1 \text{ atm})/^{\circ}C = 61.1 - 61.2$; density, $\rho_{4}^{20} = 1.4892$; refractive index, $n_{D}^{20} = 1.4464$. ESTIMATED ERROR: REFERENCES: 1. Strepikheev, Yu. A.; Babkin, B. M. |
| | glass wool. (2) Chloroform. B.p. $(1 \text{ atm})/^{\circ}C = 61.1 - 61.2$; density, $\rho_{4}^{20} = 1.4892$; refractive index, $n_{D}^{20} = 1.4464$. ESTIMATED ERROR: REFERENCES: 1. Strepikheev, Yu. A.; Babkin, B. M. |
| | glass wool. (2) Chloroform. B.p. $(1 \text{ atm})/^{\circ}C = 61.1 - 61.2$; density, $\rho_{4}^{20} = 1.4892$; refractive index, $n_{D}^{20} = 1.4464$. ESTIMATED ERROR: REFERENCES: 1. Strepikheev, Yu. A.; Babkin, B. M. |

| COMPONENTS: | ORIGINAL MEASUREMENTS: |
|---|---|
| <pre>(1) Hydrogen chloride; HCl; [7647-01-0]</pre> | Hamai, S. Bull. Chem. Soc. Jpn. 1935, 10, |
| <pre>(2) Tetrachloromethane; CCl₄; [56-23-5]</pre> | 5 - 16. |
| | |
| VARIABLES: T/K: 288.15 - 298.15 Total P/kPa: 56.06 - 103.92 (420.5 - 779.5 mmH | PREPARED BY: W. Gerrard g) |
| EXPERIMENTAL VALUES: T/K Total Pressur | M - |
| p/mmHc | |
| 288.15 420.5 515.5 614.0 | 0.00928 0.01170 |
| 664.0 | |
| (760 | 0.01826) ¹ |
| 293.15 425.0 521.0 | |
| 572.0 | 0.00876 |
| (760 | 0.01550) 1 |
| | |
| 298.15` 433.5 531.5 | 0.00622 |
| 580.0 | |
| 680.5 | 0.00955 |
| 779.5 | |
| (760 | 0.01277) ¹ |
| partial pressure of 760 mmHg (1) | the compiler for a hydrogen chloride 01.325 kPa). It was assumed that the same for the solution and pure solvent. |
| AUXILIA | RY INFORMATION |
| METHOD/APPARATUS/PROCEDURE: | SOURCE AND PURITY OF MATERIALS: |
| The apparatus consisted of a U shaped gas buret, connected to a gas reservoir (335 cm ³ capacity) which was connected to the absorp- tion vessel. The volume of hydroge chloride absorbed by 20 cm ³ of the original liquid was converted into the amount of gas absorbed at a measured total pressure. The author obtained the heat of absorption, ΔH_t , of -6100 cal mol ⁻¹ | n was passed through conc. sulfuric acid and twice condensed by |
| (-25.2 kJ mol ⁻¹) from the slope of a plot of log x_1 vs. 1/T. | ESTIMATED ERROR: |
| | REFERENCES : |
| | |

| 00000000000 | | | | | |
|---|---|---|--|--|--|
| | | | ORIGINAL MEASUREMENTS: | | |
| <pre>(1) Hydrogen chloride; HCl; [7647-01-0]</pre> | | | Howland, J. J.; Miller, D. R. Willard, J. E. | | |
| <pre>(2) Tetrachloromethane; CCl₄; [56-23-5]</pre> | | | J. Am. Chem. Soc 2807 - 2811. | e. <u>1941</u> , <i>63</i> , | |
| VARIABLES: T/K: 273.15 - 298.15 P/kPa: 16.40 - 92.66 (123 - 695 mmHg) | | | PREPARED BY: W. Ge | errard | |
| EXPERIMENT | AL VALUES: | | | | |
| Т/К | Pressure or Pressure Range pl/mmHg | Number of Determination | | Mol Fraction ² | |
| 273.15 | 269 - 667 | 4 | 3.22 ± 0.01 | 0.0245 | |
| 293.15 | 123 - 695 | 7 | 2.34 ± 0.03 | 0.0178 | |
| 298.15 | 178.5 379.5 425.0 548.5 662.5 | | 2.12 2.11 2.16 2.17 2.14 | 0.00379 ³ 0.00803 ³ 0.00922 ³ 0.01190 ³ 0.01415 ³ | |
| | 178 - 662 | 5 | 2.14 ± 0.02 | 0.0163 | |
| set o | f data given by | the authors. | | | |
| | <u> </u> | AUXILIARY | INFORMATION | | |
| METHOD/APP | ARATUS/PROCEDURE: | | SOURCE AND PURITY OF | MATERIALS: | |
| an abso added t pressur sure, p gas par total p manomet | $= p_t - p_2^{\circ}(1 - x_1)$ | solvent was the vapor . This pres- alculate the 1, from the sured by the). | dropping sul sodium chlor passed throu calcium chlo (2) Tetrachlorom | Loride. Prepared by Lfuric acid onto ride. The gas was ugh glass wool and oride. methane. Merck and Co. cade, purified and | |
| The amount of gas absorbed in a measured weight of solution with- drawn as a sample, was determined by a chemical titration. | | | ESTIMATED ERROR: $\delta K/K = 0.01$ | | |
| The heat of solution was determined to be -2.67 ± 0.30 kcal mol ⁻¹ (-11.17 kJ mol ⁻¹). | | | REFERENCES : | | |

Hydrogen Chloride in Non-Aqueous Solvents

| COMPONENTS : | | ····· | | ORI | GINAL MEASUREMENTS | : | |
|---|----------------------------------|------------------------------------|------------------|---------------------------------|--|--|---|
| (1) Hydrog | | e; HCl; | | Zielinski, A. Z. | | | |
| <pre>[7647-01-0] (2) Tetrachloromethane or carbon tetrachloride; CCl₄; [56-23-5]</pre> | | | | Pr | Przem. Chem. <u>1958</u> , 37, 338 - 339. | | |
| VARIABLES: | | | | | | <u> </u> | |
| Т | /K = 293.1 Pa = 71.8 (539. | 5 - 313.1 9 - 89.6 2 - 672.4 | 5 5 mmHg) | PRE | PARED BY: W. | Gerrard | |
| EXPERIMENTAL | VALUES: | | | | | | |
| T/K | Hydrogen Chloride Pressure | | ompositi CCl4 | .on | Kuenen Coefficient | Mol Ratio | Mol Fraction |
| | p ₁ /mmHg | | n_2/mmo | 1 | S/cm^3 (STP) g ⁻¹ atm ⁻¹ | n ₁ /n ₂ | <i>x</i> 1 |
| 293.15 | 672.4 672.4 | 1.157 1.234 | 101.4 102.1 | | 1.88 1.99 | 0.0114 0.0121 | 0.0113 0.0120 0.0132 ¹ |
| 303.15 | 613.8 613.8 | 0.971 1.009 | 97.8 101.5 | | 1.79 1.79 | 0.0099 0.0099 | 0.0098 0.0098 0.0121 ¹ |
| 313.15 | 539.2 539.2 | 0.934 0.821 | 111.6 100.4 | | 1.72 1.68 | 0.0084 0.0082 | 0.0084 0.0082 0.0117 ¹ |
| fraction The aut | n at 101.3 hor took t | 25 kPa (l he HCl pai | atm) va | lue: essu | f the experimen s were calculat ure to be the d solvent vapor p | ed by the c ifference b | ompiler. |
| | | <u> </u> | AUXILIARY | | | | |
| METHOD/APPARA | TUS/PROCEDUF | Æ: | | SOURCE AND PURITY OF MATERIALS: | | | |
| METHOD/APPARATUS/PROCEDURE: Hydrogen chloride was absorbed by the liquid in an absorption vessel described by Bichowsky and Storch (1) The amount absorbed was determined by a chemical titration. | | | | I I | May be assumed purity. | to be of sa | tisfactory |
| To calculate the volume of HCl absorbed by one gram of liquid, at 760 mmHg, 22.42 dm ³ mol ⁻¹ was taken as the the molar volume of HCl at 273.15 K and 1 atm. The volume based | | | | | | | |
| on the real density of HCl under thes conditions is (compiler) 22.247 dm ³ mol ⁻¹ . | | | EST | IIMATED ERROR: | | | |
| | | | | REI | FERENCES : | | |
| | | | | | Bichowsky, F. J. Am. Chem. S | R. v.; Stor <i>oc. <u>1915</u>, 3</i> | ch, H. 7, 2695. |
| | | | | | | | |

| Hydrogen Chloride in N | Ion-Aqueous Solvents 253 |
|---|--|
| COMPONENTS: (1) Hydrogen chloride; HCl; [7647-01-0] | ORIGINAL MEASUREMENTS: Curda, M.; Holas, J. Chem. Prumysl <u>1964</u> , 14, 547 - 548. |
| <pre>(2) Tetrachloromethane; CCl₄; [56-23-5]</pre> | |
| VARIABLES: T/K = 273.15 - 343.15 p / kPa = 101.325 (1 atm) | PREPARED BY: W. Gerrard |
| | (smoothed data calculated by H.L. Clever) |
| | atio ¹ Mol Fraction |
| $g_{1}/10^{2}$ | <i>y</i> ₂ <i>x</i> ₁ |
| 273.15 0.43 | 0.0178 |
| 283.15 0.39 | |
| 293.15 0.34 303.15 0.30 | |
| 323.15 0.19 | |
| 343.15 0.06 | 0.0025 |
| The mole fraction | |
| lated by the compi- Smoothed Data: For use between 273. | |
| | K)+1691.006 ln(T/100 K)-291.983(T/100K) |
| 1 | |
| | regression line is 5.32 x 10 ⁻⁴ . Fraction |
| I/K MOI | <i>x</i> ₁ |
| 283.15 | 0.0156 |
| | 0.0136 |
| | 0.0107 |
| | 0.0063 |
| 343.15 | |
| ¹ The weight ratio is grams of HCl p | per 100 grams of tetrachloromethane. |
| AUXILIARY | INFORMATION |
| METHOD/APPARATUS/PROCEDURE: | SOURCE AND PURITY OF MATERIALS: |
| The gas was passed through the | (1) Hydrogen chloride. May be |
| liquid in a jacketed bubbler tube | taken as of satisfactory |
| fitted with a sampling tap at the | purity. |
| bottom. The amount of hydrogen chloride in a sample was determined | (2) Tetrachloromethane. Rectified |
| by a chemical titration. | technical grade. B.p. |
| The pressure was presumably | $(1 \text{ atm})/^{\circ}C = 77.$ |
| atmospheric. | |
| | |
| | ESTIMATED ERROR: |
| | |
| | |
| | REFERENCES : |
| 1 | |
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| | |

| 254 Hydrogen Chloride in | |
|--|--|
| COMPONENTS: (1) Hydrogen chloride; HCl; [7647-01-0] | ORIGINAL MEASUREMENTS: Vdovichenko, V. T.; Kondratenko, V. I. |
| <pre>(2) Tetrachloromethane; CCl₄; [56-23-5]</pre> | Khim. Prom. <u>1967</u> , 43, 290 - 291. |
| VARIABLES: T/K = 266.15 - 298.15 p /kPa = 101.325 (1 atm) | PREPARED BY: W. Gerrard (smoothed data calculated by H.L. Clever) |
| EXPERIMENTAL VALUES: | ······································ |
| | Mol Fraction x ₁ |
| 266.15 273.15 283.15 293.15 293.15 298.15 | 0.028 0.020 0.016 0.015 0.014 |
| The mole fraction values appear to be | for a total pressure of one atm. |
| Smoothed Data: For use between 266.1 | 5 and 298.15 K. |
| $\ln x_{\tau} = -243.30 + 339$ | .06/(T/100 K) + 114.73 ln (T/100 K) |
| The standard error about the re | |
| | Mol Fraction x ₁ |
| 268.15 | |
| 278.15 288.15 | 0.018 0.015 |
| 298.15 | 0.014 |
| AUXILIARY | INFORMATION |
| ME THOD / AP PARATUS / PROCEDURE : | SOURCE AND PURITY OF MATERIALS: |
| Solubility determined at atmospheric pressure by the method described by Strepikheev and Babkin (1). | (1) Hydrogen chloride. Obtained from chemically pure sodium chloride and concentrated sulfuric acid, dried by calcium chloride and filtered through glass wool. |
| | (2) Tetrachloromethane. B.p. (1 atm)/°C = 76.7 - 76.8; density, $\rho_{\mu}^{20} = 1.5970;$ refractive index, $n_{D}^{20} = 1.4602.$ |
| | ESTIMATED ERROR: |
| | |
| | REFERENCES: 1. Strepikheev, Yu. A.; Babkin, B. M. Khim. Prom. <u>1963</u> , (1), 38. |
| | |

| Hydrogen Chloride in | Non-Aqueous Solvents 255 | | | | |
|--|---|--|--|--|--|
| COMPONENTS: | ORIGINAL MEASUREMENTS: | | | | |
| <pre>(1) Hydrogen chloride; HCl; [7647-01-0]</pre> | Khodeeva, S.M.; Rozovskii, M.B. | | | | |
| <pre>(2) Tetrachloromethane; CCl₄; [56-23-5]</pre> | Zh. Fiz. Khim. <u>1975</u> , 49, 1396-1400. Russ. J. Phys. Chem. (Engl. Transl. <u>1975</u> , 49, 824-827. | | | | |
| VARIABLES: | PREPARED BY: | | | | |
| T/K: 293 - 323 Total p/kPa : 24.13 - 99.46 (181 - 746 mmHg) | P.G.T. Fogg | | | | |
| EXPERIMENTAL VALUES: | | | | | |
| The authors stated that the data were Ilinskaya equation: | represented by the Krichevskii- | | | | |
| $\log_{10}(p_1/\text{mmHg}) = \log_{10}((K/$ | mmHg) x_1) - $\beta(1 - x_2^2)$ | | | | |
| where $\beta = A/2.303$ RT. Values of A, K 293 - 323 K. | and $\boldsymbol{\beta}$ were given at 5 K intervals from | | | | |
| Temperature t/°C T/K A/cal mol ⁻¹ | K/mmHg β | | | | |
| 25 298 1700 30 303 0 35 308 -6700 40 313 -8600 45 318 -15000 | 37200 2.4 38300 1.4* 39300 0 36300 -2.4* 33700 -6.0 31600 -10.5 24600 -17.0 | | | | |
| The value of A is not consistent wi | 313 318 323 151 0.0150 0.0129 0.0121 th that of β . The mole fraction 1.013 bar has been calculated using | | | | |
| AUXILIARY | INFORMATION | | | | |
| METHOD/APPARATUS/PROCEDURE | SOURCE AND PURITY OF MATERIALS: | | | | |
| The apparatus was similar to that described by Khodeeva (1). Total vapor pressures over solutions of different composition were measured. | Hydrogen chloride. Obtained from "pure grade" hydrochloric acid, water vapor being removed at -50°C, and HCl being collected at the temperature of liquid nitrogen. | | | | |
| | Tetrachloromethane. Chemically pure. Distilled. | | | | |
| | $d_4^{20} = 1.594 \text{ g cm}^{-3}$ | | | | |
| | ESTIMATED ERROR: | | | | |
| | REFERENCES: | | | | |
| | Khodeeva, S.M. Zh. Fiz. Khim. <u>1961</u>, 35, 629. | | | | |
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| COMPONENTS: | ORIGINAL MEASUREMENTS: | | | | |
|--|---|--|--|--|--|
| Hydrogen chloride; HCl; | Bell, R. P. | | | | |
| [7647-01-0] | L Cham Con 1021 | | | | |
| | J. Chem. Soc. <u>1931</u> , 1371 - 1382. | | | | |
| (2) Chloroethanes. | 1371 - 1382. | | | | |
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| | | | | | |
| | | | | | |
| VARIABLES: | PREPARED BY: | | | | |
| T/K: 293.15 P/kPa: 101.325 (1 atm) | W. Gerrard | | | | |
| 17 AF 41 1010000 (1 4 4 4 4) | | | | | |
| EXPERIMENTAL VALUES: | | | | | |
| EXPERIMENTAL VALUES: | , | | | | |
| T/K Partitic | | | | | |
| Coefficie | | | | | |
| c _{1,l} /c ₁ | g | | | | |
| | ane: C H Cl : | | | | |
| 1,2-Dichloroet [107-06-2] | | | | | |
| • • | | | | | |
| 293.15 14.74 | 0.0457 | | | | |
| 1,1,2,2-Tetrack | loroethane: | | | | |
| $C_{2}H_{2}Cl_{4};$ [79-34 | | | | | |
| | | | | | |
| 293.15 6.20 | 0.0265 | | | | |
| Pentachloroetha | ane. C HCl : | | | | |
| [76-01-7] | me, c ₂ , 5, | | | | |
| | | | | | |
| 293.15 3.86 | 0.0214 | | | | |
| | | | | | |
| The ideal gas conce | entration at $p_1 = 1$ atm | | | | |
| $i = 2 (mol \ dm^{-3}) =$ | n/V = p/RT = 0.0417. | | | | |
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| AUXILIARY | INFORMATION | | | | |
| METHOD/APPARATUS/PROCEDURE: | SOURCE AND PURITY OF MATERIALS: | | | | |
| The apparatus consisted of a 50 cm^3 | (1) Hydrogen chloride. Prepared by | | | | |
| bulb extended at the top as a | dropping pure concentrated | | | | |
| graduated tube, and sealed at the | hydrochloric acid into pure sulfuric acid. | | | | |
| bottom to a capillary U-tube. The liquid was saturated with gas at | sulluric aciu. | | | | |
| atmospheric pressure. The gas was | (2) Chloroethanes. Good specimens | | | | |
| displaced from the saturated solu- | were dried over calcium | | | | |
| tion by a current of dry CO ₂ free | chloride, and distilled. | | | | |
| air, absorbed in water, and | Boiling points are given in paper. | | | | |
| titrated with a solution of NaOH. | baber. | | | | |
| The solubility, c/mol dm ⁻³ , was | | | | | |
| converted to a partition coefficient | ESTIMATED ERROR: | | | | |
| by dividing by the ideal gas con- | | | | | |
| centration of HCl in the gas phase. | $\delta T/K = 0.01$ | | | | |
| | $\delta c/c = 0.01$ | | | | |
| The mole fraction solubility was calculated on the assumption that | | | | | |
| the density of the solution obeys | REFERENCES: | | | | |
| the ideal mixture law. | | | | | |
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| COMPONENTS: | ORIGINAL MEASUREMENTS: | | | | |
|---|---|--|--|--|--|
| | | | | | |
| <pre>(1) Hydrogen chloride; HCl; [7647-01-0]</pre> | Hamai, S. | | | | |
| (2) 1,2-Dichloroethane; C ₂ H ₄ Cl ₂ ; [107-06-2] | Bull. Chem. Soc. Jpn. <u>1935</u> , 10, 5 - 16. | | | | |
| VARIABLES: | PREPARED BY: | | | | |
| T/K: 288.15 - 298.15 Total P/kPa: 45.66 - 97.53 (342.5 - 731.5 mmHg) | W. Gerrard | | | | |
| EXPERIMENTAL VALUES: T/K Total Pressure p/mmHg | Mol Fraction | | | | |
| 288.15 342.5 422.0 533.5 550.0 (760.0 | 0.0188 0.0229 0.0298 0.0300 0.04377) ¹ | | | | |
| 293.15 520.5 526.5 540.0 600.0 731.5 (760.0 | 0.0253 0.0258 0.0261 0.0303 0.0350 0.03993) ¹ | | | | |
| 298.15 467.5 500.0 584.0 680.0 (760.0 | 0.0198 0.0213 0.0252 0.0291 0.03576) ¹ | | | | |
| partial pressure of 760 mmHg (101. | e compiler for a hydrogen chloride 325 kPa). It was assumed that the e for the solution and pure solvent. | | | | |
| AUXILIARY | INFORMATION | | | | |
| METHOD / APPARATUS / PROCEDURE : | SOURCE AND PURITY OF MATERIALS: | | | | |
| The apparatus consisted of a U shaped gas buret, connected to a gas reser- voir (335 cm ³ capacity) which was connected to the absorption vessel. The volume of hydrogen chloride absorbed by 20 cm ³ of the original liquid was converted into the amount of gas absorbed at a measured total pressure. The author obtained the heat of | | | | | |
| absorption, ΔH , of -3500 cal mol ⁻¹ (-14.64 kJ mole ⁻¹) from the slope of a plot of log x_1 vs. 1/T. | ESTIMATED ERROR: | | | | |
| | | | | | |
| | REFERENCES: | | | | |
| | | | | | |
| | | | | | |

| (1) Hydrogen chloride; HCl; | ORIGINAL ME | |
|---|--|--|
| | | Yu. A.; Flid, R. M.; |
| [7647-01-0] (2) 1,2-Dichloroethane; C ₂ H ₄ Cl ₂ ; | | I. F.; Avet'yan, M. G.; |
| [107-06-2] 2 4 2 1,1,2-Trichloroethane; C ₂ H ₃ Cl ₂ | Zh. Fiz. | Khim. <u>1967</u> , 41, 2967 - 8. |
| [79-00-5] 1,1,2,2-Tetrachloroethane; C ₂ H | Russ. J. | Phys. Chem. (Engl. Transl.) , 1596 - 8. |
| [79-34-5] Trichloroethene; C ₂ HCl ₃ ;[79-0] | 1-6] PREPARED BY | ?: |
| VARIABLES: $T/K = 253 - 333$ $p_1/kPa = 26.7 - 101.325$ | | W. Gerrard |
| EXPERIMENTAL VALUES: | | |
| Liquid | Enthalpy of Dissolution $\Delta H/cal mol^{-1}$ | Entropy of Dissolution $\Delta S/cal K^{-1}mol^{-1}$ |
| 1,2-Dichloroethane | -4150 ± 50 | -20.5 |
| 1,1,2-Trichloroethane | -4070 ± 100 | -19.7 |
| 1,1,2,2-Tetrachloroethane | -2820 ± 100 | -16.7 |
| Trichloroethene | -3230 ± 100 | -18.9 |
| values or units of Henry's con thermodynamic properties of di mole ratio, $K/mol mol^{-1}$ log ($K/mol mol^{-1}$) = -($\Delta H/cal mol^{-1}$) | ssolution were | e calculated from the |
| | | (K) + (ΔS /cal K 'mol ⁻¹)/2.3F |
| IIXUA | LIARY INFORMATION | |
| | COURCE AND | |
| (Continued from above) One diagram showed plots of $10^2 K/mol mol^{-1} vs$ $p_1/mmHg$. Each line was shown as b straight, but the temperature was | source and s. being (1) Hydro dried | PURITY OF MATERIALS: ogen chloride. Purified and |
| (Continued from above) One diagram showed plots of $10^2 K/mol mol^{-1} vs p_1/mmHg$. Each line was shown as b | source AND (1) Hydro dried of (2) Chlor | PURITY OF MATERIALS: ogen chloride. Purified and |
| (Continued from above) One diagram showed plots of $10^2 K/mol mol^{-1} vs$ $p_1/mmHg$. Each line was shown as b straight, but the temperature was stated. Their Fig. 2 showed plots log (K/mol mol ⁻¹) vs. $1/(T/K)$. Ea line was drawn as straight, but a value of $1/T$ was missing. The pre | SOURCE AND Source AND (1) Hydro dried dried (2) Chlor source with the source | PURITY OF MATERIALS: ogen chloride. Purified and 1. cocarbons. No information. |
| (Continued from above) One diagram showed plots of $10^2 K/mol mol^{-1} vs$ $p_1/mmHg$. Each line was shown as b straight, but the temperature was stated. Their Fig. 2 showed plots log (K/mol mol ⁻¹) vs. $1/(T/K)$. Ea line was drawn as straight, but a value of $1/T$ was missing. The pre for the K value was not given. The equation above should be used caution. It gives values of K of magnitude in figure 1, but it doe not reproduce the order of solubi shown in the figure. | source and sof cond sof cond sof cond cond cond cond cond cond cond cond | PURITY OF MATERIALS: ogen chloride. Purified and 1. cocarbons. No information. |
| (Continued from above) One diagram showed plots of $10^2 K/mol mol^{-1} vs$ $p_1/mmHg$. Each line was shown as b straight, but the temperature was stated. Their Fig. 2 showed plots log (K/mol mol ⁻¹) vs. $1/(T/K)$. Ea line was drawn as straight, but a value of $1/T$ was missing. The pre for the K value was not given. The equation above should be used caution. It gives values of K of magnitude in figure 1, but it doe not reproduce the order of solubi | source AND define a not a not (1) Hydro dried (2) Chlor a not essure a with the s lity e pressure of a for measurem king. The con | PURITY OF MATERIALS: ogen chloride. Purified and i. cocarbons. No information. ERROR: $\delta T/K = \pm 0.1$ $\delta K/K = \pm 0.01$ HCl was measured with a ments at lower partial itents of the cell were |

| ORIGINAL MEASUREMENTS: |
|---|
| Danov, S. M.; Golubev, Yu. D. |
| Khim. Prom_st. (Moscow) <u>1968</u> , 44 (2), 116 - 120. |
| PREPARED BY: |
| W. Gerrard |
| |
| |
| INFORMATION |
| SOURCE AND PURITY OF MATERIALS: |
| (1) Hydrogen chloride. Probably of |
| (2) 1,1-Dichloroethane. Purity checked by chromatography. |
| |
| ESTIMATED ERROR: |
| |
| REFERENCES: |
| |
| |

| | 2 | 04.55 | 2 | 09.65 | 2 | 15.15 | 2 | 20.65 | 2 | 26.15 | 2 | 31.15 | 2 | 36.65 | 24 | 2.65 | EXPE | (2) | (1) | KO V | 260 |
|---|-----------------------|---------|------------------|----------|--------------------------|------------------|-------|-----------------------------|------|--------|----------------|----------|------|--------|------|-----------------|---------|--|-----------------------------------|------------------------|---|
| p/mmHg | S1 | x 1 1 | S1 | x 2 1 | S1 | x 1 ² | S1 | x ₁ ² | Sì | x 2 2 | S ¹ | x 2 1 | S1 | x 2 2 | S 1 | x1 ² | RIMENTA | 1,1 [75 | Hydrogen chloride; [7647-01-0] | COMPONENTS | |
| 100 | 16.2 | 0.0674 | 12.9 | 0.0547 | 10.4 | 0.0444 | 8.4 | 0.0364 | 6.6 | 0.0288 | 5.9 | 0.0257 | 4.8 | 0.0213 | 4.1 | 0.0187 | NTA | | 47- | NTS | |
| 200 | 34.9 | 0.1348 | 27.5 | 0.1094 | 21.8 | 0.0888 | 17.6 | 0.0728 | 13.7 | 0.0576 | 12.1 | 0.0514 | 9.9 | 0.0426 | 8.4 | 0.0362 | F | Dichloroethane; 34-3] | or- | | |
| 300 | 56.7 | 0.2022 | 44.0 | 0.1641 | 34.4 | 0.1332 | 27.4 | 0.1092 | 21.2 | 0.0864 | 18.7 | 0.0771 | 15.3 | 0.0639 | 12.8 | 0.0543 | /AL | 0F | <u>o</u> c | | |
| 400 | 82.6 | 0.2696 | 62.8 | 0.2188 | 48.4 | 0.1776 | 38.1 | 0.1456 | 29.1 | 0.1152 | 25.6 | 0.1028 | 20.9 | 0.0852 | 17.5 | 0.0724 | UES | oet | loı | | |
| 500 | 113.8 | 0.3370 | 84.4 | 0.2735 | 64.0 | 0.2200 | 49.7 | 0.1820 | 37.7 | 0.1440 | 33.1 | 0.1285 | 26.7 | 0.1065 | 22.3 | 0.0905 | | cha | rid | | H Ya |
| 600 | | | 109.6 | 0.3282 | 81.4 | 0.2664 | 62.5 | 0.2184 | 46.8 | 0.1728 | 40.8 | 0.1542 | 32.9 | 0.1278 | 27.3 | 0.1086 | | ne; | | | dro |
| 700 | | | | | 114.2 | 0.3377 | 85.5 | 0.2764 | 62.8 | 0.2190 | 54.3 | 0.1953 | 43.4 | 0.1623 | 35.8 | 0.1379 | | | HC1 | | gen |
| 800 | | | | | | | 91.9 | 0.2910 | 67.1 | 0.2305 | 57.9 | 0.2056 | 46.1 | 0.1708 | 38.0 | 0.1452 | | 2 ^H , | 1; | | 오 오 |
| 900 | | | | | | | 109.0 | 0.3274 | 78.4 | 0.2593 | 67.4 | 0.2313 | 53.3 | 0.1921 | 43.7 | 0.1632 | | C2H4C12 | | | - P |
| 1000 | | | | | | | | | 90.6 | 0.2881 | 77.4 | 0.2570 | 60.8 | 0.2134 | 49.6 | 0.1813 | | 2 | | | de |
| Henry's Constan K/mmHg ¹ Kuene ² Mole ³ Henry | t n coef fracti | on hydr | , S/cm ogen c | hloride | g ⁻¹ at: , | | 2 | 749 | 3 | 470 | 3 | 891 | 46 | 82 | 5 | 510 | | 44 (2), 116 - 120. 44 (2), 116 - 120. | S. M.; Golubev, M | ORIGINAL MEASUREMENTS: | Hydrogen Chloride in Non-Aqueous Solvents |

| | | | Chioride in I | · | | | | |
|--|--|--|--|---|--|--|--|--|
| COMPONENTS: (1) Hvd: | | ride; HCl; | | ORIGINAL MEASUREME Zielinski, A. | | | | |
| | 47-01-0] | ,, | | Przem. Chem. <u>1958</u> , 37, 338 - 339. | | | | |
| (2) 1,2- [10] | -Dichloroe 7-06-2] | thane; C ₂ F | 44 ^{C1} 2; | | | | | |
| HADTADI DC. | <u> </u> | | | | | · ·· · · · · · · · · · · · · · · · · · | | |
| P ₁ | T/K = 293 /kPa = 79. (59 | .15 - 313. 74 - 92.62 8.1 - 694. | 15 2 7 mmHg) | PREPARED BY: | W. Gerrard | | | |
| EXPERIMENT | L VALUES: | | | | · · · · · · · · · · · · · · · · · · · | | | |
| | Hydrogen | Liquid Co | mposition | Kuenen | Mol Ratio | Mol | | |
| - / | Chloride | | | Coefficient | n_1/n_2 | Fraction | | |
| | Pressure p ₁ /mmHg | | $\frac{C_2H_4Cl_2}{n_2/mmol}$ | S/cm^3 (STP) g ⁻¹ atm ⁻¹ | 2 | <i>x</i> 1 | | |
| 293.15 | 694.7 | 4.336 | 122.2 | 8.79 | 0.0355 | 0.0343 | | |
| | 694.6 | 4.409 | 125.7 | 8.69 | 0.0351 | 0.0339 0.0374 ¹ | | |
| 303.15 | 661.1 | 2.989 | 121.6 | 6.40 | 0.0246 | 0.0240 | | |
| | 661.2 | 2.690 | 108.4 | 6.45 | 0.0248 | 0.0242 0.0275 ¹ | | |
| 313.15 | 598.1 | 2.466 | 134.9 | 5.26 | 0.0183 | 0.0180 | | |
| | 598.1 | 2.504 | 134.6 | 5.29 | 0.0186 | 0.0183 0.0227 ¹ | | |
| the ba | rometric | pressure a | na the pur | e solvent vapor | pressure. | | | |
| <u>. </u> | | | AUXILIARY | INFORMATION | | | | |
| Hydrogen liquid i describe (1). Th | n an abso: d by Bicho e amount a | DURE: was absor rption ves owsky and absorbed w al titrati | sel Storch as deter- | SOURCE AND PURITY May be assumed factory purity | to be of s | atis- | | |
| absorbed 760 mmHg as the m 273.15 K based on under th | by one gr , 22.42 dr olar volur and 1 atr the real | volume of ram of liq n ³ mol ⁻¹ w ne of HCl n. The vo density o tions is (| uid, at as taken at lume f HCl | ESTIMATED ERROR: | | | | |
| | | | | REFERENCES: 1. Bichowsky, J. Am. Chem | F. R. v.; S [.] . <i>Soc</i> . <u>1915</u> | torch, H. , 37, 2695. | | |
| | | | | | | | | |

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| COMPORENTS: (1) Hydrogen chloride; HCl; [7647-01-0] (2) 1.2-Dichloroethane; $C_2H_4Cl_2$; [107-06-2] VARIABLES: T/K = 273.15 - 333.15 p/KPa = 101.325 (1 atm) EXPERIMENTAL VALUES: Temporature Hydrogen $T/K = 10^2 x_1/mol \ \%$ $T/K = 10^2 x_1/mol \ \%$ $T = 10^2 (K\pi v/atm) = \lambda - (\Delta H/cal mol^{-1})/(2.3R(T/K))$ The author's definitions are: $K = y_1/x_1 = mole \ Traction \ gas \ in \ gas \ phase$ $\pi/atm \ = 0 \ fraction \ gas \ in \ liquid \ phase$, $\pi/atm \ = 0 \ fraction \ gas \ in \ liquid \ phase$, $\pi/atm \ = 0 \ fraction \ gas \ in \ liquid \ phase$, $\pi/atm \ = 0 \ fraction \ gas \ in \ liquid \ phase$, $\pi/atm \ = 0 \ fraction \ gas \ in \ liquid \ phase$, $\pi/atm \ = 0 \ fraction \ gas \ in \ liquid \ phase$, $\pi/atm \ = 0 \ fraction \ gas \ in \ liquid \ phase$, $\pi/atm \ = 0 \ fraction \ gas \ in \ liquid \ phase$, $\pi/atm \ = 0 \ fraction \ gas \ in \ liquid \ phase$, $\pi/atm \ = 0 \ fraction \ gas \ hormato \ fraction \ gas \ hormato \ fraction \ gas \ hormato \ fraction \ fraction \ gas \ hormato \ fraction \ fract$ | , | | | | | | |
|--|---|---|--|--|--|--|--|
| $ \begin{bmatrix} 7647-01-03 \\ 1,2-Dichloroethane; C_H_4Cl_2; \\ [107-06-2] \\ 107-06-2] \\ \hline \\ $ | COMPONENTS : | ORIGINAL MEASUREMENTS: | | | | | |
| VARIABLES: T/K = 273.15 - 333.15 $p/KPa = 101.325 (1 atm)$ EXPERIMENTAL VALUES: Temperature Hydrogen KTU/atm ¹ Enthalpy of Constant Interval of Chloride at Dissolution A Measurements Mol % Range 293.15 K $T/K = 10^2 x_1/mol %$ $T/K = 10^2 x_1/$ | | | | | | | |
| T/K = 273.15 - 333.15 $p/kPa = 101.325$ (1 atm)W. GerrardEXPERIMENTAL VALUES:Temperature Hydrogen Mol % Range 293.15 KEnthalpy of DissolutionTemperature Hydrogen Mol % Range 293.15 KMU/Atm ¹ DissolutionTemperature Hydrogen Mol % Range $273.15-333.15$ I - 3 24.6 A $M/kcal mol-1273.15-333.151 - 324.624.63.544.041 log (Xmv/atm) = A - (\Delta H/cal mol^{-1})/(2.3R(T/K))The author's definitions are:K = y_1/x_1 = mole fraction gas in gas phasemole fraction gas in liquid phase ,\pi/atm \doteq total pressure,v = coefficient of fugacity.The function, K\piv/atm, is equivalent to a Henry's constant in the form\pi_{1,2}/atm = (f_1/atm)/x_1 where f_1 is the fugacity.MUNILLARY INFORMATIONMUNILLARY I$ | (2) 1,2-Dichloroethane; C ₂ H ₄ Cl ₂ ; [107-06-2] | | | | | | |
| T/K = 273.15 - 333.15 $p/kPa = 101.325$ (1 atm)W. GerrardEXPERIMENTAL VALUES:Temperature Hydrogen Mol % Range 293.15 KEnthalpy of DissolutionTemperature Hydrogen Mol % Range 293.15 KMU/Atm ¹ DissolutionTemperature Hydrogen Mol % Range $273.15-333.15$ I - 3 24.6 A $M/kcal mol-1273.15-333.151 - 324.624.63.544.041 log (Xmv/atm) = A - (\Delta H/cal mol^{-1})/(2.3R(T/K))The author's definitions are:K = y_1/x_1 = mole fraction gas in gas phasemole fraction gas in liquid phase ,\pi/atm \doteq total pressure,v = coefficient of fugacity.The function, K\piv/atm, is equivalent to a Henry's constant in the form\pi_{1,2}/atm = (f_1/atm)/x_1 where f_1 is the fugacity.MUNILLARY INFORMATIONMUNILLARY I$ | VARIABLES: | PREPARED BY: | | | | | |
| Temperature Interval of MeasurementsHydrogen Chloride at 293.15 K Mol & Range 293.15 K Mol $\chi_1/mol $ Enthalpy of Dissolution Mather at Dissolution A $\Delta H/kcal mol^{-1}$ 273.15-333.151 - 324.63.544.041log ($X \pi v/atm$) = A - ($\Delta H/cal mol^{-1}//(2.3R(T/K))$ The author's definitions are: $K = y_1/x_1 = mole fraction gas in gas phasemole fraction gas in liquid phase ,\pi/atm = total pressure,v = coefficient of fugacity.The function, X \pi v/atm, is equivalent to a Henry's constant in the formH_{1,2}/atm = (f_1/atm)/x_1 where f_1 is the fugacity.AUXILIARY INFORMATIONMUXILIARY INFORMATION$ | T/K = 273.15 - 333.15 | | | | | | |
| Interval of MeasurementsChloride ange $10^2 x_1/mol %$ at DissolutionDissolution A $M/kcal mol^{-1}$ 273.15-333.15 $1 - 3$ 24.6 3.54 4.04 1log ($K\pi\nu/atm$) = A - ($\Delta H/cal mol^{-1}$)/(2.3R(T/K))The author's definitions are: $K = y_1/x_1 = mole fraction gas in gas phasemole fraction gas in liquid phase ,\pi/atm \doteq total pressure,\nu = coefficient of fugacity.The function, K\pi\nu/atm, is equivalent to a Henry's constant in the formH_{1, E}/atm = (f_1/atm)/x_1 where f_1 is the fugacity.METHOD/APPARATUS/PROCEDURE:The authors describe three methods:1.A. [Saturat. n° 1]. A measure ofthe static pressure of saturationin an apparatus which gave a precisionof 10 - 15 %.SOURCE AND PURITY OF MATERIALS:(1) Hydrogen chloride. BASF. Puritystated to be greater than 99.9 %.(2) 1,2-Dichloroethane. Attested byspectroscopy and gas chromato-graphy as having purity greaterthan 99.9 per cent.1.B. [Saturat. n° 2]. A measure ofthe static pressure of satura-tion in an apparatus which gave aprecision of 2 - 5 %.SURCE AND PURITY OF MATERIALS:(1) Hydrogen chloride. BASF. Puritystated to be greater than 99.9 %.ESTIMATED ERROR:2. [Chromato]. A Gas liquid chromato-graphic method estimated to havea precision of 2 - 5 %.ESTIMATED ERROR:ESTIMATED ERROR:3. [Anal. directe]. Direct analysisof the gaseous and liquid phases.EFERENCES:$ | EXPERIMENTAL VALUES: | | | | | | |
| I log (Kπν/atm) = A - (ΔH/cal mol ⁻¹)/(2.3R(T/K)) The author's definitions are: $K = y_1/x_1 = mole fraction gas in gas phasemole fraction gas in liquid phase ,\pi/atm \doteq total pressure,v = coefficient of fugacity. The function, Kπv/atm, is equivalent to a Henry's constant in the formH_{1,2}/atm = (f_1/atm)/x_1 where f_1 is the fugacity. METHOD/APPARATUS/PROCEDURE:The authors describe three methods:1.A. [Saturat. n° 1]. A measure ofthe static pressure of saturationin an apparatus which gave a precisionof 10 - 15 %. 1.B. [Saturat. n° 2]. A measure ofthe static pressure of saturationin an apparatus which gave aprecision of 2 - 5 %. 2. [Chromato]. A Gas liquid chromato-graphic method estimated to havea precision of 2 - 5 %. 3. [Anal. directe]. Direct analysisof the gaseous and liquid phases. $ | Interval of Chloride a Measurements Mol % Range 293. | t Dissolution 15 K A | | | | | |
| The author's definitions are: $K = y_1/x_1 = \text{mole fraction gas in gas phase} \\ \pi/atm = total pressure, \\ v = coefficient of fugacity.$ The function, $K\pi v/atm$, is equivalent to a Henry's constant in the form $H_{1,2}/atm = (f_1/atm)/x_1$ where f_1 is the fugacity. METHOD/APPARATUS/PROCEDURE: The authors describe three methods: 1.A. [Saturat. n° 1]. A measure of the static pressure of saturation in an apparatus which gave a precision of 2 - 5 %. 2. [Chromato]. A Gas liquid chromatographic method estimated to have a precision of 2 - 5 %. 3. [Anal. directe]. Direct analysis of the gaseous and liquid phases. REFERENCES: | 273.15-333.15 1 - 3 24 | .6 3.54 4.04 | | | | | |
| $K = y_1/x_1 = \frac{\text{mole fraction gas in gas phase}{\text{mole fraction gas in liquid phase}},$ $\pi/\text{atm} \doteq \text{total pressure,}$ $\nu = \text{coefficient of fugacity.}$ The function, $K\pi\nu/\text{atm}$, is equivalent to a Henry's constant in the form $H_{1,2}/\text{atm} = (f_1/\text{atm})/x_1 \text{ where } f_1 \text{ is the fugacity.}$ METHOD/APPARATUS/PROCEDURE: The authors describe three methods: 1.A. [Saturat. n ⁰ 1]. A measure of the static pressure of saturation in an apparatus which gave a precision of 10 - 15 %. 2. [Chromato]. A Gas liquid chromato- graphic method estimated to have a precision of 2 - 5 %. 3. [Anal. directe]. Direct analysis of the gaseous and liquid phases. REFERENCES: | ¹ log (K $\pi v/atm$) = A - ($\Delta H/cal mol^{-1}$ | ¹)/(2.3R(<i>T</i> /K)) | | | | | |
| $\pi/atm \doteq total pressure,$ $v = coefficient of fugacity.$ The function, $K\pi\nu/atm$, is equivalent to a Henry's constant in the form $H_{1,2}/atm = (f_1/atm)/x_1 \text{ where } f_1 \text{ is the fugacity.}$ METHOD/APPARATUS/PROCEDURE: The authors describe three methods: 1.A. [Saturat. n ⁰ 1]. A measure of the static pressure of saturation in an apparatus which gave a precision of 10 - 15 %. 1.B. [Saturat. n ⁰ 2]. A measure of the static pressure of saturation in an apparatus which gave a precision of 2 - 5 %. 3. [Anal. directe]. Direct analysis of the gaseous and liquid phases. REFERENCES: | The author's definitions are: | | | | | | |
| <pre>v = coefficient of fugacity. The function, Kmv/atm, is equivalent to a Henry's constant in the form H_{1,2}/atm = (f₁/atm)/x₁ where f₁ is the fugacity. AUXILIARY INFORMATION KETHOD/APPARATUS/PROCEDURE: The authors describe three methods: 1.A. [Saturat. n⁰ 1]. A measure of the static pressure of saturation in an apparatus which gave a precision of 10 - 15 %. 1.B. [Saturat. n⁰ 2]. A measure of the static pressure of saturation in an apparatus which gave a precision of 2 - 5 %. 2. [Chromato]. A Gas liquid chromato- graphic method estimated to have a precision of 2 - 5 %. 3. [Anal. directe]. Direct analysis of the gaseous and liquid phases. REFERENCES:</pre> | $K = y_1 / x_1 = \frac{\text{mole}}{\text{mole}}$ | fraction gas in gas phase fraction gas in liquid phase , | | | | | |
| <pre>The function, K \u03c0 \u03c0 ATT ATT ATT ATT ATT ATT ATT ATT ATT AT</pre> | π/atm ≐ total pres: | sure, | | | | | |
| <pre>H_{1,2}/atm = (f₁/atm)/x₁ where f₁ is the fugacity. AUXILIARY INFORMATION METHOD/APPARATUS/PROCEDURE: The authors describe three methods: 1.A. [Saturat. n⁰ 1]. A measure of the static pressure of saturation in an apparatus which gave a precision of 10 - 15 %. (1) Hydrogen chloride. BASF. Purity stated to be greater than 99.9 %. (1) Hydrogen chloride. BASF. Purity stated to be greater than 99.9 %. (2) 1,2-Dichloroethane. Attested by spectroscopy and gas chromato- graphy as having purity greater than 99.9 per cent. (2) 1,2-Dichloroethane. Attested by spectroscopy and gas chromato- graphy as having purity greater than 99.9 per cent. (2) I,2-Dichloroethane. Attested by spectroscopy and gas chromato- graphy as having purity greater than 99.9 per cent. (3) [Chromato]. A Gas liquid chromato- graphic method estimated to have a precision of 2 - 5 %. (3) [Anal. directe]. Direct analysis of the gaseous and liquid phases. REFERENCES: </pre> | v = coefficient of | fugacity. | | | | | |
| METHOD/APPARATUS/PROCEDURE: The authors describe three methods: 1.A. [Saturat. n⁰ 1]. A measure of the static pressure of saturation in an apparatus which gave a precision of 10 - 15 %. 1.B. [Saturat. n⁰ 2]. A measure of the static pressure of satura- tion in an apparatus which gave a precision of 2 - 5 %. 2. [Chromato]. A Gas liquid chromato- graphic method estimated to have a precision of 2 - 5 %. 3. [Anal. directe]. Direct analysis of the gaseous and liquid phases. SOURCE AND PURITY OF MATERIALS: SOURCE AND PURITY OF MATERIALS: (1) Hydrogen chloride. BASF. Purity stated to be greater than 99.9 %. (2) 1,2-Dichloroethane. Attested by spectroscopy and gas chromato- graphy as having purity greater than 99.9 per cent. | $H_{1,2}/\text{atm} = (f_1/\text{atm})/x_1 \text{ where } f_1 \text{ is the set of } f_1$ | he fugacity. | | | | | |
| The authors describe three methods: 1.A. [Saturat. n° 1]. A measure of the static pressure of saturation in an apparatus which gave a precision (2) 1,2-Dichloroethane. Attested by spectroscopy and gas chromatography as having purity greater than 99.9 per cent. (1) Hydrogen chloride. BASF. Purity stated to be greater than 99.9 %. (2) 1,2-Dichloroethane. Attested by spectroscopy and gas chromatography as having purity greater than 99.9 per cent. (2) 1,2-Dichloroethane. Attested by spectroscopy and gas chromatography as having purity greater than 99.9 per cent. (2) 1,2-Dichloroethane. Attested by spectroscopy and gas chromatography as having purity greater than 99.9 per cent. (2) 1,2-Dichloroethane. Attested by spectroscopy and gas chromatography as having purity greater than 99.9 per cent. (2) 1,2-Dichloroethane. Attested by spectroscopy and gas chromatography as having purity greater than 99.9 per cent. (3) [Anal. directe]. Direct analysis of the gaseous and liquid phases. (4) Hydrogen chloride. BASF. Purity stated to be greater than 99.9 %. (2) 1,2-Dichloroethane. Attested by spectroscopy and gas chromatography as having purity greater than 99.9 per cent. | AUXILIARY | INFORMATION | | | | | |
| The authors describe three methods: 1.A. [Saturat. n° 1]. A measure of the static pressure of saturation in an apparatus which gave a precision of 10 - 15 %. 1.B. [Saturat. n° 2]. A measure of the static pressure of saturation in an apparatus which gave a precision of 2 - 5 %. 2. [Chromato]. A Gas liquid chromatographic method estimated to have a precision of 2 - 5 %. 3. [Anal. directe]. Direct analysis of the gaseous and liquid phases. (1) Hydrogen chloride. BASF. Purity stated to be greater than 99.9 %. (1) Hydrogen chloride. BASF. Purity stated to be greater than 99.9 %. (2) 1,2-Dichloroethane. Attested by spectroscopy and gas chromatography as having purity greater than 99.9 per cent. ESTIMATED ERROR: | | | | | | | |
| <pre>graphic method estimated to have a precision of 2 - 5 %. 3. [Anal. directe]. Direct analysis of the gaseous and liquid phases. REFERENCES:</pre> | The authors describe three methods: 1.A. [Saturat. n⁰ 1]. A measure of the static pressure of saturation in an apparatus which gave a precision of 10 - 15 %. 1.B. [Saturat. n⁰ 2]. A measure of the static pressure of saturation in an apparatus which gave a | (1) Hydrogen chloride. BASF. Purity stated to be greater than 99.9 %. (2) 1,2-Dichloroethane. Attested by spectroscopy and gas chromato- graphy as having purity greater | | | | | |
| of the gaseous and liquid phases. REFERENCES: | graphic method estimated to have | ESTIMATED ERROR: | | | | | |
| | of the gaseous and liquid phases. | REFERENCES : | | | | | |
| | | | | | | | |

| | | ŀ | lydroger | Chloride in N | Ion-Aqueous So | lvents | 26 | | | |
|-------------------|--|--|---------------------|--|--|--|---|--|--|--|
| COMPONENTS | 5: | | | | ORIGINAL MEASUR | EMENTS: | | | | |
| | lrogen 547-01- | chlorid 0] | le; HCl | ; | Abdullaev, A. I.; Aliev, A. M.; Mamedov, M. B. | | | | | |
| (2) 1,2 [10 | 2-Dichl 07-06-2 | oroetha] | ane; C ₂ | H ₄ Cl ₂ : | Uch. Zap. Az Khim. Nauk <u>l</u> | erb. Gos. U 968, No. 3, | niv., Ser. 80 - 83. | | | |
| | | | | | Ref. Zh. Khi | . Zh. Khim. 1969, Abstr. No. 11B1279. | | | | |
| ARIABLES Total | T/K | = 273.] re = ba | | | PREPARED BY: | W. Gerrard | | | | |
| XPERIMEN | TAL VALU | ES: | ···- | 1 | | | | | | |
| T/K | Hydro | gen Chi | | Hydrogen C | hloride ¹ | Mol Ratio | Mol Fraction | | | |
| | а | w ₁ /wt b | Mean | g HCl per 100 g (2) | | n ₁ /n ₂ | <i>x</i> ₁ | | | |
| | 2.02 1.47 1.01 0.82 0.66 0.50 0.33 0.16 | 1.46 1.08 0.77 0.64 0.46 0.30 0.16 | - | 3.13 2.10 1.47 1.06 0.80 0.65 0.48 0.32 0.16 per cent. action valu | 23.32 16.00 11.46 7.99 6.10 4.95 3.68 2.45 1.23 es were calcu | 0.0850 0.0570 0.0399 0.0288 0.0217 0.0178 0.0132 0.0087 0.0043 | 0.0783 0.0539 0.0384 0.0280 0.0215 0.0175 0.0130 0.0086 0.0043 e compiler. | | | |
| | | | | | | ······································ | | | | |
| | | | | AUXILIARY | INFORMATION SOURCE AND PURI | ······································ | | | | |

ESTIMATED ERROR:

REFERENCES:

Hydrogen Chloride in Non-Aqueous Solvents

| COMPONENTS: | | ORIGINAL MEASUREMENTS: | | | | |
|--|---|--|--|--|--|--|
| <pre>(1) Hydrogen chloride; HCl [7647-01-0]</pre> | ; | Hamai, S. | | | | |
| (2) 1,1,2-Trichloroethane; [79-00-5] | C ₂ H ₃ Cl ₃ ; | Bull. Chem. Soc. Jpn. <u>1935</u> , 10, 207 - 211. | | | | |
| VARIABLES: | | PREPARED BY: | | | | |
| T/K: 285.15 - 29 Total P/kPa: 67.79 - 88 (508.5 - 66 | .93 | W. Gerrard | | | | |
| EXPERIMENTAL VALUES: T/K | Total M Pressure p/mmHg | fraction | | | | |
| 285.15 | 508.5 556.5 601.5 649.0 (760.0 | 0.02514 0.02705 0.02935 0.03195 0.03715) ¹ | | | | |
| 288.15 | 516.0 655.0 562.0 (760.0 | 0.02378 0.03056 0.02588 0.03463) ¹ | | | | |
| 293.15 | 523.5 523.5 620.0 620.0 640.5 667.0 (760.0 | 0.02166 0.02171 0.02488 0.02489 0.02633 0.02781 0.03101) ¹ | | | | |
| partial pressure of 760 | mmHg (101.3) | compiler for a hydrogen chloride 25 kPa). It was assumed that the for the solution and pure solvent. | | | | |
| | AUXILIARY | INFORMATION | | | | |
| METHOD/APPARATUS/PROCEDURE: | | SOURCE AND PURITY OF MATERIALS: | | | | |
| The apparatus consisted of gas buret, connected to a voir (335 cm ³ capacity) wh connected to the absorptio The volume of hydrogen chl absorbed by 20 cm ³ of the liquid was converted into of gas absorbed at a measu pressure. The author obtained the he absorption, ΔH , of -3600 c (-15.06 kJ mole ⁻¹) from th a plot of log x_1 vs. 1/T. | gas reser- ich was n vessel. oride original the amount red total at of al mol-1 | (1) Hydrogen chloride. Prepared by dropping concentrated hydro- chloric acid into pure concen- trated sulfuric acid. The gas was passed through concentrated sulfuric acid and twice con- densed by liquid nitrogen. (2) 1,1,2-Trichloroethane. Eastman, twice distilled. B.p. 385.65 - 386.15 K. ESTIMATED ERROR: | | | | |
| | | REFERENCES : | | | | |
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| COMPONENTS: | ORIGINAL MEASUREMENTS: | | | | |
|---|--|--|--|--|--|
| | | | | | |
| <pre>(1) Hydrogen chloride; HCl; [7647-01-0]</pre> | Hamai, S. | | | | |
| (2) 1,1,2,2-Tetrachloroethane; C ₂ H ₂ Cl ₄ ; [79-34-5] | Bull. Chem. Soc. Jpn. <u>1935</u> , 10, 5 - 16. | | | | |
| · · · | | | | | |
| VARIABLES: T/K: 288.15 - 298.15 Total P/kPa: 51.26 - 98.53 (384.5 - 739.0 mmHg) | PREPARED BY: W. Gerrard | | | | |
| EXPERIMENTAL VALUES: T/K Total Pressure p/mmHg | Mol Fraction | | | | |
| 288.15 384.5 573.5 663.5 722.5 (760.0 | 0.0155 0.0231 0.0261 0.0281 0.03006) ¹ | | | | |
| 293.15 390.0 582.0 621.5 631.5 680.0 731.5 (760.0 | | | | | |
| 298.15 396.0 442.0 493.5 541.0 614.5 739.0 (760.0 | 0.0201 | | | | |
| partial pressure of 760 mmHg (101 | ne compiler for a hydrogen chloride .325 kPa). It was assumed that the ame for the solution and pure solvent. | | | | |
| AUXILIAR | INFORMATION | | | | |
| METHOD/APPARATUS/PROCEDURE: | | | | | |
| The apparatus consisted of a U shaped gas buret, connected to a gas reser- voir (335 cm ³ capacity) which was connected to the absorption vessel. The volume of hydrogen chloride absorbed by 20 cm ³ of the original liquid was converted into the amount of gas absorbed at a measured total pressure. The author obtained the heat of absorption, ΔH , of -3300 cal mol ⁻¹ (-13.81 kJ mole ⁻¹) from the slope of a plot of log x_1 vs. 1/T. | dropping concentrated hydro- chloric acid into pure concen- trated sulfuric acid. The gas was passed through concentrated sulfuric acid and twice con- densed by liquid nitrogen. (2) 1,1,2,2-Tetrachloroethane. Kahlbaum, twice distilled. B.p. 416.65 - 417.15 K. | | | | |
| | REFERENCES : | | | | |

| COMPONENTS: | ····· | | | ORIGINAL MEASUREMEN | TS: | | | | |
|---|--|---|---|--|--------------------------------|---|--|--|--|
| | ogen chlor 7-01-0] | ide; HCl; | | Zielinski, A. Z. <i>Przem. Chem.</i> <u>1958</u> , 37, 338 - 339. | | | | | |
| (2) 1,1,2 | - | hloroethan 4-5] | ie; | | | | | | |
| VARIABLES : | | | | PREPARED BY: | | | | | |
| VARIABLES: 7 P1/k | 7/K = 293. Pa = 98.2 (736 | 15 - 313.1 5 - 100.10 .9 - 750.8 | .5) mmHg) | | errard | | | | |
| EXPERIMENTAL | | | | | | | | | |
| T/K | Hydrogen Chloride | Liquid Co | mposition | Kuenen Coefficient | Mol Ratio | Mol Fraction | | | |
| | Pressure p ₁ /mmHg | HCl n ₁ /mmol | $C_2H_2Cl_4$ $n_2/mmol$ | | n ₁ /n ₂ | <i>x</i> ₁ | | | |
| 293.15 | 750.8 | 2.879 | 95.5 | 4.07 | 0.0301 | 0.0293 | | | |
| | 750.8 750.8 | 2.802 2.841 | 95.8 98.2 | 3.95 3.91 | 0.0292 0.0289 | 0.0284 0.0281 0.0289 ¹ | | | |
| 303.15 | 761.7 | 2.652 | 97.3 | 3.63 | 0.0273 | 0.0265 | | | |
| 505.15 | 761.7 | 2.244 | 81.7 | 3.66 | 0.0275 | 0.0267 0.0265 ¹ | | | |
| 313.15 | 736.9 | 2.318 | 90.8 | 3.51 | 0.0255 | 0.0249 | | | |
| | 736.9 | 2.541 | 98.2 | 3.57 | 0.0259 | 0.0252 0.0258 ¹ | | | |
| The aut the bar | hor took a ometric pi | the HCl pa ressure and | rtial pre d the pur | ssure to be the e solvent vapor | difference pressure. | between | | | |
| <u></u> | | | AUXILIARY | INFORMATION | | | | | |
| the liqui described (1). The mined by To calcul absorbed | chloride y d in an al by Bichoy amount al a chemical ate the yo by one gra | URE: was absorb bsorption wsky and S bsorbed wa l titratio blume of H am of liqu mol ⁻¹ wa | vessel torch s deter- n. Cl id. at | SOURCE AND PURITY (May be assumed satisfactory pu | to be of | | | | |
| as the mo 273.15 K | lar volume and l atm. | e of HCl a | t ume | | | | | | |
| | se conditi | lons is (c | | ESTIMATED ERROR: | | <u></u> | | | |
| | | | | REFERENCES: 1. Bichowsky, F J. Am. Chem. | | | | | |
| | | | | | | | | | |

| COMPONENTS : | ORIGINAL MEASUREMENTS: | | |
|---|---|--|--|
| <pre>(1) Hydrogen chloride; HCl; [7647-01-0]</pre> | Hamai, S. | | |
| <pre>(2) Pentachloroethane; C₂HCl₅; [76-01-7]</pre> | Bull. Chem. Soc. Jpn. <u>1935</u> , 10, 207 - 211. | | |
| VARIABLES: | DEDADED NY | | |
| T/K: 285.15 - 293.15 Total P/kPa: 45.26 - 95.73 (339.5 - 718.0 mmHg) | PREPARED BY: W. Gerrard | | |
| EXPERIMENTAL VALUES: T/K Total Pressure p/mmHg | Mol Fraction | | |
| 285.15 560.5 611.5 657.5 712.5 (760.0 | 0.01865 0.02018 0.02199 0.02381 0.02502) ¹ | | |
| 288.15 562.0 611.5 661.5 (760.0 | 0.01790 0.01934 0.02096 0.02396) ¹ | | |
| 293.15 339.5 565.5 614.0 666.0 718.0 (760.0 | 0.009946 0.01666 0.01838 0.01937 0.02125 0.02250) ¹ | | |
| ¹ These values were calculated by the compiler for a hydrogen chloride partial pressure of 760 mmHg (101.325 kPa). It was assumed that the solvent vapor pressure was the same for the solution and pure solvent. | | | |
| AUXILIARY | INFORMATION | | |
| METHOD/APPARATUS/PROCEDURE: The apparatus consisted of a U shaped gas buret, connected to a gas reser- voir (335 cm ³ capacity) which was connected to the absorption vessel. The volume of hydrogen chloride absorbed by 20 cm ³ of the original liquid was converted into the amount of gas absorbed at a measured total pressure. The author obtained the heat of absorption, ΔH , of -2200 cal mol ⁻¹ (-9.20 kJ mole ⁻¹) from the slope of a plot of log x_1 vs. 1/T. | <pre>dropping concentrated hydro- chloric acid into pure concen- trated sulfuric acid. The gas was passed through concentrated sulfuric acid and twice con- densed by liquid nitrogen. (2) Pentachloroethane. Eastman, twice distilled. B.p. 431.65 - 432.65 K.</pre> | | |
| | REFERENCES : | | |

| | ADTOTALL AND AND AND AND A | | |
|--|---|--|--|
| COMPONENTS: | ORIGINAL MEASUREMENTS: | | |
| <pre>(1) Hydrogen chloride; HCl; [7647-01-0]</pre> | Gerrard, W.; Mincer, A. M. A.; Wyvill, P. L. | | |
| (2) l-Chlorobutane; C ₄ H ₉ Cl; [109-69-3] | J. Appl. Chem. <u>1959</u> , 9, 89 – 93. | | |
| VARIABLES: | PREPARED BY: | | |
| т/К: 273.15 - 293.55 | W. Gerrard | | |
| Total P/kPa: 101.325 (1 atm) | w. Gerrard (smoothed data calculated by H.L. Clever) | | |
| | | | |
| EXPERIMENTAL VALUES: | | | |
| T/K Mol Ratio ⁿ HCl/ ⁿ C ₄ H ₉ Cl | Mol Fraction ^x HCl | | |
| | | | |
| 273.15 0.0843 277.05 0.0759 | 0.0777 0.0705 | | |
| 282.15 0.0701 | 0.0655 | | |
| 293.55 0.0520 | 0.0494 | | |
| The mole fraction values were calcula | ted by the compiler. | | |
| | | | |
| Smoothed Data: $\ln x_{HC1} = -8.995 + 17$ | .607/(T/100) | | |
| Standard error about : | regression line = 1.54×10^{-3} | | |
| T/K | Mol Fraction | | |
| • | ^x HCl | | |
| | | | |
| 273.15 283.15 | | | |
| 293.15 | 0.0503 | | |
| | | | |
| AUXILIARY | INFORMATION | | |
| METHOD/APPARATUS/PROCEDURE: | SOURCE AND PURITY OF MATERIALS: | | |
| The solvent was weighed in a bubbler tube. The amount of gas absorbed was determined by reweighing to constant weight. The total pressure was barometric, very nearly 1 atm. | (1) Hydrogen chloride. Good specimen | | |
| | ESTIMATED ERROR: $\delta x/x = 0.015$ REFERENCES: | | |
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|---|---|--|--|--|
| COMPONENTS : | ORIGINAL MEASUREMENTS: | | | |
| <pre>(1) Hydrogen chloride; HCl; [7647-01-0]</pre> | Gerrard, W.; Mincer, A. M. A.; Wyvill, P. L. | | | |
| (2) 1-Chlorohexane; C ₆ H ₁₃ Cl; | J. Appl. Chem. <u>1959</u> , 9, 89 - 93. | | | |
| [544-10-5] | | | | |
| | | | | |
| VARIABLES: | PREPARED BY: | | | |
| T/K: 197.15 - 315.95 | W. Gerrard | | | |
| Total P/kPa: 101.325 (1 atm) | (smoothed data calculated by H.L. Clever) | | | |
| EXPERIMENTAL VALUES: | L | | | |
| | No.2. Proceeding | | | |
| T/K Mol Ratio | Mol Fraction | | | |
| $\underline{\qquad \qquad } \frac{{}^{n}\mathrm{HCl}/{}^{n}\mathrm{C}_{6}\mathrm{H}_{13}\mathrm{C}_{6}}{}^{n}\mathrm{Hcl}/{}^{n}\mathrm{C}_{6}\mathrm{H}_{13}\mathrm{C}_{6}\mathrm{H}_{1$ | 1 ^x HCl | | | |
| 197.15 2.639 | 0.725 | | | |
| 208.15 1.194 229.65 0.468 | 0.544 0.319 | | | |
| 243.45 0.261 | 0.207 | | | |
| 251.15 0.179 | 0.152 | | | |
| 261.65 0.124 273.45 0.0885 | 0.110 0.0813 | | | |
| 273.43 0.0885 | 0.0716 | | | |
| 287.65 0.0699 | 0.0653 | | | |
| 295.45 0.0555 303.45 0.0452 | 0.0526 0.0432 | | | |
| 303.45 0.0432 | 0.0432 | | | |
| 315.95 0.0325 | 0.0315 | | | |
| The mole fraction values were calculation | ted by the compiler. | | | |
| | 71/(T/100) - 8.348 ln (T/100) | | | |
| HCl HCl Standown should | regression line = 1.68×10^{-2} | | | |
| Standard error about | $\frac{1}{2}$ | | | |
| T/K Mol Fraction | T/K Mol Fraction | | | |
| ^x HC1 | ^x HCl | | | |
| 203.15 0.629 | 263.15 0.115 | | | |
| 213.15 0.463 | 273.15 0.0888 283.15 0.0693 293.15 0.0545 | | | |
| 223.15 0.344 233.15 0.258 | | | | |
| 243.15 0.195 | 303.15 0.0431 | | | |
| | 313.15 0.0343 | | | |
| METHOD/APPARATUS/PROCEDURE: | SOURCE AND PURITY OF MATERIALS: | | | |
| The solvent was weighed in a bubbler | (1) Hydrogen chloride. Good specimen | | | |
| tube. The amount of gas absorbed was determined by reweighing to constant | from a commercial cylinder was dried. | | | |
| weight. The total pressure was | dited. | | | |
| barometric, very nearly 1 atm. | (2) 1-Chlorohexane. Carefully puri- | | | |
| For determination at temperatures | fied, and purity rigorously attested. | | | |
| below 273 K, a chemical titration was carried out. After the maximum | | | | |
| absorption at the stated temperature, | | | | |
| the bubbler tube was attached to a | | | | |
| flask containing 1 dm^3 of water, and allowed to warm slowly (12 hours) to | | | | |
| room temperature. The contents of | ESTIMATED ERROR: | | | |
| the bubbler tube were then added to | $\delta T/K = 2 < 273K$ | | | |
| the water, and the total chloride ion was determined by the Volhard method. | $\delta x/x = 0.035$ | | | |
| A low temperature, Teddington-type YM | | | | |
| thermostat was used for temperatures below 273 K, the control being within | REFERENCES : | | | |
| below 273 K, the control being within $\frac{1}{2}$ K. | | | | |
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| COMPONENTS : | ORIGINAL MEASUREMENTS: | |
|---|---|--|
| <pre>1. Hydrogen chloride; HCl; [7647-01-0]</pre> | Ahmed, W.; Gerrard, W.; Maladkar, V. K. | |
| <pre>2. 1-Chlorooctane; C₈H₁₇Cl; [111-85-3]</pre> | J. Appl. Chem. <u>1970</u> , 20, 109 - 115. | |
| VARIABLES: | PREPARED BY: | |
| T/K: 273.15 Total P/kPa: 101.325 (1 atm) | W. Gerrard | |
| EXPERIMENTAL VALUES: | | |
| T/K Mol Rat ⁿ HCl/ ⁿ C ₈ H | | |
| 273.15 0.1 | 12 0.107 | |
| The mole fraction solubility was calculated from the mole ratio by the compiler. | | |
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| | | |
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| | | |
| | | |
| | | |
| AUXILIARY INFORMATION | | |
| METHOD /APPARATUS / PROCEDURE : | SOURCE AND PURITY OF MATERIALS: | |
| Hydrogen chloride was passed into a known weight of liquid in a bubbler tube at a total pressure measured by a manometer assembly. The absorbed gas was weighed by re-weighing the bubbler tube. The temperature was manually controlled to within 0.2 K. The procedure and apparatus are described by Gerrard (1,2). | Hydrogen chloride. Obtained from a cylinder containing a good com- mercial specimen. Was dried by passage through concentrated sulfuric acid. | |
| | 1-Chlorooctane. Best obtainable specimen was suitably purified, dried, and fractionally distilled, and attested. | |
| | | |
| | ESTIMATED ERROR: | |
| | $\begin{array}{rcl} \delta \mathbf{T}/\mathbf{K} &= & 0.2 \\ \delta \mathbf{X}/\mathbf{X} &= & 0.05 \end{array}$ | |
| | REFERENCES: 1. Gerrard, W. J. Appl. Chem. Biotechnol. <u>1972</u> , 22, 623 - 650. | |
| | 2. Gerrard, W. "Solubility of Gases and Liquids" Plenum Press, New York, 1976 | |

| COMPONENTS : | ORIGINAL MEASUREMENTS: | | |
|--|--|--|--|
| <pre>(1) Hydrogen chloride; HCl; [7647-01-0]</pre> | Fernandes, J. B.; Sharma, M. M. | | |
| <pre>(2) 1-Chlorododecane or laury1 chloride; C₁₂H₂₅Cl; [112-52-7]</pre> | Indian Chem. Eng. <u>1965</u> , 7, 38 - 40. | | |
| VARIABLES: | PREPARED BY: | | |
| T/K: 313.15 - 433.15 HCl P/kPa: 101.325 (760 mmHg) | W. Gerrard (smoothed data calculated by H.L. Clever) | | |
| EXPERIMENTAL VALUES: | | | |
| T/K Mol Rati n ₁ /n ₂ | Mol Fraction | | |
| 313.15 0.0276 333.15 0.0174 353.15 0.0132 393.15 0.0072 433.15 0.0037 | 0.0171 | | |
| The compiler calculated the mole fraction solubility values. | | | |
| Smoothed Data: $\ln x_1 = -10.572 + 23$ | | | |
| Standard error about the re | egression line = 7.27×10^{-4} . | | |
| T/K Mol Fraction x1 | | | |
| 333.15 0 353.15 0 373.15 0 393.15 0 413.15 0 | .0273 .0179 .0124 .0089 .0066 .0050 .0040 | | |
| AUXILIARY | INFORMATION | | |
| METHOD/APPARATUS/PROCEDURE: | SOURCE AND PURITY OF MATERIALS: | | |
| Hydrogen chloride was bubbled into the solvent for more than an hour. Approximately 1 cm ³ of the solution was transferred to a weighed sample tube and the whole re-weighed. The contents were transferred to water, and the chloride content determined by the Volhard method. | (1) Hydrogen chloride. Self prepared by the method of Sloan (1). (2) 1-Chlorododecane. Prepared from dodecanol by the interaction of hydrogen chloride in the presence of zinc chloride at 393 - 453 K. | | |
| | ESTIMATED ERROR: $\delta T/K = 0.2$ $\delta x_1/x_1 = 0.05$ REFERENCES: 1. Sloan, A. D. B. Chem. Ind. <u>1964</u> , 574. | | |
| | | | |

| COMPONENTS: (1) Hydrogen chloride; HCl; | ORIGINAL MEASUREMENTS: Fernandes, J. B.; Sharma, M. M. | | |
|---|---|--|--|
| [7647-01-0] | Indian Chem. Eng. <u>1965</u> , 7, 38 - 40. | | |
| (2) 1-Chlorohexadecane or cetyl chloride; C ₁₆ H ₃₃ C1; [4860-03-1] | , , , , , , , , , , , , , , , , , | | |
| VARIABLES: | PREPARED BY: | | |
| T/K: 313.15 HCl P/kPa: 101.325 (760 mmHg) | W. Gerrard | | |
| EXPERIMENTAL VALUES: | | | |
| T/K Mol Rat | io Mol Fraction | | |
| 313.15 0.038 | 0.0369 | | |
| The compiler calc fraction solubili | | | |
| AUXILIARY | INFORMATION | | |
| METHOD/APPARATUS/PROCEDURE: Hydrogen chloride was bubbled into the solvent for more than an hour. Approximately 1 cm ³ of the solution was transferred to a weighed sample tube and the whole re-weighed. The contents were transferred to water, and the chloride content determined by the Volhard method. | SOURCE AND PURITY OF MATERIALS: (1) Hydrogen chloride. Self prepared by the method of Sloan (1). (2) 1-Chlorohexadecane. Prepared from 1-hexadecanol and hydrogen chloride in the presence of zinc chloride at 393-453 K. ESTIMATED ERROR: $\delta T/K = 0.2$ $\delta x_1/x_1 = 0.05$ REFERENCES: 1. Sloan, A. D. B. <i>Chem. Ind.</i> <u>1964</u> , 574. | | |
| | | | |

| COMPONENTS : | | | ORI | SINAL MEASURE | ENTS: | |
|---|--|--|----------------------------|---------------------------------------|-------------------------|--------------|
| (1) | | | | | | |
| <pre>(1) Hydrogen chloride; HCl; [7647-01-0]</pre> | | S | cher, M.; G Jelinek, R | ill, W. N.; . V. | | |
| (2) 1-Chlorohexadecane; C ₁₆ H ₃₃ Cl; [4860-03-1] | | | nd. Eng. Ch , 107 - 112 | em., Fundam | <i>n.</i> <u>1963</u> , | |
| VARIABLES : | | | PRE | PARED BY: | | |
| | <pre>/K: 313.15 /a: 50.66 - 98.66</pre> | | W. Gerrard | | | |
| EXPERIMENTAL VAL | UES: | | | | <u></u> | |
| T/K | Henry's Constants | <u></u> | | Number | Percent | Mol Fraction |
| | K'/mmHg dm ³ mol ⁻¹ | K/mm | | of Points | Mean Deviation | <i>x</i> 1 |
| 313.15 | 6460 | 20,9 | 80 | 4 | ±0.6 | 0.0362 |
| Henry's d | constants: | | | | | |
| K'/mmHg d | $lm^3 mol^{-1} = (p_1/mmHg)$ | g)/(c] | /mo | 1 dm ⁻³) | | |
| | $(p_1/mmHg)/x_1$ | | | | | |
| The compiler calculated the mole fraction solubility value at 101.325 kPa (760 mmHg). | | | | | | |
| [| AUX | ILIARY | INFO | RMATION | | |
| METHOD/APPARATUS | /PROCEDURE: | | sou | RCE AND PURIT | Y OF MATERIAL | S: |
| The solubility was measured in an apparatus designed to determine the kinetic rate of catalyzed hydro- chlorination of hexadecene in the presence of ferric chloride. The volume of gas absorbed by the pure liquid at increasing pressures, 380 - 740 mmHg, was measured. The individual solubility values are presented in a graph. The Henry's constants were tabulated. | | (1) Hydrogen chloride. Matheson Co. Sublimed at high vacuum and liquid air temperature, and distilled into storage and supply system. (2) 1-Chlorohexadecane. Not stated. | | | | |
| The paper re | ferences a value of | | EST | IMATED ERROR: | | |
| Henry's cons | tant in 2-chlorohexa hich was not availal | a- | | | | |
| 1 | | | REF | ERENCES: | | |
| | | | 1. | Domash, L Ph. D. the Purdue Un: | esis, 1952 | |
| | | | 1 | | | |

| COMPONENTS: (1) Hydrogen chloride; HCl; [7647-01-0] | ORIGINAL MEASUREMENTS: Bell, R. P. | | |
|--|---|--|--|
| (2) Bromine substituted alkanes | J. Chem. Soc. <u>1931</u> , 1371 - 1382. | | |
| | | | |
| | | | |
| VARIABLES: T/K: 293.15 | PREPARED BY: | | |
| P/kPa: 101.325 (1 atm) | W. Gerrard | | |
| EXPERIMENTAL VALUES: | | | |
| T/K Partition Coefficien C1,1/C1,5 | | | |
| Bromoethane; C ₂ H | H ₅ Br; [74-96-4] | | |
| 293.15 35.15 | 0.1019 | | |
| 1,2-Dibromoethar [106-93-4] | ne; C ₂ H ₄ Br ₂ ; | | |
| 293.15 10.3 | 0.0348 | | |
| Tribromomethane | ; CHBr ₃ ; [75-25-2] | | |
| 293.15 4.78 | 0.0306 | | |
| 1,1,2,2-Tetrabro [79-27-6] | omoethane; C ₂ H ₂ Br ₄ ; | | |
| 293.15 3.93 | 0.0236 | | |
| The ideal gas concer | ntration is | | |
| $c_{1,g} = n/V = p/RT =$ | 0.0417 mol dm ⁻³ . | | |
| AUXILIARY | INFORMATION | | |
| METHOD/APPARATUS/PROCEDURE: | SOURCE AND PURITY OF MATERIALS: | | |
| The apparatus consisted of a 50 cm ³ bulb extended at the top as a graduated tube, and sealed at the bottom to a capillary U-tube. The liquid was saturated with gas at | Hydrogen chloride. Prepared by dropping pure concentrated hydrochloric acid into pure sulfuric acid. | | |
| atmospheric pressure. The gas was displaced from the saturated solu- tion by a current of dry CO ₂ free | (2) Bromine substituted alkanes. Good specimens were dried over calcium chloride, and distilled. Boiling points are given in | | |
| air, absorbed in water, and titrated with a solution of NaOH. | paper. | | |
| The solubility, $c/mol \ dm^{-3}$, was converted to a partition coefficient | ESTIMATED ERROR: | | |
| by dividing by the ideal gas con- centration of HCl in the gas phase. | $\delta T/K = 0.01$ $\delta c/c = 0.01$ | | |
| The mole fraction solubility was calculated on the assumption that | REERENANG | | |
| the density of the solution obeys the ideal mixture law. | REFERENCES : | | |
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| COMPONENTS : | ORIGINAL MEASUREMENTS: |
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| <pre>(1) Hydrogen chloride; HCl; [7647-01-0]</pre> | Hamai, S. |
| <pre>(2) 1,2-Dibromoethane; C₂H₄Br₂; [106-93-4]</pre> | Bull. Chem. Soc. Jpn. <u>1935</u> , 10, 5 - 16. |
| VARIABLES: | PREPARED BY: |
| T/K: 288.15 - 298.15 Total P/kPa: 37.20 - 95.86 (279.0 - 719.0 mmHg) | W. Gerrard |
| EXPERIMENTAL VALUES: T/K Total Pressure p/mmHg | Mol Fraction |
| 288.15 354.0 531.0 672.0 719.0 | 0.0180 0.0266 0.0325 0.0348 |
| (760.0 | 0.03754) 1 |
| 293.15 362.0 453.5 496.0 679.5 (760.0 | 0.0165 0.0207 0.0225 0.0309 0.03441) ¹ |
| 298.15 279.0 368.5 507.0 601.0 672.0 (760.0 | 0.0117 0.0153 0.0206 0.0242 0.0269 0.03116) ¹ |
| ¹ These values were calculated by the partial pressure of 760 mmHg (101.3 solvent vapor pressure was the same | e compiler for a hydrogen chloride 325 kPa). It was assumed that the 2 for the solution and pure solvent. |
| AUXILIARY | INFORMATION |
| METHOD/APPARATUS/PROCEDURE: The apparatus consisted of a U shaped gas buret, connected to a gas reser- voir (335 cm ³ capacity) which was connected to the absorption vessel. The volume of hydrogen chloride absorbed by 20 cm ³ of the original liquid was converted into the amount of gas absorbed at a measured total pressure. The author obtained the heat of absorption, ΔH , of -3200 cal mol ⁻¹ (-13.39 kJ mole ⁻¹) from the slope of a plot of log x_1 vs. 1/T. | SOURCE AND PURITY OF MATERIALS: (1) Hydrogen chloride. Prepared by dropping concentrated hydro- chloric acid into pure concen- trated sulfuric acid. The gas was passed through concentrated sulfuric acid and twice con- densed by liquid nitrogen. (2) 1,2-Dibromoethane. Takeda, twice distilled. B.p. 402 K. |
| | REFERENCES : |
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| Gerrard, W.; Mincer, A. M. A.; Wyvill, P. L. | | | | | | |
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| 9 - 93. | | | | | | |
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| H.L. Clever) | | | | | | |
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| (T/100) | | | | | | |
| -4 | | | | | | |
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| ^x HCl 0.0760 | | | | | | |
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| ood specimen | | | | | | |
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| nyarogen enerae i | in Non-Aqueous Solvents 217 |
|---|--|
| COMPONENTS : | ORIGINAL MEASUREMENTS: |
| <pre>(1) Hydrogen chloride; HCl; [7647-01-0]</pre> | Gerrard, W.; Mincer, A. M. A.; Wyvill, P. L. |
| (2) l-Bromohexane; C ₆ H ₁₃ Br; [111-25-1] | J. Appl. Chem. <u>1959</u> , 9, 89 - 93. |
| VARIABLES: | PREPARED BY: |
| T/K: 273.15 - 315.65 Total P/kPa: 101.325 (1 atm) | W. Gerrard (smoothed data calculated by H.L. Clever) |
| EXPERIMENTAL VALUES: | |
| T/K Mol Ratic ⁿ HCl/ ⁿ C ₆ H ₁₃ 273.15 0.0896 282.35 0.0709 293.15 0.0567 298.15 0.0508 304.15 0.0464 | |
| 315.65 0.0340 | 0.0329 |
| | regression line = 1.34 x 10 ⁻³ Mol Fraction ^x HCl |
| AUXILIA | RY INFORMATION |
| METHOD/APPARATUS/PROCEDURE: The solvent was weighed in a bubbler tube. The amount of gas absorbed was determined by reweighing to constant weight. The total pressure was barometric, very nearly 1 atm. | SOURCE AND PURITY OF MATERIALS: (1) Hydrogen chloride. Good specimen from a commercial cylinder was dried. (2) 1-Bromohexane. Carefully puri- fied, and purity rigorously attested. ESTIMATED ERROR: $\delta x/x = 0.015$ REFERENCES: |
| | |

| 270 Hydrogen Chloride in 1 | Non-Aquebus bolvents | | | | | |
|--|---|--|--|--|--|--|
| COMPONENTS: | ORIGINAL MEASUREMENTS: | | | | | |
| <pre>(1) Hydrogen chloride; HCl; [7647-01-0]</pre> | Gerrard, W.; Mincer, A. M. A.; Wyvill, P. L. | | | | | |
| (2) 1-Bromooctane; C ₈ H ₁₇ Br; [111-83-1] | J. Appl. Chem. <u>1959</u> , 9, 89 – 93. | | | | | |
| | | | | | | |
| VARIABLES: | PREPARED BY: | | | | | |
| T/K: 273.15 - 317.15 Total P/kPa: 101.325 (1 atm) | W. Gerrard (smoothed data calculated by H.L. Clever) | | | | | |
| EXPERIMENTAL VALUES: | | | | | | |
| | Nol Duochion | | | | | |
| T/K Mol Ratio ⁿ HCl/ ⁿ C ₈ H ₁₇ B | Mol Fraction r ^x HCl | | | | | |
| 273.15 0.0958 | 0.0874 | | | | | |
| 280.15 0.0820 | 0.0758 | | | | | |
| 289.15 0.0687 296.75 0.0601 | 0.0643 0.0567 | | | | | |
| 302.55 0.0540 | 0.0512 | | | | | |
| 310.45 0.0439 | 0.0421 | | | | | |
| 317.15 0.0371 | 0.0358 | | | | | |
| | | | | | | |
| The mole fraction values were calcula | ted by the compiler. | | | | | |
| | .914/(T/100) - 26.875 ln (T/100) | | | | | |
| Standard èrror about | regression line = 1.19×10^{-3} | | | | | |
| T/K M | 101 Fraction ^x HC1 | | | | | |
| | | | | | | |
| 273.15 | | | | | | |
| 283.15 | 0.0730 | | | | | |
| 293.15 303.15 | 0.0606 0.0494 | | | | | |
| 313.15 | 0.0396 | | | | | |
| 323.15 | 0.0314 | | | | | |
| | | | | | | |
| AUXILIARY | INFORMATION | | | | | |
| METHOD / APPARATUS / PROCEDURE : | SOURCE AND PURITY OF MATERIALS: | | | | | |
| The solvent was weighed in a bubbler | (1) Hydrogen chloride. Good specimen | | | | | |
| tube. The amount of gas absorbed was | | | | | | |
| determined by reweighing to constant weight. The total pressure was | dried. | | | | | |
| barometric, very nearly 1 atm. | (2) 1-Bromooctane. Carefully | | | | | |
| | purified, and purity | | | | | |
| | rigorously attested. | | | | | |
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| | ESTIMATED ERROR: | | | | | |
| | ESTIMATED ERROR: | | | | | |
| | $\delta x/x = 0.01$ | | | | | |
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| | REFERENCES : | | | | | |
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| nyalogen d | | Non-Aqueous Solvenis 2 | | | | |
|---|---|---|--|--|--|--|
| COMPONENTS: | · | ORIGINAL MEASUREMENTS: | | | | |
| <pre>1. Hydrogen chloride; HCl; [7647-01-0]</pre> | | Ahmed, W.; Gerrard, W.; Maladkar, V. K. | | | | |
| 2. 1-Bromooctane; C ₈ H ₁₇ Br; [111-83-1] | | J. Appl. Chem. <u>1970</u> , 20, 109 - 115. | | | | |
| VARIABLES: | | | | | | |
| T/K: $243.15 - 273.15$ | 5 | PREPARED BY: | | | | |
| Total P/kPa: 101.325 (1 atm) | | W. Gerrard (smoothed data calculated by H.L. Clever) | | | | |
| EXPERIMENTAL VALUES: | | | | | | |
| T/K | Mol Ra | tio Mol Fraction | | | | |
| | ⁿ HCl/ ⁿ C ₈ | H ₁₇ Br X _{HCl} | | | | |
| 243.15 | 0.36 | | | | | |
| 263.15 273.15 | 0.14 | | | | | |
| | | | | | | |
| The mole fraction solubilitie compiler. | es were ca | alculated from the mole ratio by the | | | | |
| Smoothed Data: $\ln X_{HC1} = -10$ | .764 + 22 | 2.939/(T/100) | | | | |
| | | regression line = 2.82×10^{-3} | | | | |
| | T/K 1 | 101 Fraction | | | | |
| | | X _{HCl} | | | | |
| | 243.15 | 0.265 | | | | |
| | 263.15 273.15 | 0.129 0.094 | | | | |
| | | | | | | |
| | | INFORMATION | | | | |
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| METHOD/APPARATUS/PROCEDURE: | | SOURCE AND PURITY OF MATERIALS: | | | | |
| Hydrogen chloride was passed known weight of liquid in a b tube at a total pressure meas a manometer assembly. The ab gas was weighed by re-weighin bubbler tube. The temperatur | ubbler ured by sorbed g the | Hydrogen chloride. Obtained fro a cylinder containing a good com mercial specimen. Was dried by passage through concentrated sulfuric acid. | | | | |
| manually controlled to within The procedure and apparatus a described by Gerrard (1,2). For the first temperature a c | 0.2 K. re | 2. 1-Bromooctane. Best obtainable specimen was suitably purified, dried, and fractionally dis- tilled, and attested. | | | | |
| titration was conducted. | | | | | | |
| | | ESTIMATED ERROR: | | | | |
| | | $\begin{array}{rcl} \delta \mathbf{T}/\mathbf{K} &= & 0.2 \\ \delta \mathbf{X}/\mathbf{X} &= & 0.01 \end{array}$ | | | | |
| | | | | | | |
| | | REFERENCES: 1. Gerrard, W. J. Appl. Chem. Biotechnol. <u>1972</u> , 22, 623 - 650. | | | | |
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| $\begin{array}{c} \label{eq:construction} \hline COMPORENTS: \\ 1. Hydrogen chloride; HCl; \\ [7647-01-0] \\ 2. 1-Iodooctane; C_{g}H_{17}I; [629-27-6] \\ \hline VARIABLES: \\ T/K: 213.15 - 293.15 \\ Total P/KPa: 101.325 (1 atm) \\ \hline VARIABLES: \\ T/K: 213.15 - 293.15 \\ Total P/KPa: 101.325 (1 atm) \\ \hline NCL^{n}C_{G}^{n}H_{17}I \\ \hline NCL^{n}C_{G}^{n}H_{G}^{n}H_{C}^{n}H_$ | | von-Aqueous Solvents | | | | |
|--|---|---|--|--|--|--|
| $ \begin{bmatrix} (7647-01-0] \\ 2. 1-Iodooctane; C_{g}H_{17}I; (629-27-6] \\ \hline Maladkar, V. K. \\ 2. 1-Iodooctane; C_{g}H_{17}I; (629-27-6] \\ \hline Maladkar, V. K. \\ J. Appl. Chem. 1970, 20, 109 - 115. \\ \hline J. $ | COMPONENTS: | ORIGINAL MEASUREMENTS: | | | | |
| VARIABLES: T/K: 213.15 - 293.15 Total P/KPa: 101.325 (1 atm) EXPERIMENTAL VALUES: T/K Mol. Ratio Mol Fraction MC1/ ⁿ C ₈ H ₁₇ T X _{HC1} 213.15 0.47 0.412 223.15 0.47 0.412 223.15 0.17 0.412 223.15 0.17 0.412 223.15 0.17 0.412 223.15 0.17 0.412 223.15 0.17 0.412 223.15 0.10 0.0909 293.15 0.10 0.0909 293.15 0.10 0.0909 293.15 0.10 0.0909 293.15 0.10 0.0909 293.15 0.28 T/K Mol Fraction Smoothed Data: ln X _{HC1} = 14.263 - 14.459/(T/100) - 11.088 ln (T/100) Standard error about regression line = 6.37 x 10 ⁻³ T/K Mol Fraction XHC1 213.15 0.125 0.327 233.15 0.266 243.15 0.215 233.15 0.174 203.15 0.113 203.15 0.104 203.15 0.104 203.15 0.174 203.15 0.113 203.15 0.113 203.15 0.0266 233.15 0.174 203.15 0.113 203.15 0.0261 203.15 0.0141 273.15 0.113 203.15 0.0261 203.15 0.0746 METHOD APPARATUS/PROCEDURE: Hydrogen chloride was passed into a ROWN weight of liquid in a bubbler tubbe at a total pressure measured by a manometer assembly. The baborbed gas was weighted by re-weighing the bubbler tube. The temperature was manually controlled to within 0.2 K. The procedure and apparatus are described by Gerrard (1.2). For temperatures below 268 K a chem- ical titration was performed. ESTIMATED ERROR: ESTIMATED ERROR: ESTIMATED ERROR: | | , , | | | | |
| T/K: 213.15 - 293.15 Total P/KPa: 101.325 (1 atm) EXPERIMENTAL VALUES: T/K Mol_Ratio NGC Praction NGC/ $^{0}C_{0}H_{17}T$ X _{HC1} 213.15 0.70 0.412 223.15 0.47 0.320 223.15 0.27 233.15 0.27 233.15 0.17 243.15 0.12 233.15 0.10 0.0909 233.15 0.08 0.0740 The mole fraction solubilities were calculated from the mole ratio by the compiler. Smoothed Data: ln X _{HC1} = 14.263 - 14.459/(T/100) - 11.088 ln (T/100) Standard error about regression line = 6.37 x 10 ⁻³ T/K: Mol Fraction $\frac{X_{HC1}}{213.15}$ 0.215 0.215 0.215 0.215 0.215 0.215 0.215 0.215 0.215 0.215 0.215 0.215 0.215 0.215 0.215 0.215 0.231.15 0.104 223.15 0.0821 233.15 0.026 233.15 0.026 233.15 0.174 233.15 0.104 233.15 0.104 233.15 0.104 233.15 0.026 233.15 0.174 234.15 0.174 235.15 0.174 235.15 | 2. 1-Iodooctane; C ₈ H ₁₇ I; [629-27-6] | J. Appl. Chem. <u>1970</u> , 20, 109 - 115. | | | | |
| T/K: 213.15 - 293.15 Total P/KPa: 101.325 (1 atm) EXPERIMENTAL VALUES: T/K Mol Ratio NG Fraction NCL/ ^A C ₂ H ₁ /T X _{HC1} 213.15 0.47 0.320 233.15 0.47 0.320 233.15 0.27 0.213 253.15 0.17 0.145 273.15 0.13 0.115 283.15 0.10 0.0909 293.15 0.08 0.0740 The mole fraction solubilities were calculated from the mole ratio by the compiler. Smoothed Data: $\ln X_{HC1} = 14.263 - 14.459/(T/100) - 11.088 \ln (T/100)$ Standard error about regression line = 6.37 x 10 ⁻³ T/K: Mol Fraction $\frac{X_{HC1}}{233.15}$ 0.215 233.15 0.266 243.15 0.215 233.15 0.266 243.15 0.215 233.15 0.104 $\frac{X_{HC1}}{233.15}$ 0.141 233.15 0.266 243.15 0.215 233.15 0.164 233.15 0.266 243.15 0.215 253.15 0.174 233.15 0.164 233.15 0.164 233.15 0.164 233.15 0.164 233.15 0.174 233.15 0.164 233.15 0.174 233.15 0.174 233.15 0.174 233.15 0.174 233.15 0.164 233.15 0.174 233.15 0.1 | 0 17 | | | | | |
| T/K: 213.15 - 293.15 Total P/KPa: 101.325 (1 atm) EXPERIMENTAL VALUES: T/K Mol Ratio NG Fraction NCL/ $^{P}C_{0}H_{17}T$ X _{HC1} 213.15 0.47 0.320 233.15 0.47 0.320 233.15 0.27 0.213 253.15 0.17 0.145 273.15 0.10 0.0909 293.15 0.08 0.0740 The mole fraction solubilities were calculated from the mole ratio by the compiler. Smoothed Data: ln X _{HC1} = 14.263 - 14.459/(T/100) - 11.088 ln (T/100) Standard error about regression line = 6.37 x 10 ⁻³ T/K. Mol Fraction $\frac{X_{HC1}}{233.15}$ 0.215 $\frac{1}{233.15}$ 0.266 243.15 0.215 $\frac{1}{233.15}$ 0.266 243.15 0.215 $\frac{1}{233.15}$ 0.174 $\frac{1}{233.15}$ 0.266 243.15 0.266 243.15 0.215 $\frac{1}{233.15}$ 0.141 $\frac{1}{233.15}$ 0.164 $\frac{1}{233.15}$ 0.164 $\frac{1}{233.15}$ 0.174 $\frac{1}{233.15}$ 0.164 $\frac{1}{233.15}$ 0.176 $\frac{1}{233.15}$ 0.215 $\frac{1}{233.15}$ 0.164 $\frac{1}{233.15}$ 0.174 $\frac{1}{233.15}$ 0.125 $\frac{1}{233.15}$ 0.126 $\frac{1}{233.15}$ 0.127 $\frac{1}{233.15}$ 0.126 $\frac{1}{233.15}$ 0.127 $\frac{1}{233.15}$ 0.126 $\frac{1}{233.15}$ 0.126 $\frac{1}{2$ | | | | | | |
| Total P/kPa: 101.325 (1 atm) W. GETRIG (smoothed data calculated by H.L. Clever) EXPERIMENTAL VALUES: T/K Mol Ratio Mol Fraction HCL/PCgH ₁ T X _{HCl} 223.15 0.47 0.320 233.15 0.215 0.177 263.15 0.17 0.145 273.15 0.10 0.0909 293.15 0.008 0.07740 The mole fraction solubilities were calculated from the mole ratio by the compiler. Smoothed Data: ln X _{HCl} = 14.263 - 14.459/(T/100) - 11.088 ln (T/100) Standard error about regression line = 6.37 x 10 ⁻³ T/K. Mol Fraction X _{HCl} 213.15 0.266 243.15 0.215 0.401 223.15 0.266 243.15 0.215 233.15 0.266 243.15 0.215 233.15 0.00821 233.15 0.0821 233.15 0.00821 233.15 0.00821 233.15 0.0141 273.15 0.0141 273.15 0.0141 273.15 0.0141 273.15 0.0141 273.15 0.0141 273.15 0.0141 273.15 0.0141 273.15 0.0174 203.15 0.0126 203.15 0.0174 203.15 0.01821 203.15 0.0141 273.15 0.0141 273.15 0.0141 273.15 0.0174 203.15 0.01821 203.15 0.0141 273.15 0.0141 273.15 0.0141 273.15 0.0141 273.15 0.113 203.15 0.0141 273.15 0.113 203.15 0.0141 273.15 0.114 273.15 0.113 203.15 0.0121 203.15 0.0141 273.15 0.113 203.15 0.0121 203.15 0.0141 273.15 0.113 203.15 0.0121 203.15 0.0121 203.15 0.0141 273.15 0.113 203.15 0.0121 203.15 0.0121 203.15 0.0121 203.15 0.0121 203.15 0.0121 203.15 0.0121 203.15 0.0121 203.15 0.0121 203.15 0.0131 203.15 | VARIABLES: | PREPARED BY: | | | | |
| $\begin{tabular}{ c c c c c c c c c c c c c c c c c c c$ | | W. Gerrard | | | | |
| $\begin{tabular}{ c c c c c c c c c c c c c c c c c c c$ | Total P/RPa: 101.325 (1 atm) | (smoothed data calculated by H.L. Clever) | | | | |
| $\begin{tabular}{ c c c c c c c c c c c c c c c c c c c$ | EXPEDIMENTAL VALUES. | | | | | |
| 213.15 0.70 0.412 223.15 0.35 0.259 233.15 0.215 0.177 263.15 0.215 0.177 263.15 0.13 0.115 273.15 0.13 0.115 273.15 0.13 0.115 273.15 0.10 0.0909 293.15 0.08 0.0740 The mole fraction solubilities were calculated from the mole ratio by the compiler. Smoothed Data: In $x_{HC1} = 14.263 - 14.459/(T/100) - 11.088 ln (T/100) Standard error about regression line = 6.37 x 10-3 T/K: Mol Fraction XHC1 213.15 0.215 223.15 0.215 233.15 0.216 233.15 0.217 233.15 0.216 233.15 0.174 263.15 0.141 273.15 0.113 203.15 0.0216 203.15 0.0113 203.15 0.0216 203.15 0.0216 203.15 0.0216 $ | | tio Mol Fraction | | | | |
| $\begin{array}{c} 223.15 & 0.47 & 0.320 \\ 233.15 & 0.35 & 0.259 \\ 243.15 & 0.21 & 0.213 \\ 253.15 & 0.21 & 0.177 \\ 263.15 & 0.13 & 0.145 \\ 273.15 & 0.10 & 0.0909 \\ 293.15 & 0.08 & 0.0740 \end{array}$ The mole fraction solubilities were calculated from the mole ratio by the compiler. Smoothed Data: ln X _{HC1} = 14.263 - 14.459/(T/100) - 11.088 ln (T/100) Standard error about regression line = 6.37 x 10 ⁻³ $\begin{array}{rrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrr$ | | | | | | |
| $\begin{array}{c} 233.15 & 0.35 & 0.259 \\ 243.15 & 0.215 & 0.177 \\ 263.15 & 0.17 & 0.145 \\ 273.15 & 0.10 & 0.0909 \\ 293.15 & 0.08 & 0.0740 \end{array}$ The mole fraction solubilities were calculated from the mole ratio by the compiler. Smoothed Data: $\ln \chi_{HC1} = 14.263 - 14.459/(T/100) - 11.088 \ln (T/100) \\ \text{Standard error about regression line = 6.37 x 10^{-3} \\ \hline T/K & MOI Fraction \\ \chi_{HC1} \\ 213.15 & 0.327 \\ 233.15 & 0.266 \\ 243.15 & 0.215 \\ 253.15 & 0.174 \\ 265.15 & 0.141 \\ 273.15 & 0.141 \\ 273.15 & 0.0821 \\ 293.15 & 0.0746 \\ \hline \end{array}$ METHOD 'APPARATUS/FROCEDURE: In Hydrogen chloride was passed into a known weight of liquid in a bubbler tube at a total pressure measured by a manometer assembly. The absorbed gas was weighed by re-weighing the bubbler tube. The temperature was manually controlled to within 0.2 K. The procedure and apparatus are described by Gerrard (1,2). For temperatures below 268 K a chemical titration was performed. \\ \hline ESTIMATED ERROR: \\ \hline \end{array} | | | | | | |
| $\begin{array}{c} 243.15 & 0.27 & 0.213\\ 253.15 & 0.17\\ 263.15 & 0.17\\ 263.15 & 0.13 & 0.115\\ 273.15 & 0.13 & 0.115\\ 283.15 & 0.08 & 0.0740\\ \hline \end{array}$ The mole fraction solubilities were calculated from the mole ratio by the compiler. Smoothed Data: $\ln X_{HC1} = 14.263 - 14.459/(T/100) - 11.088 \ln (T/100)$ Standard error about regression line = 6.37 x 10 ⁻³ $\begin{array}{r} T/K \text{Mol Fraction} \\ \hline $ | 1 | | | | | |
| $\begin{array}{c} 263.15 & 0.17 & 0.145 \\ 273.15 & 0.13 & 0.115 \\ 283.15 & 0.08 & 0.0740 \end{array}$ The mole fraction solubilities were calculated from the mole ratio by the compiler. Smoothed Data: $\ln X_{HC1} = 14.263 - 14.459/(T/100) - 11.088 \ln (T/100) \\ Standard error about regression line = 6.37 x 10^{-3} \\ \hline T/K. Mol Fraction \\ \hline X_{HC1} \\ \hline 213.15 & 0.327 \\ 233.15 & 0.215 \\ 253.15 & 0.124 \\ 263.15 & 0.141 \\ 273.15 & 0.113 \\ 203.15 & 0.0821 \\ 293.15 & 0.0821 \\ 293.15 & 0.0746 \\ \hline \end{array}$ METNOD/APPARATUS/PROCEDURE: Hydrogen chloride was passed into a known weight of liquid in a bubbler tube at total pressure measured by a manometer assembly. The absorbed gas was weighed by re-weighing the bubbler tube. The temperature was manually controlled to within 0.2 K. The procedure and apparatus are described by Gerrard (1,2). For temperatures below 268 K a chemical titration was performed. | | | | | | |
| $\begin{array}{c} 273.15 & 0.13 & 0.115 \\ 283.15 & 0.10 & 0.0909 \\ 293.15 & 0.08 & 0.0740 \\ \hline \\ $ | | | | | | |
| $\begin{array}{c} 283.15 & 0.10 & 0.0909 \\ \underline{293.15} & 0.08 & 0.0740 \\ \hline \\ $ | | | | | | |
| $\frac{293.15}{293.15} 0.08 0.0740$ The mole fraction solubilities were calculated from the mole ratio by the compiler. Smoothed Data: ln X _{HCl} = 14.263 - 14.459/(T/100) - 11.088 ln (T/100) Standard error about regression line = 6.37 x 10 ⁻³ T/K. Mol Fraction X _{HCl} 213.15 0.215 223.15 0.215 233.15 0.216 243.15 0.215 253.15 0.174 263.15 0.113 203.15 0.0821 293.15 0.0746 AUXILIARY INFORMATION METHOD 'APPARATUS/PROCEDURE: Hydrogen chloride was passed into a known weight of liquid in a bubler tube at a total pressure measured by a manometer assembly. The absorbed gas was weighed by re-weighing the bubbler tube. The temperature was manually controlled to within 0.2 K. The procedure and apparatus are described by Gerrard (1,2). For temperatures below 268 K a chem- ical titration was performed. SURCE AND PURITY OF MATERIALS: ESTIMATED ERROR: $\delta T/K = 0.2$ | | | | | | |
| compiler. Smoothed Data: ln X _{HCl} = 14.263 - 14.459/(T/100) - 11.088 ln (T/100) Standard error about regression line = 6.37 x 10 ⁻³ T/K. Mol Fraction X _{HCl} 213.15 0.401 223.15 0.226 243.15 0.215 253.15 0.174 263.15 0.113 203.15 0.0021 293.15 0.0746 AUXILIARY INFORMATION METHOD 'APPARATUS/PROCEDURE: Hydrogen chloride was passed into a Known weight of liquid in a bubbler tube at a total pressure measured by a manometer assembly. The absorbed gas was weighed by re-weighing the bubbler tube. The temperature was manually controlled to within 0.2 K. The procedure and apparatus are described by Gerrard (1,2). For temperatures below 268 K a chem- ical titration was performed. ESTIMATED ERROR: (AUXILIARY INFORMATION ENDINE) | | | | | | |
| Smoothed Data: ln X _{HCl} = 14.263 - 14.459/(T/100) - 11.088 ln (T/100) Standard error about regression line = 6.37 x 10 ⁻³ T/K. Mol Fraction XHCl 213.15 0.401 223.15 0.266 243.15 0.215 253.15 0.174 263.15 0.141 273.15 0.141 273.15 0.141 273.15 0.141 273.15 0.141 273.15 0.141 273.15 0.141 273.15 0.141 273.15 0.0746 METHOD /APPARATUS/PROCEDURE: Hydrogen chloride was passed into a known weight of liquid in a bubbler tube at a total pressure measured by a manometer assembly. The absorbed gas was weighed by re-weighing the bubbler tube. The temperature was manually controlled to within 0.2 K. The procedure and apparatus are described by Gerrard (1,2). For temperatures below 268 K a chem- ical titration was performed. ESTIMATED ERROR: $\delta T/K = 0.2$ | | alculated from the mole ratio by the | | | | |
| Standard error about regression line = 6.37 x 10 ⁻³ T/K. Mol Fraction XHCl 213.15 213.15 213.15 213.15 23.15 23.15 23.15 23.15 23.15 23.15 AUXILIARY INFORMATION METHOD /APPARATUS/PROCEDURE: Hydrogen chloride was passed into a known weight of liquid in a bubbler tube at a total pressure measured by a manually controlled to within 0.2 K. The procedure and apparatus are described by Gerrard (1,2). For temperatures below 268 K a chemical titration was performed. ESTIMATED ERROR: (ST/K = 0.2 | - | 459/(T/100) = 11.088 ln (T/100) | | | | |
| T/K. Mol Fraction X_{HCl} 213.150.401223.150.327233.150.266243.150.215253.150.174263.150.113203.150.0821293.150.0746Source Easymptic Anton weight of liquid in a bubblerHydrogen chloride was passed into a known weight of liquid in a bubblerSource Easymptic Anton weight of liquid in a bubblerBOURCE AND PURITY OF MATERIALS:1. Hydrogen chloride. Obtained from a cylinder containing a good com- mercial specimen. Was dried by passage through concentrated sulfuric acid.Source Easymptic Anton weight of liquid in a bubbler tube at a total pressure measured by a manometer assembly. The absorbed gas was weighed by re-weighing the bubbler tube. The temperature was manually controlled to within 0.2 K. The procedure and apparatus are described by Gerrard (1,2).Source AND PURITY OF MATERIALS: 1. Hydrogen chloride. Obtained from a cylinder containing a good com- mercial specimen was suitably purified, dried, and fractionally dis- tilled, and attested.ESTIMATED ERROR: $\delta T/K = 0.2$ | | | | | | |
| XHC1 213.15 0.401 223.15 0.327 233.15 0.266 243.15 0.215 253.15 0.174 263.15 0.141 273.15 0.113 283.15 0.0821 293.15 0.0746 SOURCE AND PURITY OF MATERIALS: Hydrogen chloride was passed into a known weight of liquid in a bubbler 1. Hydrogen chloride. Obtained from a acylinder containing a good commercial specimen. Was dried by gas was weighed by re-weighing the sulfuric acid. bubbler tube. The temperature was sulfuric acid. 213.15 0.12K. The procedure and apparatus are described by Gerrard (1,2). For temperatures below 268 K a chemical titration was performed. ESTIMATED ERROR: ESTIMATED ERROR: | · | | | | | |
| 213.150.401223.150.327233.150.266243.150.215253.150.174263.150.141273.150.113283.150.0821293.150.0746AUXILIARY INFORMATIONMETHOD /APPARATUS/PROCEDURE:Hydrogen chloride was passed into a known weight of liquid in a bubbler tube at a total pressure measured by a manometer assembly. The absorbed gas was weighed by re-weighing the bubbler tube. The temperature was manually controlled to within 0.2 K. The procedure and apparatus are described by Gerrard (1,2).Source AND PURITY OF MATERIALS: 1. Hydrogen chloride. Obtained from a cylinder containing a good com- mercial specimen. Was dried by passage through concentrated sulfuric acid.2. 1-Iodooctane. Best obtainable specimen was suitably purified, dried, and fractionally dis- tilled, and attested.ESTIMATED ERROR: ST/K = 0.2 | | | | | | |
| 223.150.327233.150.266243.150.215253.150.174263.150.141273.150.113203.150.0746AUXILIARY INFORMATIONMETHOD /APPARATUS/PROCEDURE:Hydrogen chloride was passed into a known weight of liquid in a bubbler tube at a total pressure measured by a manometer assembly. The absorbed gas was weighed by re-weighing the bubbler tube. The temperature was manually controlled to within 0.2 K. The procedure and apparatus are described by Gerrard (1,2).SOURCE AND PURITY OF MATERIALS: 1. Hydrogen chloride. Obtained from a cylinder containing a good com- mercial specimen. Was dried by passage through concentrated sulfuric acid.2. 1-Iodoctane. Best obtainable specimen was suitably purified, dried, and fractionally dis- tilled, and attested.For temperatures below 268 K a chem- ical titration was performed.ESTIMATED ERROR: $\delta T/K = 0.2$ | <u> 313-15</u> | | | | | |
| 233.150.266243.150.215253.150.174263.150.141273.150.113203.150.0821293.150.0746AUXILIARY INFORMATIONMETHOD /APPARATUS/PROCEDURE:Hydrogen chloride was passed into a known weight of liquid in a bubbler tube at a total pressure measured by a manometer assembly. The absorbed gas was weighed by re-weighing the bubbler tube. The temperature was manually controlled to within 0.2 K. The procedure and apparatus are described by Gerrard (1,2).SOURCE AND PURITY OF MATERIALS: 1. Hydrogen chloride. Obtained from a cylinder containing a good com- mercial specimen. Was dried by passage through concentrated sulfuric acid.2. 1-Iodooctane. Best obtainable specimen was suitably purified, dried, and fractionally dis- tilled, and attested.ESTIMATED ERROR: bubbler | | | | | | |
| 243.150.215253.150.174263.150.111273.150.113203.150.0821293.150.0746AUXILIARY INFORMATIONMETHOD /APPARATUS/PROCEDURE:Hydrogen chloride was passed into a known weight of liquid in a bubbler tube at a total pressure measured by a manometer assembly. The absorbed gas was weighed by re-weighing the bubbler tube. The temperature was manually controlled to within 0.2 K. The procedure and apparatus are described by Gerrard (1,2).SOURCE AND PURITY OF MATERIALS: 1. Hydrogen chloride. Obtained from mcrcial specimen. Was dried by passage through concentrated sulfuric acid.2. 1-Iodooctane. Best obtainable specimen was suitably purified, dried, and fractionally dis- tilled, and attested.ESTIMATED ERROR: 0.7/K = 0.2 | | | | | | |
| 263.150.141273.150.113203.150.0821293.150.0746293.150.0746AUXILIARY INFORMATIONMETHOD /APPARATUS/PROCEDURE:Hydrogen chloride was passed into a known weight of liquid in a bubbler tube at a total pressure measured by a manometer assembly. The absorbed gas was weighed by re-weighing the bubbler tube. The temperature was manually controlled to within 0.2 K. The procedure and apparatus are described by Gerrard (1,2).SOURCE AND PURITY OF MATERIALS: 1. Hydrogen chloride. Obtained from a cylinder containing a good com- mercial specimen. Was dried by passage through concentrated sulfuric acid.2. 1-Iodooctane. Best obtainable specimen was suitably purified, dried, and fractionally dis- tilled, and attested.For temperatures below 268 K a chem- ical titration was performed.ESTIMATED ERROR: $\delta T/K = 0.2$ | - | 0.215 | | | | |
| 273.150.113283.150.0821293.150.0746AUXILIARY INFORMATIONMETHOD /APPARATUS/PROCEDURE:Hydrogen chloride was passed into a known weight of liquid in a bubbler tube at a total pressure measured by a manometer assembly. The absorbed gas was weighed by re-weighing the bubbler tube. The temperature was manually controlled to within 0.2 K. The procedure and apparatus are described by Gerrard (1,2).SOURCE AND PURITY OF MATERIALS: 1. Hydrogen chloride. Obtained from a cylinder containing a good com- mercial specimen. Was dried by passage through concentrated sulfuric acid.2. 1-Iodooctane. Best obtainable specimen was suitably purified, dried, and fractionally dis- tilled, and attested.For temperatures below 268 K a chem- ical titration was performed.ESTIMATED ERROR: 0T/K = 0.2 | | | | | | |
| 283.150.0821293.150.0746AUXILIARY INFORMATIONMETHOD/APPARATUS/PROCEDURE:Hydrogen chloride was passed into a known weight of liquid in a bubbler tube at a total pressure measured by a manometer assembly. The absorbed gas was weighed by re-weighing the bubbler tube. The temperature was manually controlled to within 0.2 K. The procedure and apparatus are described by Gerrard (1,2).SOURCE AND PURITY OF MATERIALS: 1. Hydrogen chloride. Obtained from a cylinder containing a good com- mercial specimen. Was dried by passage through concentrated sulfuric acid.2. 1-Iodooctane. Best obtainable specimen was suitably purified, dried, and fractionally dis- tilled, and attested.ESTIMATED ERROR: br/K = 0.2 | | | | | | |
| 293.150.0746AUXILIARY INFORMATIONMETHOD /APPARATUS/PROCEDURE:Hydrogen chloride was passed into a known weight of liquid in a bubbler tube at a total pressure measured by a manometer assembly. The absorbed gas was weighed by re-weighing the bubbler tube. The temperature was manually controlled to within 0.2 K. The procedure and apparatus are described by Gerrard (1,2).SOURCE AND PURITY OF MATERIALS: 1. Hydrogen chloride. Obtained from a cylinder containing a good com- mercial specimen. Was dried by passage through concentrated sulfuric acid.2. 1-Todooctane. Best obtainable specimen was suitably purified, dried, and fractionally dis- tilled, and attested.For temperatures below 268 K a chem- ical titration was performed.ESTIMATED ERROR: $\delta T/K = 0.2$ | | | | | | |
| METHOD /APPARATUS/PROCEDURE: Hydrogen chloride was passed into a known weight of liquid in a bubbler tube at a total pressure measured by a manometer assembly. The absorbed gas was weighed by re-weighing the bubbler tube. The temperature was manually controlled to within 0.2 K. The procedure and apparatus are described by Gerrard (1,2). For temperatures below 268 K a chem- ical titration was performed. SOURCE AND PURITY OF MATERIALS: 1. Hydrogen chloride. Obtained from a cylinder containing a good com- mercial specimen. Was dried by passage through concentrated sulfuric acid. 2. 1-Iodooctane. Best obtainable specimen was suitably purified, dried, and fractionally dis- tilled, and attested. ESTIMATED ERROR: | 293.15 | 0.0746 | | | | |
| Hydrogen chloride was passed into a known weight of liquid in a bubbler tube at a total pressure measured by a manometer assembly. The absorbed gas was weighed by re-weighing the bubbler tube. The temperature was manually controlled to within 0.2 K. The procedure and apparatus are described by Gerrard (1,2). For temperatures below 268 K a chemical titration was performed. ESTIMATED ERROR: 6T/K = 0.2 | AUXILIARY | INFORMATION | | | | |
| Hydrogen chloride was passed into a known weight of liquid in a bubbler tube at a total pressure measured by a manometer assembly. The absorbed gas was weighed by re-weighing the bubbler tube. The temperature was manually controlled to within 0.2 K. The procedure and apparatus are described by Gerrard (1,2). For temperatures below 268 K a chemical titration was performed. ESTIMATED ERROR: 6T/K = 0.2 | METHOD /APPARATUS / PROCEDURE - | SOURCE AND PURTTY OF MATERIALS. | | | | |
| known weight of liquid in a bubbler tube at a total pressure measured by a manometer assembly. The absorbed gas was weighed by re-weighing the bubbler tube. The temperature was manually controlled to within 0.2 K. The procedure and apparatus are described by Gerrard (1,2). For temperatures below 268 K a chem- ical titration was performed. a cylinder containing a good com- mercial specimen. Was dried by passage through concentrated sulfuric acid. 2. 1-Iodooctane. Best obtainable specimen was suitably purified, dried, and fractionally dis- tilled, and attested. ESTIMATED ERROR: δT/K = 0.2 | | | | | | |
| <pre>tube at a total pressure measured by a manometer assembly. The absorbed gas was weighed by re-weighing the bubbler tube. The temperature was manually controlled to within 0.2 K. The procedure and apparatus are described by Gerrard (1,2). For temperatures below 268 K a chem- ical titration was performed.</pre> mercial specimen. Was dried by passage through concentrated sulfuric acid. 2. 1-Iodooctane. Best obtainable specimen was suitably purified, dried, and fractionally dis- tilled, and attested. ESTIMATED ERROR: | | a cylinder containing a good com- | | | | |
| <pre>gas was weighed by re-weighing the bubbler tube. The temperature was manually controlled to within 0.2 K. The procedure and apparatus are described by Gerrard (1,2). For temperatures below 268 K a chem- ical titration was performed.</pre> Sulfuric acid. 2. 1-Iodooctane. Best obtainable specimen was suitably purified, dried, and fractionally dis- tilled, and attested. ESTIMATED ERROR: δT/K = 0.2 | tube at a total pressure measured by | mercial specimen. Was dried by | | | | |
| <pre>bubbler tube. The temperature was manually controlled to within 0.2 K. The procedure and apparatus are described by Gerrard (1,2). For temperatures below 268 K a chem- ical titration was performed.</pre> 2. 1-Iodooctane. Best obtainable specimen was suitably purified, dried, and fractionally dis- tilled, and attested. ESTIMATED ERROR: | | | | | | |
| <pre>manually controlled to within 0.2 K. The procedure and apparatus are described by Gerrard (1,2). For temperatures below 268 K a chem- ical titration was performed.</pre> 2. 1-Iodobctane. Best obtainable specimen was suitably purified, dried, and fractionally dis- tilled, and attested. ESTIMATED ERROR: | | | | | | |
| The procedure and apparatus are described by Gerrard (1,2). For temperatures below 268 K a chem- ical titration was performed. ESTIMATED ERROR: $\delta T/K = 0.2$ | | | | | | |
| tilled, and attested. For temperatures below 268 K a chem- ical titration was performed. ESTIMATED ERROR: $\delta T/K = 0.2$ | | | | | | |
| For temperatures below 268 K a chem- ical titration was performed. ESTIMATED ERROR: $\delta T/K = 0.2$ | described by Gerrard (1,2). | | | | | |
| ESTIMATED ERROR: $\delta T/K = 0.2$ | | | | | | |
| $\delta T/K = 0.2$ | ical titration was performed. | | | | | |
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| | | 0.025 | | | | |
| | | REPERTING. | | | | |
| REFERENCES : | | | | | | |
| 1. Gerrard, W. J. Appl. Chem. Biotechnol. <u>1972</u> , 22, 623 - 650. | | J. Appl. Chem. Biotechnol. <u>1972</u> , | | | | |
| 2. Gerrard, W. | | | | | | |
| "Solubility of Gases and Liquids" | | "Solubility of Gases and Liquids" | | | | |
| | | Plenum Press, New York, 1976 | | | | |

| ORIGINAL MEASUREMENTS: | | | | | |
|---|--|--|--|--|--|
| Hannaert, H.; Haccuria, M.; Mathieu, M. P. | | | | | |
| Ind. Chim. Belge. <u>1967</u> , 32, 156 - 164. | | | | | |
| PREPARED BY: W. Gerrard | | | | | |
| | | | | | |
| Enthalpy of Constant /atm ¹ Solution t A .15 K $\Delta H/kcal mol^{-1}$ | | | | | |
| 42) 4.26 4.80 | | | | | |
| (2.3R(T/K)) lent to a Henry's constant in the f_1 is the fugacity. $x_1 = \frac{\text{mole fraction HCl in the gas}}{\text{mole fraction HCl in the liquid}}$ = total pressure, = coefficient of fugacity. | | | | | |
| INFORMATION | | | | | |
| SOURCE AND PURITY OF MATERIALS: | | | | | |
| (1) Hydrogen chloride. BASF. Purity stated to be greater than 99.9 %. | | | | | |
| (2) Chloroethene. BASF. Degassed by repeated fusions in a vacuum. Purity greater than 99.9 %. Several values of both vapor pressure and density are given in the paper. | | | | | |
| ESTIMATED ERROR: | | | | | |
| REFERENCES : | | | | | |
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281

| 262 Hydrogen Chloride In 1 | Non-Aqueous Solvents |
|--|---|
| COMPONENTS: (1) Hydrogen chloride; HCl; [7647-01-0] | ORIGINAL MEASUREMENTS: Danov, S. M.; Golubev, Yu. D. |
| <pre>(2) Chloroethene or vinyl chloride; C₂H₃Cl; [75-01-4]</pre> | Khim. Prom_st. (Moscow) <u>1968</u> , 44 (2), 116 - 120. |
| | |
| VARIABLES: | PREPARED BY: |
| T/K = 204.55 - 242.65 $p_1/kPa = (100 - 1000 \text{ mmHg})$ | W. Gerrard |
| EXPERIMENTAL VALUES: | |
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| AUXILIARY | INFORMATION |
| METHOD/APPARATUS/PROCEDURE: | SOURCE AND PURITY OF MATERIALS: |
| Solubilities were stated to be | (1) Hydrogen chloride. Probably of |
| measured by a static method. The pressures were stated to have been | satisfactory purity. |
| measured to an accuracy of 1 mmHg | (2) Chloroethene. Purity of vinyl |
| on a mercury column. | chloride was checked by chromato- |
| Note that in the authors' table the | graphy; stated to be not less than 99.999%. |
| pressures were given in steps of 100 | Chail 33.3338. |
| mmHg. This appears to indicate a | |
| smoothing of primary data. | 1 |
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| | ESTIMATED ERROR: |
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| 1 | REFERENCES : |
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|---|------------------------------------|--|---|-----------------------------|---|-----------------------------|---|-----------------------------|---|----------------------------|--|--|--|--|--|---|--|--|----------------|----------------------------------|
| T/K | 2 | 04.55 | 2(| 09.65 | 2] | 15.15 | 22 | 20.65 | 22 | 26.15 | 2 | 31.15 | 2 | 36.65 | 2 | 42.65 | (2) | (1) | COMP | |
| p/mmHg | <i>S</i> ¹ | x ₁ ¹ | S1 | x ₁ ² | <i>S</i> ¹ | x ₁ ² | <i>S</i> ¹ | x ₁ ² | S1 | x_1 ² | <i>S</i> ¹ | x ₁ ² | <i>S</i> ¹ | x ₁ ² | S ¹ | x ₁ ² | Chloroe C ₂ H ₃ Cl; | Hydrogen ([7647-01-(| COMPONENTS | |
| 100 200 300 400 500 600 700 800 900 1000 | 55.8 90.9 132.4 | 0.0675 0.1350 0.2025 0.2700 0.3375 | 44.6 71.3 101.9 137.1 | | 35.3 55.7 78.3 103.5 131.9 | | 28.3 44.1 61.4 80.2 100.8 138.1 148.3 | 0.2783 0.2930 | 22.0 34.0 46.9 60.6 75.3 101.1 108.0 126.3 | 0.2202 0.2930 0.2607 | 19.1 29.5 40.4 52.0 64.3 85.5 91.2 ³ 105.9 | 0.0508 0.0762 0.1016 0.1270 0.1524 0.1928 0.2030 0.2284 | 16.0 24.5 33.5 42.9 52.7 69.5 73.9 85.4 | 0.0642 0.0856 0.1070 0.1284 0.1627 0.1712 0.1926 | 13.5 20.6 28.1 42.9 43.8 57.4 60.9 70.1 | 0.0182 0.0364 0.0546 0.0728 0.0910 0.0109 ³ 0.1382 0.1455 0.1637 0.1819 | oethene or vinyl chloride; 1; [75-01-4] | gen chloride; HCl; -01-0] | | nyurugen Chioriae in Non-Aqueous |
| ² Mole ³ Value | nt 2n coef fracti 2 appea | 481 ficient on hydro rs to bo stant, | , S/cm ⁸ ogen ch e in en | loride, ror. | g ⁻¹ atm , x ₁ . | | 27 | 730 | 34 | 150 | 3 | 840 | 4 | 671 | 54 | 96 | 6 - 120. | Danov, S. M.; Golubev, Yu. D. Khim. Prom st. (Moscow) 1968. | MEASUREMENTS : | T NOU-Aqueous Solvents |
| | | | | | | | | | | | | | | | | | | | | 202 |

| <pre>COMPONENTS: (1) Hydrogen chloride; HCl; [7647-01-0] (2) (E)-1,2-Dichloroethene or trans-dichloroethene; C₂H₂Cl₂; [156-60-5]</pre> | ORIGINAL MEASUREMENTS: Danov, S. M.; Golubev, Yu. D. Khim. Prom_st. (Moscow) <u>1968</u> , 44 (2), 116 - 120. |
|--|--|
| VARIABLES: T/K = 225.15 - 256.15 $p_1/kPa = (100 - 1000 \text{ mmHg})$ | PREPARED BY: W. Gerrard |
| EXPERIMENTAL VALUES: | |
| See next p | age |
| • | |
| | |
| AUXILIARY | INFORMATION |
| METHOD /APPARATUS / PROCEDURE : | SOURCE AND PURITY OF MATERIALS; |
| Solubilities were stated to be measured by a static method. The pressures were stated to have been measured to an accuracy of 1 mmHg on a mercury column. Note that in the authors' table the pressures were given in stages of 100 mmHg. This appears to indicate a smooting of primary data. | (1) Hydrogen chloride. Probably of satisfactory purity. (2) (E)-1,2-dichloroethene or trans-dichloroethene. Purity checked by chromatography. |
| | ESTIMATED ERROR: |
| | |

| | | | | | | | | | | | | | EXPERIMENTAL | (2) | (1) | COMPONENTS | |
|---------------------|-------|----------------|------------------------|-------------------------------------|------|-------------|-------------------|-------------|------|---------|------|--------|--------------|---|--------------------------------|-------------|-------|
| T/K 225.15 229.65 | | 225.15 229.65 | | 25.15 229.65 | | 235. | 235.15 241.65 | | 5 | 251. | 15 | 256.1 | 256.15 | | (<i>E</i>) - dich [156 | Hydı [76 | NENTS |
| p/mmHg | SI | x ₁ | S1 | x_{1}^{2} | S | x_{1}^{2} | s' | x_{1}^{2} | - ST | x_1^2 | ST | | NTAL, | 1,2 10r 60 | Hydrogen ([7647-01-1 | | |
| 100 | 4.5 | 0.0193 | 3.9 | 0.0168 | 3.4 | 0.0146 | 2.8 | 0.0121 | 2.2 | 0.0096 | 1.9 | 0.0084 | MEA | ,-Dichloroethene oethene; C ₂ H ₂ Cl ₂ ; -5] | - ch | | |
| 200 | 9.2 | 0.0386 | 8.0 | 0.0336 | 6.7 | 0.0292 | 5.7 | 0.0242 | 4.1 | 0.0192 | 4.0 | 0.0168 | SURI | chlo ene; | lori | | |
| 300 | 14.2 | 0.0579 | 12.2 | 0.0504 | 10.6 | 0.0438 | 8.7 | 0.0363 | 6.9 | 0.0288 | 5.9 | 0.0252 | MEASUREMENTS | C ₂ I | chloride; -0] | | |
| 400 | 19.3 | 0.0772 | 16.6 | 0.0672 | 14.3 | 0.0584 | 11.7 | 0.0484 | 9.2 | 0.0384 | 8.0 | 0.0336 | TS: | then ^H 2C1 | HC1; | | |
| 500 | 24.7 | 0.0965 | 21.1 | 0.0840 | 18.2 | 0.0730 | 18.2 | 0.0630 | 11.6 | 0.0480 | 10.1 | 0.0420 | | 2° or | - | | |
| 600 | 30.3 | 0.1158 | 25.8 | 0.1008 | 22.2 | 0.0876 | 16.7 ³ | 0.0726 | 14.2 | 0.0576 | 12.3 | 0.0504 | | 1 | | | |
| 760 | 39.8 | 0.1470 | 33.7 | 0.1275 | 28.8 | 0.1111 | 23.4 | 0.0920 | 18.3 | 0.0734 | 15.7 | 0.0640 | | trans | | | |
| 800 | | | 35.8 | 0.1342 | 30.6 | 0.1169 | 24.7 | 0.0968 | 19.7 | 0.0772 | 16.6 | 0.0674 | | | | E | |
| 900 | | | | | 35.0 | 0.1315 | 28.2 | 0.1089 | 22.0 | 0.0868 | 18.1 | 0.0758 | | 116 116 | Danov | EVALUATOR | |
| 1000 | | | | | 39.5 | 0.1461 | 31.2 | 0.1210 | 24.5 | 0.0964 | 21.2 | 0.0842 | | 1 1. | | TOR: | |
| lenry's | | | | | | | | | | | | | | 120. | | | |
| Constant" K/mmHg | 5169 |) | 5957 | | 683 | 39 | 8260 | | 1035 | 0 | 1187 | 0 | | 17 | ີ . ດ | | |
| l Kuener | meffi | icient S/ | ти ³ (STTP) | g ⁻¹ atm ⁻¹ . | | | | | | | | | | (M08cow) | Golubev | | |
| | | n hydrogen | | - | | | | | | | | | | 000, | ev, | | |
| | | s to be in | | 1. | | | | | | | | | | | | | |
| | | tant, K/mmi | | $/\text{mmHg})/x_{1}$ | | | | | | | | | | (<u>8967</u> | | | |
| - | | - | 1' | 1 | | | | | | | | | | 44 | • | | |
| | | | | | | | | | | | | | | (2) | | | |

Hydrogen Chloride in Non-Aqueous Solvents

| COMPONENTS : | ORIGINAL MEASUREMENTS: | | | | | |
|---|--|--|--|--|--|--|
| (1) Hydrogen chloride; HCl; | Bell, R. P. | | | | | |
| [7647-01-0] | | | | | | |
| | J. Chem. Soc. 1931 , | | | | | |
| (2) Chloroethenes | 1371 - 1382. | | | | | |
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| | | | | | | |
| VARIABLES: | PREPARED BY: | | | | | |
| T/K: 293.15 | W. Gerrard | | | | | |
| P/kPa: 101.325 (1 atm) | | | | | | |
| | | | | | | |
| EXPERIMENTAL VALUES: | | | | | | |
| | | | | | | |
| -, | n Mol Fraction | | | | | |
| Coefficie | | | | | | |
| c _{1,1} /c _{1,} | g | | | | | |
| | | | | | | |
| Trichloroethene | ; C ₂ HCL ₃ ; | | | | | |
| [79-01-6] | | | | | | |
| 293.15 5.79 | 0.0206 | | | | | |
| | | | | | | |
| Tetrachloroethe | ne; C ₂ Cl ₄ ; | | | | | |
| [127-18-4] | 2 1 | | | | | |
| 293.15 3.88 | 0.0163 | | | | | |
| 293.15 5.88 | 0:0105 | | | | | |
| | | | | | | |
| The ideal gas conce | ntration at one atm | | | | | |
| is $c_1 \ /mol \ dm^{-3} =$ | n/V = p/RT = 0.0417. | | | | | |
| ±,9, | | | | | | |
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| AUXILIARY | INFORMATION | | | | | |
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| METHOD/APPARATUS/PROCEDURE: | SOURCE AND PURITY OF MATERIALS: | | | | | |
| The apparatus consisted of a 50 cm^3 | (1) Hydrogen chloride. Prepared by | | | | | |
| | dropping pure concentrated | | | | | |
| graduated tube, and sealed at the bottom to a capillary U-tube. The | hydrochloric acid into pure sulfuric acid. | | | | | |
| bottom to a capillary U-tube. The liquid was saturated with gas at | Sulluite actu. | | | | | |
| atmospheric pressure. The gas was | (2) Chloroethenes. Good specimens | | | | | |
| displaced from the saturated solu- | were dried over calcium | | | | | |
| tion by a current of dry CO, free | chloride, and distilled. | | | | | |
| air, absorbed in water, and | Boiling points are given in | | | | | |
| titrated with a solution of NaOH. | paper. | | | | | |
| | | | | | | |
| The solubility, c/mol dm ⁻³ , was | ESTIMATED ERROR: | | | | | |
| converted to a partition coefficient | CONTRALED ERROR: | | | | | |
| by dividing by the ideal gas con- | $\delta T/K = 0.01$ | | | | | |
| centration of HCl in the gas phase. | $\delta c/c = 0.01$ | | | | | |
| The mole fraction solubility was | | | | | | |
| calculated on the assumption that | REFERENCES : | | | | | |
| the density of the solution obeys | | | | | | |
| the ideal mixture law. | | | | | | |
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| COMPONENT | S: | | | | ORIGINAL MEASUR | | | |
|---|--|---|---|--|--|--|--|--|
| <pre>(1) Hydrogen chloride; HCl; [7647-01-0]</pre> | | | | | Abdullaev, A. I.; Aliev, A. M.; Mamedov, M. B. | | | |
| (2) Tr | <pre>(2) Trichloroethene; C₂HCl₃; [79-01-6]</pre> | | | | | Uch. Zap. Azerb. Gos. Univ., Ser. Khim. Nauk. <u>1968</u> , No. 3, 80 - 83. | | |
| | | | | | From <i>Ref.</i> Zi Abstr. No. | | <u>69</u> , | |
| VARIABLES | :: | | | | PREPARED BY: | | | |
| T/K = 273.15 - 353.15 Total pressure = barometric | | | | W. Gerrard | | | | |
| EXPERIMEN T/K | TAL VALU | ES: | lorido | Hydrogen Ch | loridol | Mol Patio | Mol Fraction | |
| 171 | nyuro | w _γ /wi | t % | | · <u>.</u> · · · · · · · · · · · · · · · · · · · | | | |
| | a | b | | g HCl per 100 g (2) | cm HCl per 1 cm (2) | ⁿ 1/n2 | <i>x</i> ₁ | |
| | 0.88 | | | | 8.00 | 0.0324 | 0.0314 | |
| | 0.62 | | 0.68 | | 6.07 | 0.0245 | 0.0239 | |
| | 0.50 | | 0.54 | | 4.90 | 0.0195 | 0.0191 | |
| | 0.44 | | 0.45 | | 4.10 3.31 | 0.0162 0.0133 | 0.0160 0.0132 | |
| | 0.31 | | | | 2.71 | 0.0108 | 0.0132 | |
| | 0.24 | | | | 2.03 | 0.00829 | 0.00822 | |
| | 0.17 | | | | 1.59 | 0.00649 | 0.00645 | |
| 353.15 | 0.16 | 0.14 | 0.15 | 0.15 | 1.35 | 0.00541 | 0.00538 | |
| The mo | d on th le rati | | - | - | es were calc | ulated by t | he compiler. | |
| The mo | | | - | - | es were calc | ulated by t | he compiler. | |
| The mo | | | - | caction valu | es were calc | ulated by t | he compiler. | |
| | | o and m | nole fi | caction valu | | - | | |
| METHOD/AH The ap which tube c furic tube c | le rati PPARATUS/ paratus hCl is ontaini acid, a | o and m PROCEDUR consis generat ng conc bubble ng abou | E: E: sts of centrat er abso | AUXILIARY a flask in bubbler :ed sul- | INFORMATION SOURCE AND PUR (1) Hydroge from ch chlorid sulfuri | ITY OF MATERI n chloride. emically pu e and conce c acid. | ALS: Prepared re sodium ntrated | |
| METHOD/AI The ap which tube c furic tube c trichl The ga bubble a samp | PPARATUS/ paratus HCl is ontaini acid, a ontaini oroethy s was p r tube le of t | PROCEDUR consis generat ng conc bubble ng abou lene. assed f was coc he solu | E: ter abso ter abso to cor 3 h bled to tion w | AUXILIARY a flask in bubbler ed sul- orption | INFORMATION SOURCE AND PUR (1) Hydroge from ch chlorid sulfuri (2) Trichlo | ITY OF MATERI n chloride. emically pu e and conce c acid. | ALS: Prepared re sodium | |
| METHOD/AI The ap which tube c furic tube c trichl The ga bubble a samp | PPARATUS/ paratus HCl is ontaini acid, a ontaini oroethy s was p r tube le of t | PROCEDUR consis generat ng conc bubble ng abou lene. assed f was coc he solu | E: ter abso ter abso to cor 3 h bled to tion w | AUXILIARY AUXILIARY a flask in bubbler a sul- orption m ³ of the ours, the o 258 K, and vas with- | INFORMATION SOURCE AND PUR (1) Hydroge from ch chlorid sulfuri (2) Trichlo | ITY OF MATERI n chloride. emically pu e and conce c acid. roethene. | ALS: Prepared re sodium ntrated | |
| METHOD/AI The ap which tube c furic tube c trichl The ga bubble a samp | PPARATUS/ paratus HCl is ontaini acid, a ontaini oroethy s was p r tube le of t | PROCEDUR consis generat ng conc bubble ng abou lene. assed f was coc he solu | E: ter abso ter abso to cor 3 h bled to tion w | AUXILIARY AUXILIARY a flask in bubbler a sul- orption m ³ of the ours, the o 258 K, and vas with- | INFORMATION SOURCE AND PUR (1) Hydroge from ch chlorid sulfuri (2) Trichlo | ITY OF MATERI n chloride. emically pu e and conce c acid. roethene. | ALS: Prepared re sodium ntrated | |
| METHOD/AI The ap which tube c furic tube c trichl The ga bubble a samp | PPARATUS/ paratus HCl is ontaini acid, a ontaini oroethy s was p r tube le of t | PROCEDUR consis generat ng conc bubble ng abou lene. assed f was coc he solu | E: ter abso ter abso to cor 3 h bled to tion w | AUXILIARY AUXILIARY a flask in bubbler a sul- orption m ³ of the ours, the o 258 K, and vas with- | INFORMATION SOURCE AND PUR (1) Hydroge from ch chlorid sulfuri (2) Trichlo ESTIMATED ERRO | ITY OF MATERI n chloride. emically pu e and conce c acid. roethene. | ALS: Prepared re sodium ntrated | |
| METHOD/AI The ap which tube c furic tube c trichl The ga bubble a samp | PPARATUS/ paratus HCl is ontaini acid, a ontaini oroethy s was p r tube le of t | PROCEDUR consis generat ng conc bubble ng abou lene. assed f was coc he solu | E: ter abso ter abso to cor 3 h bled to tion w | AUXILIARY AUXILIARY a flask in bubbler a sul- orption m ³ of the ours, the o 258 K, and vas with- | INFORMATION SOURCE AND PUR (1) Hydroge from ch chlorid sulfuri (2) Trichlo | ITY OF MATERI n chloride. emically pu e and conce c acid. roethene. | ALS: Prepared re sodium ntrated | |
| METHOD/AI The ap which tube c furic tube c trichl The ga bubble a samp | PPARATUS/ paratus HCl is ontaini acid, a ontaini oroethy s was p r tube le of t | PROCEDUR consis generat ng conc bubble ng abou lene. assed f was coc he solu | E: ter abso ter abso to cor 3 h bled to tion w | AUXILIARY AUXILIARY a flask in bubbler a sul- orption m ³ of the hours, the o 258 K, and vas with- | INFORMATION SOURCE AND PUR (1) Hydroge from ch chlorid sulfuri (2) Trichlo ESTIMATED ERRO | ITY OF MATERI n chloride. emically pu e and conce c acid. roethene. | ALS: Prepared re sodium ntrated | |

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| COMPONENTS : | ORIGINAL MEASUREMENTS: |
| (1) Hydrogen chloride; HCl; | Curda, M.; Holas, J. |
| [7647-01-0] | Cham Drawning 1 1064 14 EAR EAR |
| (2) Tetrachlereethere, C Cl · | Chem. Prumysl <u>1964</u> , 14, 547 - 548. |
| (2) Tetrachloroethene; C ₂ Cl ₄ ; [127-18-4] | |
| [127-10-4] | |
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| | |
| VARIABLES: | PREPARED BY: |
| T/K = 293.15 - 363.15 | W. Gerrard |
| p / kPa = 101.325 (1 atm) | (smoothed data calculated by H.L. Clever) |
| | |
| EXPERIMENTAL VALUES: | |
| T/K weight i | ratio Mol Fraction |
| g ₁ /10 | a^2g_2 x_1 |
| | |
| 293.15 0.35 | 0.0157 |
| 303.15 0.31 | |
| 323.15 0.22 | |
| 343.15 0.15 | |
| 363.15 0.08 | 0.0036 |
| | |
| | values were calcu- |
| lated by the comp | iler. |
| Empothed Datas For use between 202 | 15 and 262 15 V |
| Smoothed Data: For use between 293. | 15 and 363.15 K. |
| $\ln x = 95.045 - 137$ | .022/(T/100 K) - 48.788 ln (T/100 K) |
| | (1) 100 N, 100,00 IN (1) 100 N, |
| | Aol Fraction |
| | <i>x</i> ₁ |
| | |
| 298.15 | 0.0148 |
| 313.15 | 0.0122 |
| 328.15 343.15 | 0.0092 |
| | |
| 358.15 | 0.0043 |
| | |
| | |
| ¹ The weight ratio is grams of HCl p | per 100 grams of tetrachloroethene. |
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| AUXILIARY | INFORMATION |
| | |
| METHOD/APPARATUS/PROCEDURE: The gas was passed through the liquid | SOURCE AND PURITY OF MATERIALS: |
| in a jacketed bubbler tube fitted | taken as of satisfactory |
| with a sampling tap at the bottom. | purity. |
| The amount of hydrogen chloride in a | purrey. |
| sample was determined by a chemical | (2) Tetrachloroethene. Rectified |
| titration. | technical grade. B.p. |
| | $(1 \text{ atm})/^{\circ}C = 120.$ |
| The pressure was presumably | |
| atmospheric. | |
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| | ESTIMATED ERROR: |
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| | REFERENCES : |
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| 20/20/20/20/20/20/20/20/20/20/20/20/20/2 | |
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| COMPONENTS: (1) Hydrogen chloride; HCl; | ORIGINAL MEASUREMENTS: Curda, M.; Holas, J. |
| [7647-01-0] | curua, M., noras, J. |
| (2) 3-Chloro-1-propene or allyl chloride; C ₃ H ₅ Cl; [107-05-1] | Chem. Prumysl <u>1964</u> , 14, 547 - 548. |
| 55 | |
| VARIABLES: | PREPARED BY: |
| T/K = 273.15 p /kPa = 101.325 (1 atm) | W. Gerrard |
| EXPERIMENTAL VALUES: T/K Weight Rat | iol Mol Fraction |
| g ₁ /10 ² g | x ₁ |
| 273.15 3.05 | 0.0609 |
| ¹ The weight ratio in 100 grams of 1-ch | ls grams of HCl per Loropropene. |
| | alue was calculated by |
| ene compilei. | |
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| · | INFORMATION |
| METHOD/APPARATUS/PROCEDURE: | SOURCE AND PURITY OF MATERIALS: |
| The gas was passed through the liquid in a jacketed bubbler tube fitted with a sampling tap at the bottom. | (1) Hydrogen chloride. May be taken as of satisfactory purity. |
| The amount of hydrogen chloride in a sample was determined by a chemical | (2) 1-Chloropropene. Redistilled. |
| titration. The pressure was presumably | B.p. $(1 \text{ atm})/^{\circ}C = 44.$ |
| atmospheric. | |
| | ESTIMATED ERROR: |
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| | REFERENCES : |
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| COMPONENTS : | ORIGINAL MEASUREMENTS: |
|--|---|
| <pre>1. Hydrogen Chloride; HCl; [7647-01-0]</pre> | Cook, T. M. |
| 2. 3-Chloro-1-propene or allyl chloride; C ₃ H ₅ Cl; [107-05-1] | Thesis, <u>1966</u> University of London |
| | |
| VARIABLES: | PREPARED BY: |
| T/K: 268.95 - 283.15 | W. Gerrard |
| Total P/kPa: 101.325 (1 atm) | (smoothed data calculated by H.L. Clever) |
| EXPERIMENTAL VALUES: | |
| T/K Mol Ratio | Mol Fraction |
| ⁿ HC1/ ⁿ C ₃ H ₅ C | ri ^x hci |
| 268.95 0.0536 | |
| 273.65 0.0484 | |
| 274.65 0.0475 278.15 0.0407 | |
| 283.15 0.0320 | 0.0310 |
| | |
| The mole fraction values were calculat | ed by the compiler. |
| Smoothed Data: ln X _{HC1} = 485.138 - 65 | 5.137/(T/100) - 247.155 ln (T/100) |
| Standard Error About F | Regression Line = 4.12×10^{-4} |
| | |
| , Т/К М | lol Fraction |
| | x _{HC1} |
| 263.15 | 0.0520 |
| 273.15 | 0.0468 |
| 283.15 | 0.0309 |
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| AUXILIARY | INFORMATION |
| METHOD/APPARATUS/PROCEDURE: | SOURCE AND PURITY OF MATERIALS: |
| The data were cited by Gerrard (1). | 1. Hydrogen chloride. Sample of best |
| Wudrogon chlerido una presed into a | quality was self prepared, and was |
| Hydrogen chloride was passed into a bubbler tube containing a weighed | passed through concentrated sul- furic acid and calcium chloride. |
| amount of solvent at the specified | 2. 3-Chloropropene. Fractionally |
| temperature until the increase in weight was constant at the | distilled, boiling point (l atm) = |
| barometric pressure (2). | 45-45.5°C, and refractive index, |
| For temperatures below 273 K a | $n_D^{20} = 1.4151.$ |
| weighed amount (excess) of pyridine | |
| was quantitatively injected into the absorption vessel at the temperature | |
| of the thermostat. The tube was then | ESTIMATED ERROR: |
| weighed at room temperature. | $\delta x_1 / x_1 = 0.02$ |
| | |
| | REFERENCES : |
| | 1. Gerrard, W. |
| | J. Chim. Phys. <u>1964</u> , 61, 73; Solubility of Gases in Liquids, |
| | Plenum Press, New York, 1976. |
| | 2. Ahmed, W.; Gerrard, W.; Maladkar, V. K. J. Appl. Chem. |
| | <u>1970</u> , 20, 109. |
| | <u></u> |

| COMPONENTS : | EVALUATOR: |
|---|--|
| <pre>1. Hydrogen Chloride; HCl; [7647-01-0]</pre> | Peter G. T. Fogg Department of Applied Chemistry and Life Sciences, |
| 2. Halogenated Aromatic Compounds | Polytechnic of North London, Holloway, London, N7 8DB, U.K. January 1989 |

CRITICAL EVALUATION:

Solubility of Hydrogen Chloride in Halogenated Aromatic Compounds.

Solubility in chlorobenzene has been measured at barometric pressure by Bell (1), Gerrard et al.(2), and by Zetkin et al.(3). Measurements were made over a pressure range below 101.3 kPa by O'Brien (4,5) and by Wyrzykwoska-Stankiewicz et al.(6) and over a pressure range to 5050 kPa by Strepikheev & Babkin (7). Measurements by these various authors extend over the temperature range 273 to 391 K. Mole fraction solubilities for a partial pressure of 101.3 kPa calculated from the available data are shown in fig 1. The value for 391 K, estimated from measurements by Strepikheev & Babkin, can be disregarded because of the high vapor pressure of the solvent at this temperature. Other values may be fitted to the equation :

 $\ln x_{\rm HCl} = -82.804 + 5275.3/(T/K) + 10.802 \ln(T/K)$

The standard deviation in values of x_{HC1} is 0.0021.

Solubility in bromobenzene at barometric pressure was measured by Bell (1) at 293.15 K and by Gerrard (2) over the temperature range 273.45 K to 316.75 K. O'Brien & Byrne (4) made measurements at 298.15 K over a pressure range to 38.7 kPa. The mole fraction solubilities for a partial pressure of 101.3 kPa estimated from the published data may be fitted to the equation :

 $\ln x_{\rm HCl} = 231.01 - 8259.3/(T/K) - 36.315 \ln(T/K)$

The standard deviation in values of $x_{\rm HCl}$ is 0.0012.

O'Brien & Byrne (4) also measured solubilities in fluorobenzene and iodobenzene at 298.15 K over a pressure range to 35 kPa. No other measurements on this system are available for comparison. The compiler has estimated mole fraction solubilities for a partial pressure of 101.3 kPa from the average value of the Henry's constants reported by O'Brien. An alternative method is to fit the data to a form of the Krichevskii-Il'inskaya equation applicable to moderate pressures. i.e.

 $\log_{10} \frac{P_{HC1}/mmHg}{x_{HC1}} = \log_{10} (H/mmHg) - B (1 - x_{solvent})$

where B is a constant and H is the limiting value of Henry's constant defined as : H = lim. (P_{HCl}/x_{HCl}) x_{HCl}^{+0}

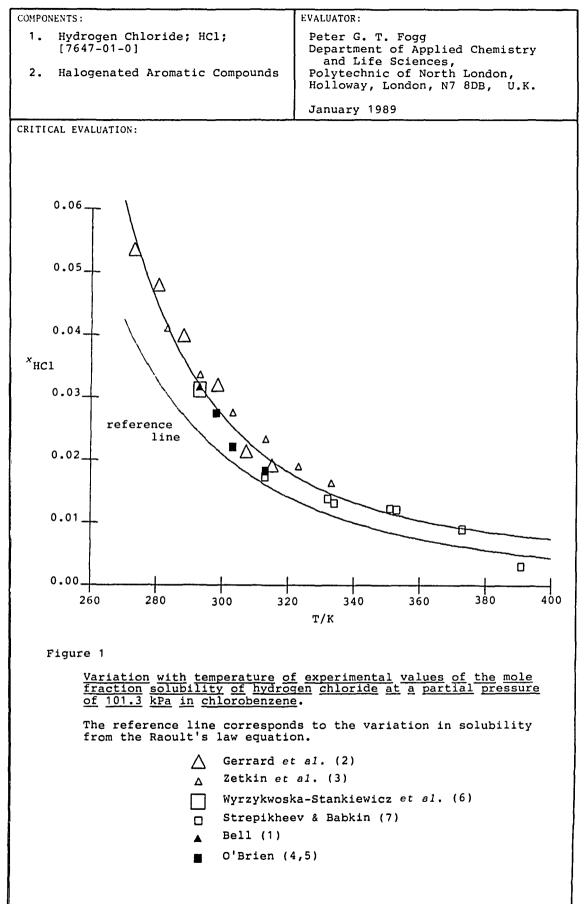
The corresponding values of mole fraction solubilities for a partial pressure of 101.3 kPa from O'Brien's data estimated in this way then fall in the order fluorobenzene (0.048) > chlorobenzene (0.027) > bromobenzene (0.026) > iodobenzene (0.022).

Zetkin *et al.*(3) measured solubility in 1,2-dichlorobenzene at barometric pressure over the temperature range 288.15 K to 333.15 K. Lavrova & Tudorovskaya (8) made measurements over the range 293.15 K to 438.15 K, also at barometric pressure, but corrected the values to a partial pressure of 101.15 kPa before publication. The data given by Zetkin, corrected to a partial pressure of 101.325 kPa is in good agreement with that given by Lavrova except at 293.15 K. Mole fraction solubilities at this temperature are 0.0209 (Zetkin) and 0.0220 (Lavrova). Mole fraction solubilities from the two sets of data may be represented by the equation :

 $\ln x_{HC1} = 18.049 - 106.766/(T/K) - 3.8027 \ln(T/K)$

The standard deviation in values of $x_{\rm HCl}$ is 0.00090. This equation is based upon data for the range 288 K to 438 K.

The solubility in 1,2,4-trichlorobenzene was measured by Zetkin *et al.*(3) at barometric pressure in the temperature range 288.15 K to 333.15 K. These values are self-consistent and probably as reliable as other



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|--|---|
| COMPONENTS : | EVALUATOR: |
| 1. Hydrogen Chloride; HCl; [7647-01-0] | Peter G. T. Fogg Department of Applied Chemistry |
| 2. Halogenated Aromatic Compounds | and Life Sciences, Polytechnic of North London, |
| | Holloway, London, N7 8DB, U.K. |
| | January 1989 |
| | |
| CRITICAL EVALUATION: | |
| measurements by these authors of the so There are, however, no other measuremen comparison may be made. | |
| Bell (1) measured the solubility in (c) pressure and 293.15 K. No other measur for comparison. | |
| The solubility in (trichloromethyl)benz measured by Bell (1) at 293.15 K and by range 273.65 K to 315.95 K. The mole f Bell's measurement is in sharp contrast temperature by interpolation of Gerrard measurements are consistent over the te be the more reliable. | Gerrard <i>et al.</i> (2) over the temperature raction solubility of 0.0275 from to the value of 0.0449 at this 's measurements. Gerrard's |
| range 279 K to 353 K. The measurements other measurements on this system with authors also published data for solubil | barometric pressure over the temperature are self consistent but there are no which comparisons may be made. These ity in mixtures of this solvent with zenes. The compiler has noted errors in |
| Ahmed (10) reported the solubility in the equal to barometric pressure over the the 293.15 K. Mole fraction solubilities for self-consistent and lower than values for the carbonyl group. No other available for comparison. | emperature range 253.15 K to rom these measurements are or chlorobenzene and other solvents |
| REFERENCES | |
| 1. Bell, R. P. J. Chem. Soc. <u>1931</u> , 1 | 371 - 1382. |
| | , P. L. J. Appl. Chem. 1959, 9, 89 - 93. |
| | |
| 3. Zetkin, V. I.; Kosorotov, V. I.; S Khim. Prom. <u>1971</u> , 47, 102 - 103.; | tul, B. Ya.; Dzhagatspanyan, R. V. <i>Soviet Chem. Ind. <u>1971</u>, 3, 89 - 90.</i> |
| 4. O'Brien, S. J.; Byrne, J. B. J. A | m. Chem. Soc. <u>1940</u> , 62, 2063 – 2065. |
| 5. O'Brien, S. J. J. Am. Chem. Soc. | <u>1941</u> , 63, 2709 - 2712. |
| Wyrzykwoska-Stankiewicz, D.; Szfra Polon. Sci., Ser. Sci. Chim. <u>1971</u>, | nski, A.; Kaminski, M. Bull. Acad. 19, 199 - 205. |
| Strepikheev, Yu. A.; Babkin, B. M. 38 - 39. | Khim. Prom_st (Moscow) <u>1963</u> , No. 1, |
| 8. Lavrova, E. M.; Tudorovskaya, G. L 2105 - 2106.; J. Appl. Chem. USSR | . Zh. Prikl. Khim. (Leningrad) <u>1977</u> , 50, <u>1977</u> , 50, 2005 - 2006. |
| 9. Ushakov, A. A.; Kosorotov, V. I.; Dzhagatspanyan, R. V. Zh. Prikl. J. Appl. Chem. USSR <u>1977</u> , 50, 403 | Khim. (Leningrad) <u>1977</u> , 50, 425 - 427.; |
| 10. Ahmed, W. Thesis, <u>1970</u> , Universit | y of London. |
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| | chloride; 0] | HCl; | ORIGINAL MEASUREMENTS: O'Brien, S. J.; Byrne, J. B. J. Am. Chem. Soc. <u>1940</u> , 62, 2063 - 2065. | | | |
|---|---|---|---|--|--|--|
| (2) Fluoroben | .zene; C ₆ H ₅ | F; [462-06-6] | | | | |
| VARIABLES: T/K: P/kPa: | 298.15 6.52 - 34 (48.9 - 2 | | PREPARED | BY: W. Ger | rard | |
| EXPERIMENTAL VAL | WES: | | 1 | | | |
| <u>т/к</u> | Pressure P ₁ /mmHg | - | Henry's Constant k ¹ | Mol Ratio | Mol Fraction ^x 1 | |
| ² Value c constan gives a | alculated t. Use of | the high and 0.0281 to 0.03 | r from th low value | e average v s of Henry' | alue of Henry's | |
| · · · · · · · · · · · · · · · · · · · | | | | | | |
| | | AUXILIARY | INFORMATIO | N | | |
| Saylor (1) as al. (2). The use of a 1 to to 7 day equi The apparatus which are sep solvent is pa the gas, and the lower bul partially eva and the whole thermostat fr The tap is cl | ad apparatu modified main diff 2 day ins libration consists arated by artially sa the soluti b. The bu cuated, the apparatus com 1 to 2 cosed. The aquantitat | is are those of by O'Brien <i>et</i> erence is the tead of a 5 time. of two bulbs a tap. The turated with on added to the tap opened, put in a days. HC1 in the tively removed | SOURCE ANI (1) Hydr from chlc Drie (2) Fluc Atte | O PURITY OF MA ogen chlori a chemically bride and su ord by phosph probenzene. ested by ref 1.4650. | de. Prepared pure potassium lfuric acid. orus pentoxide. Eastman Kodak Co. ractive index, | |

| | Hyurc | gen Chioriae in i | von-Aquec | ous Solvents | 295 | |
|-----------------------------|--|-------------------------|--------------------|--|---------------------------------------|--|
| COMPONENTS: | | | ORIGINAL N | EASUREMENTS: | | |
| | <pre>(1) Hydrogen chloride; HCl; [7647-01-0]</pre> | | | Ushakov, A. A.; Kosorotov, V. I.; Stul, B. Ya.; Motsarev, G. V.; Dzhagatspanyan, R. V. | | |
| (2) (Trifluorom | (2) (Trifluoromethyl)-benzene or benzotrifluoride; C ₇ H ₅ F ₃ ; | | | kl. Khim. (Leningrad | () <u>1977</u> , | |
| [98-08-8] | 02140, 0 | 7-5-3' | J. Appl | - 427. . Chem. USSR (Engl. | Transl.) | |
| | | ····· | <u>1977,</u> 5 | 0, 403 - 405. | | |
| VARIABLES: T/K = | : 279 - 3 | 53 | PREPARED | | | |
| | 101.325 | | (smooth | W. Gerrard ed data calculated by H. | L. Clever) | |
| EXPERIMENTAL VALUES | : | | | | | |
| | T/K | Hydrogen Chl | oride | Mol Fraction | | |
| | | w ₁ /wt % Mc | ol Ratio n_1/n_2 | <i>x</i> 1 | | |
| | 279 | 1.280 (| 0.0512 | 0.0487 | | |
| | 298 | 0.540 0 | .0216 | 0.0211 | | |
| | 313 | | 0.0137 | 0.0135 | | |
| | 323 333 | | 0.0098 | 0.0097 | | |
| | 353 | | 0.0071 0.0036 | 0.00705 0.0036 | | |
| Smoothed Data: | For use | between 278 a | nd 353 K | • | | |
| | $\ln x_{\tau} =$ | -15.1689 + 33 | .8866/(T | /100 к) | | |
| The sta | 1 | | | on line is 7.55 x 10 | - 4 | |
| | | T/K Mol Fra | | | • | |
| | | x 1 | | | | |
| | | 278 0.05 288 0.03 | | | | |
| | | 298 0.02 | | | | |
| | | 313 0.01 323 0.00 | | | | |
| | | 333 0.00 | | | | |
| | | 343 0.00 353 0.00 | | | | |
| | - | | | | · · · · · · · · · · · · · · · · · · · | |
| | | AUXILIARY | INFORMATIO | | | |
| METHOD/APPARATUS/PR | | heric pressure | | D PURITY OF MATERIALS: rogen chloride. Pre | nared | |
| in a thermostat | ed cylind | irical vessel | fro | m cp grade NaCl and | concen- | |
| of 200 cm ³ capa | city fit | ted with a | | ted H_SO4. Dried by | | |
| reflux condense | | | (2) (50 | ifluoromethyl)-benze | - | |
| and the HCl con | s a samp. tent dete | ermined by | | tified, purity 99.8 | | |
| alkalimetry, un | | | | cirica, paricy solo | per cent. | |
| tration was att | ained. | | | | | |
| | | | | | | |
| | | | | | | |
| | | | DOBTICATION | | | |
| | | | ESTIMATEI | ERROR: | | |
| | | | | | | |
| ļ | | | | · · · · · · · · · · · · · · · · · · · | | |
| | | | REFERENCI | 2S : | | |
| 1 | | | 1 | | | |
| | | | | | | |
| | | | | | | |
| | | | 1 | | | |

| COMPONENTS: (1) Hydrogen chloride; HCl; [7647-01-0] (2) (Trifluoromethyl)-benzene or benzotrifluoride; $C_7H_5F_3$; [98-08-8] (3) Chloro(trifluoromethyl)-benzene; $C_7H_4ClF_3$; [52181-51-8] VARIABLES: T/K = 298 - 353 p/kPa = 101.325 (1 atm) | ORIGINAL MEASUREMENTS: Ushakov, A. A.; Kosorotov, V. I.; Stul, B. Ya.; Motsarev, G. V.; Dzhagatspanya, R. V. Zh. Prikl. Khim. (Leningrad) <u>1977</u> , 50, 425 - 427. J. Appl. Chem. USSR (Engl. Transl.) <u>1977</u> , 50, 403 - 405. PREPARED BY: W. Gerrard | | |
|--|--|--|--|
| EXPERIMENTAL VALUES: T/K Composition of Initial Mixt | ture Hydrogen Chloride | | |
| | | | |
| | $\frac{\omega_1/\text{wt } \text{\% Mol Ratio}}{n_1/(n_2 + n_3)}$ | | |
| 298 84.84 15.16 313 323 333 353 | $\begin{array}{ccccccc} 0.544 & 0.0116 & (0.0225)^{1} \\ 0.348 & 0.0074 & (0.0144)^{1} \\ 0.258 & 0.0055 & (0.0107)^{1} \\ 0.188 & 0.0040 & (0.0078)^{1} \\ 0.102 & 0.0024 & (0.0042)^{1} \end{array}$ | | |
| The probable source of the discrepa molecular weight in place of the H The authors tabulated values of the | e Gibbs energy, enthalpy, and entropy atio values. The values need to be | | |
| AUXILIARY | INFORMATION | | |
| METHOD/APPARATUS/PROCEDURE: Determined under atmospheric pressure in a thermostated cylindrical vessel of 200 cm capacity fitted with a reflux condenser and a bubbler. Every 20 minutes a sample was removed, and the HCl content deter- mined by alkalimetry, until a con- stant concentration was attained. Component (3) is probably mostly 1-chloro-3-(trifluoromethyl)-benzene [98-15-7]. | SOURCE AND PURITY OF MATERIALS: | | |

| | | , | | | | | |
|---|--|--|------------------------------|---|------------|--|--|
| COMPONENTS | : | | | ORIGINAL MEASUREME | NTS: | | |
| | | oride; HCl; | | Ushakov, A. A.; Kosorotov, V. I.; | | | |
| | 7-01-0] | | | Stul, B. Ya.; | Motsarev, | G. V.; | |
| | | chyl)-benzer | | Dzhagatspanya, R. V. | | | |
| (3) Chlo | oro(triflu | ride; C ₇ H ₅ F loromethyl) | benzene: | 2n. Frikt. Knim. (Leningrad) 1917, | | | |
| C-H, | ClF ₂ ; [52 | 2181-51-8] | | 50, 425 - 427. | | | |
| (4) Dích C ₇ H ₃ | lorŏ(trii Cl ₂ F ₃ ; [] | fluoromethy: 30498-35-2] | l)-benzene; | J. Appl. Chem. 1977 , 50, 403 | | gl. Transl.) | |
| VARIABLES | : | 298 - 353 | | PREPARED BY: | <u></u> | | |
| | | L01.325 (1 | atm) | w. | Gerrard | | |
| | | | , | | | | |
| EVDEDTMEN | TAL VALUES: | | | | | | |
| T/K | | ion of Init | iol Mivtur | o Hudre | ogen Chlo | | |
| 1/K | | | MIXCUL | | Mol F | | |
| | | C7H4ClF3 | | w_1 /wt % | | $+ n_3 + n_4)$ | |
| | _ | | | | | | |
| 298 | 58.29 | 39.47 | 2.24 | 0.540 | 0.0123 | | |
| 313 323 | | | | 0.362 | | $(0.0159)^{1}$ | |
| 323 | | | | 0.280 0.212 | 0.0064 | | |
| 353 | | | | 0.140 | 0.0048 | $(0.0093)^{1}$ $(0.0061)^{1}$ | |
| | | | | 01110 | 0.0001 | (, | |
| 298 | 22.82 | 60.86 | 16.32 | 0.550 | 0.0138 | | |
| 313 | | | | 0.374 | | $(0.0181)^{1}$ | |
| 323 | | | | 0.302 | 0.0076 | | |
| 353 | | | | 0.230 0.152 | 0.0035 | $(0.0111)^{1}$ $(0.0073)^{1}$ | |
| The a of di | uthors ta ssolution | bulated val based on t | ues of the he mole ra | l molecular weig Gibbs energy, e tio values. The e ratio values. | enthalpy, | and entropy eed to be | |
| | | | AUXILIARY | INFORMATION | | | |
| METHOD /AP | PARATUS/PRO | CEDURE : | | SOURCE AND PURITY | OF MATERIA | 1.5 : | |
| | | atmospheri | c pressure | | | | |
| in a th of 200 reflux | ermostate cm³ capac condenser | ed cylindric ity fitted and a bubb a sample w | al vessel with a pler. | (1) Hydrogen ch | Cl and c | oncentrated | |
| removed mined b | , and the y alkalim | HCl conten etry, until ion was att | it deter- . a con- | (2, 3, 4) Mixtu chlorinatic benzene at of FeCl ₃ . | on of (tr | ared by ifluoromethyl the presence | |
| | | | | ESTIMATED ERROR: | | | |
| | | | | | | | |

| COMPONENTS: (1) Hydrogen chloride; HCl; [7647-01-0] | ORIGINAL MEASUREMENTS: Bell, R. P. |
|---|--|
| (2) Chlorobenzene and (chloromethyl)- benzenes | J. Chem. Soc. <u>1931</u> , 1371 - 1382. |
| | |
| VARIABLES: | PREPARED BY: |
| T/K: 293.15 P/kPa: 101.325 (1 atm) | W. Gerrard |
| EXPERIMENTAL VALUES: | |
| T/K Partition Coefficient c1,1/c1,g | |
| Chlorobenzene; C | 5H ₅ Cl; [108-90-7] |
| 293.15 7.63 | 0.0315 |
| (Chloromethyl)ber [100-44-7] | <pre>izene; C7H7Cl;</pre> |
| 293.15 9.75 | 0.0448 |
| (Trichloromethyl) C7 ^H 5 ^{Cl} 3; [98-07- | benzene; 7] |
| 293.15 4.77 | 0.0275 |
| The ideal gas concen is c _{l,g} /mol dm ⁻³ = n | tration at $p_1 = 1$ atm / $v = p/RT = 0.0417$. |
| AUXILIARY | INFORMATION |
| METHOD / APPARATUS / PROCEDURE : | SOURCE AND PURITY OF MATERIALS: |
| The apparatus consisted of a 50 cm ³ bulb extended at the top as a graduated tube, and sealed at the bottom to a capillary U-tube. The liquid was saturated with gas at atmospheric pressure. The gas was displaced from the saturated solu- tion by a current of dry CO_2 free air, absorbed in water, and titrated with a solution of NaOH. | (1) Hydrogen chloride. Prepared by dropping pure concentrated hydrochloric acid into pure sulfuric acid. (2) Chlorobenzene and (chloromethyl)- benzenes. Good specimens were dried over calcium chloride, and distilled. Boiling points are given in paper. |
| The solubility, $c/mol dm^{-3}$, was converted to a partition coefficient | ESTIMATED ERROR: |
| by dividing by the ideal gas con- centration of HCl in the gas phase. | $\begin{array}{rcl} \delta T/K &= & 0.01 \\ \delta c/c &= & 0.01 \end{array}$ |
| The mole fraction solubility was calculated on the assumption that the density of the solution obeys the ideal mixture law. | REFERENCES : |
| | |

| | пуа | rogen Unioriae in | Non-Aqueo | us Solvents | | 299 |
|---|--|---|---|---|--|-----|
| COMPONENTS : | | | ORIGINAL M | EASUREMENTS: | | |
| (1) Hydrogen [7647-01- | | HCl; | O'Brien, S. J.; Byrne, J. B. | | | |
| (2) Chloroben | (2) Chlorobenzene; C ₆ H ₅ Cl; [108-90-7] | | | J. Am. Chem. Soc. <u>1940</u> , 62, 2063 - 2065. | | |
| | | | Į | | | |
| | | | <u> </u> | | | |
| VARIABLES: T/K: | 298.15 | | PREPARED B | Υ: | | |
| P/kPa: | 4.01 - 45 (30.1 - 3 | | | W. Gerr | ard | |
| THERE AND THE TAX | | | I | | <u> </u> | |
| EXPERIMENTAL VAL | Pressure | Molality | Henry's | Mol Ratio | Mol Fraction | - ' |
| | p1/mmHg | - | Constant k ¹ | ⁿ 1 ^{/n} 2 | | |
| 298.15 | 30.1 | 0.0081 | 4.85 | 0.00091 | 0.00091 | |
| | 48.0 | 0.0152 | 4.16 | 0.00171 | 0.00171 | |
| | 108 | 0.0310 | 4.58 | 0.00349 | 0.00346 | 1 |
| 1 | 193 | 0.0578 | 4.39 | 0.00650 | 0.00646 | |
| | 198 | 0.0597 | 4.31 | 0.00672 0.0116 | 0.00667 0.0114 | |
| | 340 | 0.1027 | 4.35 | 0.0110 | 0.0114 | |
| | (760 | 0.228 | 4.38 av. | 0.0257 | 0.0251) ² | |
| ² Value c | alculated | $(p_1/atm)/(m_1/m)$ by the compile the high and | r from the | e average v | value of Henry's | |
| | | | | | | |
| | | AUXILIARY | INFORMATION | N | | |
| Saylor (1) as al. (2). The use of a 1 to to 7 day equi The apparatus which are sep solvent is pa the gas, and the lower bul partially eva and the whole | d apparatu modified main diff 2 day ins libration consists arated by rtially sa the soluti b. The bu cuated, th apparatus | by O'Brien et erence is the tead of a 5 time. of two bulbs a tap. The turated with on added to lbs are e tap opened, put in a | <pre>(1) Hydro chemi chloi Dried (2) Chloi Attes ^{n²⁰},</pre> | ically pure ride and su l by phosph robenzene. sted by ref 1.5240. | ATERIALS: de. Prepared f potassium lfuric acid. orus pentoxide. Eastman Kodak ractive index, | |
| thermostat fr | om 1 to 2 | days. | ESTIMATED | ERROR: | | |
| and titrated | quantitat with NaOH. | ively removed The HCl | | δ τ/ Κ = | 0.02 | |
| partial press the bulb volu moles of HCl behavior. A is removed fr titrated with | me and the assuming i weighed so om the low | number of deal gas lution sample | J. An 2. O'Bri Zeuro | or, J. H. n. <i>Chem. So</i> len, S. J.; cher, R. A. | c. <u>1937</u> , 59, 17 Kenny, C. L. c. <u>1939</u> , 61, 25 | |
| L | | | L | ······ | | |

| COMPONENTS : | | - | IODICINAL A | T LOUDEL THE | | |
|--|--|--|--|--|--|------|
| | | wol . | | ÆASUREMENTS: | | |
| <pre>(1) Hydrogen chloride; HCl; [7647-01-0] (2) Chlorobenzene; C₆H₅Cl; [108-90-7]</pre> | | O'Brien, S. J. J. Am. Chem. Soc. <u>1941</u> , 63, 2709 - 2712. | | | | |
| | | | | | | |
| | | | | | | |
| VARIABLES: T/K: P/kPa: | 303.15, 3 3.03 - 33 (22.7 - 2 | •/5 | PREPARED I | W. Gerrar | đ | |
| EXPERIMENTAL VAL | JES: | * | | | | |
| T/K | Pressure P1 ^{/mmHg} | | Henry's Constant k ¹ | Mol Ratio | Mol Fraction | |
| 303.15 | 22.7 23.9 113 103 156 253 | 0.0058 0.0069 0.0311 0.0312 0.0449 0.0726 | 5.16 4.59 4.78 4.30 4.58 4.76 | 0.000652 0.000776 0.00350 0.00351 0.00505 0.00817 | 0.000775 0.00349 0.00350 0.00803 | |
| 313.15 | 38.8 75.2 118 139 203 | 0.0093 0.0170 0.0291 0.0314 0.0470 | 5.48 5.82 5.34 5.82 5.68 | | 0.00105 0.00191 | |
| ' (760 r ¹ The uni | nmHg). ts of Henr | y's constant, (p ₁ /atm)/(m ₁ /m | k, are at | - | 93 for 101.325 | |
| | | AUXILIARY | INFORMATIO | | | |
| METHOD /APPARATUS | PROCEDURE . | | SOURCE ANI | D PURITY OF MA | TEDIAIC | |
| The method and Saylor (1) as al . (2). The | d apparatu modified main diff 2 day ins | erence is the tead of a 5 to | (1) Hydr from chlo | ogen chlori chemically ride and su | de. Prepared pure potassium lfuric acid. orus pentoxide | |
| The apparatus which are sepa solvent is par- the gas, and the lower bull partially evac and the whole | arated by rtially sa the soluti b. The bu cuated, th | a tap. The turated with on added to lbs are e tap opened, | calc ⁿ²⁰ , | 1.5420. | Stored over e and distilled | 1, |
| thermostat fro | | | ESTIMATED | ERROR: | | |
| The tap is cld upper bulb is and titrated up artial press the bulb volum moles of HCl a behavior. A u | quantitat with NaOH. Ire is cal- ne and the assuming i weighed so | ively removed The HCl culated from number of deal gas lution sample | J. A | or, J. H. m. Chem. So | c. <u>1937</u> , 59, 1 | 712. |
| is removed fro titrated with | | er bulb and | Zeur | cher, R. A. | Kenny, C. L. c. <u>1939</u> , 61, 2 | 504. |

| COMPONENTS : | ORIGINAL MEASUREMENTS: |
|--|---|
| <pre>(1) Hydrogen chloride; HCl; [7647-01-0]</pre> | Gerrard, W.; Mincer, A. M. A.; Wyvill, P. L. |
| (2) Chlorobenzene; C ₆ H ₅ Cl; [108-90-7] | J. Appl. Chem. <u>1959</u> , 9, 89 – 93. |
| | |
| VARIABLES: T/K: 273.15 - 315.15 | PREPARED BY: |
| Total P/kPa: 101.325 (1 atm) | W. Gerrard |
| | (smoothed data calculated by H.L. Clever) |
| EVDEDTAENTAL VALUES. | |
| EXPERIMENTAL VALUES: | |
| T/K Mol Ratio | |
| ⁿ HC1/ ⁿ C ₆ H ₅ C | l ^x HCl |
| | - <u></u> - |
| 273.15 0.0561 280.55 0.0498 | 0.0531 0.0474 |
| 288.15 0.0498 | 0.0392 |
| 298.55 0.0322 | 0.0312 |
| 307.35 0.0210 | 0.0206 |
| 315.15 0.0185 | 0.0182 |
| | |
| The mole fraction values were calculat | ted by the compiler. |
| Smoothed Data: $\ln x_{1101} = 97.858 - 130$ | 0.990/(T/100) - 52.571 ln (T/100) |
| | |
| Standard error about i | regression line = 1.63×10^{-3} |
| ······································ | |
| T/K Ma | ol Fraction |
| | ^x HCl |
| | |
| 273.15 | 0.0538 |
| 283.15 | 0.0442 |
| 293.15 303.15 | 0.0345 0.0258 |
| 313.15 | 0.0186 |
| 323.15 | 0.0130 |
| | |
| | |
| | |
| AUXILIARY | INFORMATION |
| METHOD/APPARATUS/PROCEDURE: | SOURCE AND PURITY OF MATERIALS: |
| The solvent was weighed in a bubbler | (1) Hydrogen chloride. Good specimen |
| tube. The amount of gas absorbed was | from a commercial cylinder was |
| determined by reweighing to constant | dried. |
| weight. The total pressure was barometric, very nearly 1 atm. | (2) Chlorobenzene. Carefully puri- |
| balometric, very hearry r atm. | fied, and purity rigorously |
| | attested. |
| | |
| | |
| | |
| | |
| | ESTIMATED ERROR: |
| | CONTRACTED BANDA: |
| | |
| | $\delta x/x = 0.01$ |
| | |
| | REFERENCES : |
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| | L |

| ORIGINAL MEASUREMENTS: Strepikheev, Yu. A.; Babkin, B. M. |
|--|
| Strepikheev, Yu. A.; Babkin, B. M. |
| |
| Khim. Prom_st (Moscow) <u>1963</u> , No. 1, 38 - 39. |
| PREPARED BY: W. Gerrard |
| raction x ₁ |
| 0.0320 (4 points) 0.0175 27 L9 D1 98 D.0060 L0 ne data are displayed in two diagrams. |
| g. 1 by the compiler. The figure shows a tmospheric) $vs. t/^{\circ}C$. The in- e due to the chlorobenzene is clearly boncave upward plot over the 333 to |
| Pressure Mol Fraction |
| $\frac{x_1}{50}$ $\frac{x_2}{0.29}$ |
| 0.24 0.22 0.17 0.155 |
| ler from Fig. 2 which shows a plot of for five isotherms from 443 to 523 K ginal paper.) |
| |
| INFORMATION |
| SOURCE AND PURITY OF MATERIALS: (1) Hydrogen chloride. Prepared by action of concentrated sulfuric acid on chemically pure sodium chloride, dried with calcium chlorides, and filtered through glass wool. |
| <pre>(2) Chlorobenzene. Dried over calcium chloride and distilled. B.p. (l atm)/°C = 132 ± 0.2.</pre> |
| For the high pressure measurements $\delta T/K = \pm 1$ $\delta p/atm = \pm 0.5$ |
| REFERENCES : |
| |

| COMPONENTS : | | ORIGINAL MEASUREMENTS: |
|--|--|--|
| | | |
| <pre>(1) Hydrogen chloride; HO [7647-01-0]</pre> | :1; | Wyrzykwoska-Stankiewicz, D.; Szafranski, A.; Kaminski, M. |
| (2) Chlorobenzene; C ₆ H ₅ C] [108-90-7] | .; | Bull. Acad. Polon. Sci., Ser. Sci. Chim. <u>1971</u> , 19, 199 - 205. |
| VARIABLES: K = 293.15 kPa = 20.265 - 10 (152 - 760 m) | | PREPARED BY: W. Gerrard |
| EXPERIMENTAL VALUES: | | |
| | lydrogen Mo Chloride 2 ₁ /mmHg | 1 Fraction x ₁ |
| 293.15 | 152 204 380 500 608 760 | 0.0059 0.0081 0.0151 0.0203 0.0248 0.0312 |
| | | |
| | AUXILIARY | INFORMATION |
| METHOD/APPARATUS/PROCEDURE: | | SOURCE AND PURITY OF MATERIALS: |
| The design of the equilib was stated to be based on method, or on the dynamic although each procedure w and diagram of each was d not clear which data were a particular method. The | the static method; and as described rawn, it is obtained by dynamic | (2) Chlorobenzene. Technical grade. |
| method required a bubble hydrogen chloride in a sa saturated solution was de titration with standard a presence of bromothymol b phenol red. | mple of the termined by lkali in the | B. p. $(755 \text{ mmHg})/C = 131.5;$ refractive index, $n_D^{20} = 1.5245;$ density $\rho_4^{20}/\text{g cm}^{-3} = 1.106.$ ESTIMATED ERROR: |
| method required a bubble hydrogen chloride in a sa saturated solution was de titration with standard a presence of bromothymol b | mple of the termined by lkali in the | |

| 304 Hydrogen Chlonde in | Non-Aqueous Solvents |
|---|--|
| COMPONENTS: | ORIGINAL MEASUREMENTS: |
| <pre>(1) Hydrogen chloride; HCl; [7647-01-0]</pre> | Zetkin, V. I.; Kosorotov, V. I.; Stul, B. Ya.; Dzhagatspanyan, R. V. |
| (2) Chlorobenzene; C ₆ H ₅ Cl; [108-90-7] | Khim. Prom. <u>1971</u> , 47, 102 - 103. |
| | Soviet Chem. Ind. <u>1971</u> , 3, 89 - 90. |
| | |
| VARIABLES: | PREPARED BY: |
| T/K = 283.15 - 333.15 p/kPa = 101.325 (1 atm) | W. Gerrard (smoothed data calculated by H.L. Clever) |
| EXPERIMENTAL VALUES: | |
| Temperature | |
| $t/^{\circ}C$ T/K | <u>x</u> |
| 10 283.15 | 0.0407 |
| | |
| 30 303.15 40 313.15 | 0.0269 0.0224 |
| 50 323.15 | 0.0178 |
| 60 333.15 | 0.0148 |
| The measurements were stated to be for | or atmospheric pressure |
| | |
| Smoothed Data: For use between 283.1 | L5 and 333.15 K. |
| $\ln x_{\tau} = 15.0758 - 17.0226/(T)$ | /100 K) - 11.7856 ln (T/100 K) |
| 1 | regression line is 2.51×10^{-4} . |
| | Mol Fraction |
| . 1/K | |
| | <i>x</i> |
| 283.15 | |
| 293.15 | 0.0332 |
| 298.15 | 0.0299 |
| 303.15 | 0.0270 |
| 313.15 323.15 | |
| 333.15 | 0.0180 0.0147 |
| | |
| | |
| AUXILIARY | INFORMATION |
| METHOD/APPARATUS/PROCEDURE: | SOURCE AND PURITY OF MATERIALS: |
| Gas absorbed at atmospheric pressure | |
| as described by Zetkin and Kosorotov | (1) Hydrogen chloride. Self prepared from sodium chloride and concen- |
| (1). The amount of gas absorbed | trated sulfuric acid. Dried |
| was determined by a chemical | with sulfuric acid. |
| titration. | (2) Chlorobenzene. Purity stated |
| The author's fitted the data to the | to be greater than 99%. Dried |
| linear equation | with calcium chloride. |
| $\log x_1 = -4.54 + 900/(T/K)$. | |
| However, the three constant equation | |
| above fits the data much better. The | ESTIMATED ERROR: |
| author's equation gives an enthalpy of solution of $-4.1 \text{ kcal mol}^{-1}$. | |
| - Joracron of -4.1 Koar mor . | |
| | |
| | REFERENCES: |
| | 1. Zetkin, V. I.; Kosorotov, V. I. |
| | <i>Zh. Fiz. Khim.</i> 1970, 44, 830. |
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|---|---|
| COMPONENTS: | ORIGINAL MEASUREMENTS: |
| <pre>(1) Hydrogen chloride; HC1; [7647-01-0]</pre> | Zetkin, V. I.; Kosorotov, V. I.; Stul, B. Ya.; Dzhagatspanyan, R. V. |
| (2) 1,2-Dichlorobenzene; C ₆ H ₄ Cl ₂ ; [95-50-1] | Khim. Prom. <u>1971</u> , 47, 102 - 103. |
| | Soviet Chem. Ind. <u>1971</u> , 3, 89 - 90. |
| VARIABLES: | PREPARED BY: |
| T/K = 288.15 - 333.15 | W. Gerrard |
| p/kPa = 101.325 (1 atm) | (smoothed data calculated by H.L. Clever) |
| | (smoothed data carculated by h.b. crever) |
| EXPERIMENTAL VALUES: Temperature | Mol Fraction |
| <i>t/</i> °C <i>T/</i> K | <i>x</i> ₁ |
| 15 288.15 | |
| 20 293.15 | |
| 30 303.15 | 0.0166 |
| 40 313.15 | |
| 50 323.15 60 333.15 | |
| | |
| The measurements were stated to be for | or atmospheric pressure. |
| Smoothed Data: For use between 288.] | .5 and 333.15 K. |
| $\ln x_{\star} = -42.6859 + 60.6173/(2)$ | 7/100 K) + 16.7806 ln (T/100 K) |
| 1 1 | regression line is 4.82×10^{-4} . |
| | |
| | ol Fraction |
| | <u>x</u> 1 |
| 288.15 | |
| 293.15 298.15 | 0.0191 0.0179 |
| 303.15 | 0.0179 |
| 313.15 | 0.0154 |
| 323.15 | 0.0143 |
| 333.15 | 0.0136 |
| | |
| | |
| AUXILIARY | INFORMATION |
| | |
| METHOD/APPARATUS/PROCEDURE: Gas absorbed at atmospheric pressure | SOURCE AND PURITY OF MATERIALS: (1) Hydrogen chloride. Self prepared |
| as described by Zetkin and Kosorotov | from sodium chloride and concen- |
| (1). The amount of gas absorbed was | trated sulfuric acid. Dried |
| determined by a chemical titration. | with sulfuric acid. |
| The author's fitted the data to the | (2) 1,2-Dichlorobenzene. Purity |
| linear equation | stated to be greater than 99%. |
| $\log x_1 = -2.86 + 330/(T/K)$ | Dried with calcium chloride. |
| 1 * | |
| However, the three constant equation above fits the data much better. | |
| The author's equation gives an | PETIMATED EDDODA |
| enthalpy of solution of -1.5 kcal | ESTIMATED ERROR: |
| mol ⁻¹ . | 1 |
| | |
| | REFERENCES : |
| | 1. Zetkin, V. I.; Kosorotov, V. I. |
| | <i>Zh. Fiz. Khim.</i> 1970, 44, 830. |
| | ,,, |
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|] |) |
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| COMPONENTS: | ORIGINAL MEASUREMENTS: | |
|--|---|--|
| <pre>(1) Hydrogen chloride; HCl; [7647-01-0]</pre> | Lavrova, E. M.; Tudorovskaya, G. L. Zh. Prikl. Khim. (Leningrad) <u>1977</u> , | |
| (2) 1,2-Dichlorobenzene; C ₆ H ₄ Cl ₂ ; [95-50-1] | 50, 2105 - 2106. J. Appl. Chem. USSR (Engl. Transl.) | |
| | <u>1977</u> , <i>50</i> , 2005 - 2006. | |
| VARIABLES: T/K = 293 - 438 | PREPARED BY: | |
| Total $p/kPa = 101.3$ (1 atm) | W. Gerrard (smoothed data calculated by H.L. Clever) | |
| EXPERIMENTAL VALUES: | | |
| Temperature Mol | Ratio ¹ Mol Fraction ² | |
| $\frac{t/^{\circ}C}{T/K}$ | $\frac{1^{n_2}}{2}$ $\frac{x_1}{2}$ | |
| 20 293 0.0224 | 6 0.0220 | |
| 40 313 0.0160 60 333 0.0129 | 000 [sic] 0.0157 7 0.0128 | |
| 80 353 0.0092 | | |
| 100 373 0.0090 | 10 0.00892 | |
| | | |
| 140 413 0.0062 165 438 0.0044 | | |
| | | |
| ¹ corrected by authors to $p_1 = 101.3$ k Smoothed Data: For use between 293 a $\ln x_1 = \pm 8.2612 + 12.$ | nd 438 K. | |
| 1 | regression line is 6.90×10^{-4} . | |
| | | |
| T/K | Mol Fraction | |
| 293 | $\frac{x_1}{0.0216}$ | |
| 313 | | |
| 333 | 0.0127 | |
| 353 | 0.0102 | |
| 373 | 0.0084 | |
| 393 413 | 0.0070 0.0060 | |
| 413 | 0.0050 | |
| | INFORMATION | |
| | | |
| METHOD/APPARATUS/PROCEDURE: The gas was passed into the liquid in | SOURCE AND PURITY OF MATERIALS: | |
| a bubbler tube, to which a reflux condenser was fitted. The HCl con- tent in a sample of the saturated solution (p _{total} , 1 atm) was deter- | from sulfuric acid and chemically pure concentrated hydrochloric acid, and dried. | |
| mined by an acid-alkali titration. | <pre>(2) 1,2-Dichlorobenzene. Distilled. B.p. (l atm)/°C = 183.</pre> | |
| The compiler's smoothed data equation confirms the authors thermodynamic values for the enthalpy and entropy of dilution | | |
| $\Delta H/kcal mol^{-1} = -2.603$ | ESTIMATED ERROR: | |
| $\Delta S/cal K^{-1} mol^{-1} = -16.464$ | 1 | |
| However the signs in the authors smoothed data equation appear to be reversed and the calculated values of mol mol^{-1} and wt % of Table 1 | REFERENCES : | |
| appear to be in error. | | |
| L | | |

| | Non-Aqueous Solvents 307 |
|---|--|
| COMPONENTS: | ORIGINAL MEASUREMENTS: |
| <pre>(1) Hydrogen chloride; HCl; [7647-01-0]</pre> | Zetkin, V. I.; Kosorotov, V. I.; Stul, B. Ya.; Dzhagatspanyan, R. V. |
| (2) 1,2,4-Trichlorobenzene; C ₆ H ₃ Cl ₃ ; [120-82-1] | Khim. Prom_st. (Moscow) <u>1971</u> , 47, 102 - 103. |
| | Sov. Chem. Ind. (Engl. Transl.) <u>1971</u> , 3, 89 - 90. |
| VARIABLES: $T/K = 288.15 - 333.15$ | PREPARED BY: |
| p/kPa = 101.325 (1 atm) | W. Gerrard |
| | (smoothed data calculated by H.L. Clever) |
| EXPERIMENTAL VALUES: Temperature | Mol Fraction |
| $t/^{\circ}C$ T/K | |
| $\frac{27-6}{15} = \frac{17}{288.15}$ | 0.0301 |
| 20 293.15 | 0.0251 |
| 30 303.15 40 313.15 | |
| 40 313.15 50 323.15 | 0.0151 0.0141 |
| 60 333.15 | 0.0117 |
| The measurements were stated to be for | or atmospheric pressure. |
| | |
| Smoothed Data: For use between 288.] | |
| 1 - | (T/100 K) + 48.4095 ln (T/100 K) |
| | regression line is 6.35 x 10 ⁻⁴ . |
| | Nol Fraction |
| | <u>x</u> |
| 288.15 293.15 | 0.0298 0.0251 |
| 298.15 | 0.0217 |
| 303.15 | 0.0190 |
| 313.15 323.15 | 0.0154 0.0133 |
| 333.15 | 0.0120 |
| | |
| | |
| AUXILIARY | INFORMATION |
| METHOD/APPARATUS/PROCEDURE: | SOURCE AND PURITY OF MATERIALS: |
| Gas absorbed at atmospheric pressure as described by Zetkin and Kosorotov | (1) Hydrogen chloride. Self prepared |
| (1). The amount of gas absorbed was | from sodium chloride and concen- trated sulfuric acid. Dried |
| determined by a chemical titration. | with sulfuric acid. |
| The author's fitted the data to the | (2) 1,2,4-Trichlorobenzene. Purity |
| linear equation | stated to be greater than 99%. |
| $\log x_1 = -4.83 + 940/(T/K)$. | Dried with calcium chloride. |
| However, the three constant equation above fits the data much better. The | |
| author's equation gives an enthalpy | ESTIMATED ERROR: |
| of solution of -4.4 kcal mol ⁻¹ . | 1 |
| | |
| | |
| 1 | REFERENCES: |
| | 1. Zetkin, V. I.; Kosorotov, V. I. <i>2h. Fiz. Khim.</i> <u>1970</u> , <i>44</i> , 830. |
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Hydrogen Chloride in Non-Aqueous Solvents

| COMPONENTS : | ORIGINAL MEASUREMENTS: |
|---|---|
| <pre>(1) Hydrogen chloride; HCl; [7647-01-0]</pre> | Gerrard, W.; Mincer, A. M. A.; Wyvill, P. L. |
| (2) (Trichloromethyl) benzene; C ₇ H ₅ Cl ₃ ; [98-07-7] | J. Appl. Chem. <u>1959</u> , 9, 89-93. |
| | |
| VARIABLES: | PREPARED BY: |
| T/K: 273.65 - 315.95 | W. Gerrard |
| Total P/kPa: 101.325 (l atm) | (smoothed data calculated by H.L. Clever) |
| | 1 |
| EXPERIMENTAL VALUES: | |
| | Mol Fraction |
| ⁿ HCl/ ⁿ C7 ^H 5 | с1 ₃ ^ж нс1 |
| 273.65 0.0751 | |
| 279.15 0.0664 | |
| 285.15 0.0600 | 0.0566 |
| 293.75 0.0465 | |
| 294.85 0.0457 303.65 0.0340 | |
| 315.95 0.0275 | |
| The mole fraction values were calcula | |
| | |
| Smoothed Data: $\ln x_{HC1} = 20.018 - 22$ | 2.099/(T/100) - 14.488 ln (T/100) |
| Standard error about | regression line = 1.75×10^{-3} |
| Scandard error about | $10 = 1.75 \times 10$ |
| | Mol Fraction |
| 1/1. | ^x HCl |
| | HCI |
| 273.15 | 0.0720 |
| 283.15 293.15 | 0.0569 |
| 293.15 | 0.0449 |
| 303.15 313.15 | 0.0354 |
| 313.15 323.15 | 0.0280 0.0221 |
| | |
| | |
| AUXILIARY | INFORMATION |
| METHOD/APPARATUS/PROCEDURE: | SOURCE AND PURITY OF MATERIALS: |
| The solvent was weighed in a bubbler | (1) Hydrogen chloride. Good specimen |
| tube. The amount of gas absorbed was | |
| determined by reweighing to constant | dried. |
| weight. The total pressure was | |
| barometric, very nearly 1 atm. | (2) (Trichloromethyl) benzene. Care- |
| | fully purified, and purity rigorously attested. |
| | rigorousry accested. |
| | |
| | |
| | |
| | ESTIMATED ERROR: |
| | |
| | $\delta x/x = 0.03$ |
| | |
| | REFERENCES: |
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| f | 1 |
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| OPTOTNAL MEASUREMENTS . |
|--|
| ORIGINAL MEASUREMENTS: |
| Bell, R. P. |
| J. Chem. Soc. <u>1931</u> , 1371 - 1382. |
| |
| PREPARED BY: W. Gerrard |
| 1 <u></u> |
| on Mol Fraction |
| .ent " |
| x1 |
| 0.0305 |
| centration at $p_{1} = 1$ atm |
| - |
| n/V = p/RT = 0.0417. |
| |
| INFORMATION |
| SOURCE AND PURITY OF MATERIALS: |
| (1) Hydrogen chloride. Prepared by dropping pure concentrated hydrochloric acid into pure sulfuric acid. (2) Bromobenzene. Good specimen was dried over calcium chloride, and distilled. Boiling point is given in paper. |
| |
| ESTIMATED ERROR: $\delta T/K = 0.01$ $\delta c/c = 0.01$ |
| REFERENCES : |
| |
| |

| COMPONENTS: (1) Hydrogen chloride; HCl; | | | |
|---|--|--|--|
| () Hydroden chioride, HCL, | | MEASUREMENTS: | |
| | O'Brien, | S. J.; Byr | ne, J. B. |
| [7647-01-0] | J. Am. Chem. Soc. 1940, 62, | | |
| (2) Bromobenzene; C ₆ H ₅ Br; | 2063 - 2 | | <u>, , , , , , , , , , , , , , , , , , , </u> |
| [108-86-1] | | | |
| | 1 | | |
| | | | |
| | | | |
| VARIABLES: | PREPARED | BY: | |
| T/K: 298.15 | | | - |
| P/kPa: 7.09 - 38.71 | 1 | W. Gerr | ard |
| (53.2 - 290 mmHg) | | | |
| EXPERIMENTAL VALUES: | | | |
| | Henry's | Mol Ratio | Mol Fraction |
| | Constant | n_1/n_2 | <i>x</i> ₁ |
| p ₁ /mmHg m ₁ /mol kg ⁻¹ | k ¹ | 1, 2 | 1 |
| | E 25 | 0.00206 | 0.00205 |
| 298.15 53.2 0.0131 110 0.0272 | 5.35 5.30 | 0.00427 | 0.00425 |
| 116 0.0272 | 5.51 | 0.00436 | 0.00435 |
| 128 0.0328 | 5.12 | 0.00515 | 0.00512 |
| 134 0.0346 | 5.11 | 0.00543 | 0.00540 |
| 189 0.0447 | 5.57 | 0.00702 | 0.00700 |
| 290 0.0686 | 5.56 | 0.0108 | 0.0107 |
| | | | • |
| (760 0.185 | 5.40 | 0.0291 | $0.0283)^{2}$ |
| | | | |
| ¹ k/atm mol ⁻¹ kg = $(p_1/atm)/(m_1/m_1)$ | $(01 ka^{-1})$ | | |
| ² Value calculated by the compile | | | |
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| AUXILIARY | INFORMATIC | DN | |
| AUXILIARY METHOD/APPARATUS/PROCEDURE: | | DN D PURITY OF MA | ATERIALS : |
| METHOD/APPARATUS/PROCEDURE: | SOURCE AN | D PURITY OF MA | |
| · · · · · · · · · · · · · · · · · · · | SOURCE AN (1) Hydi cher | D PURITY OF MA rogen chlori nically pure | de. Prepared from potassium |
| METHOD/APPARATUS/PROCEDURE: The method and apparatus are those of Saylor (1) as modified by O'Brien et al. (2). The main difference is the | SOURCE AN (1) Hydd cher chlo | D PURITY OF MA rogen chlori nically pure oride and su | de. Prepared from potassium lfuric acid. |
| METHOD/APPARATUS/PROCEDURE: The method and apparatus are those of Saylor (1) as modified by O'Brien et al. (2). The main difference is the use of a 1 to 2 day instead of a 5 to | SOURCE AN (1) Hydd cher chlo | D PURITY OF MA rogen chlori nically pure oride and su | de. Prepared from potassium |
| METHOD/APPARATUS/PROCEDURE: The method and apparatus are those of Saylor (1) as modified by O'Brien et al. (2). The main difference is the | SOURCE AN (1) Hydi cher chlo Drie | D PURITY OF MA rogen chlori mically pure oride and su ed by phosph | de. Prepared from potassium llfuric acid. Norus pentoxide. |
| METHOD/APPARATUS/PROCEDURE: The method and apparatus are those of Saylor (1) as modified by O'Brien et al. (2). The main difference is the use of a 1 to 2 day instead of a 5 to 7 day equilibration time. | SOURCE AN (1) Hydi cher chlo Drie (2) Bron | D PURITY OF MA rogen chlori nically pure oride and su ed by phosph mobenzene. | de. Prepared from potassium llfuric acid. lorus pentoxide. Eastman Kodak Co. |
| METHOD/APPARATUS/PROCEDURE: The method and apparatus are those of Saylor (1) as modified by O'Brien et al. (2). The main difference is the use of a 1 to 2 day instead of a 5 to 7 day equilibration time. The apparatus consists of two bulbs | SOURCE AN (1) Hydi cher chlo Drie (2) Bron Atte | D PURITY OF MA rogen chlori nically pure oride and su ed by phosph mobenzene. ested by ref | de. Prepared from potassium llfuric acid. Norus pentoxide. |
| METHOD/APPARATUS/PROCEDURE: The method and apparatus are those of Saylor (1) as modified by O'Brien et al. (2). The main difference is the use of a 1 to 2 day instead of a 5 to 7 day equilibration time. The apparatus consists of two bulbs which are separated by a tap. The | SOURCE AN (1) Hydi cher chlo Drie (2) Bron Atte | D PURITY OF MA rogen chlori nically pure oride and su ed by phosph mobenzene. | de. Prepared from potassium llfuric acid. lorus pentoxide. Eastman Kodak Co. |
| METHOD/APPARATUS/PROCEDURE: The method and apparatus are those of Saylor (1) as modified by O'Brien et al. (2). The main difference is the use of a 1 to 2 day instead of a 5 to 7 day equilibration time. The apparatus consists of two bulbs which are separated by a tap. The solvent is partially saturated with | SOURCE AN (1) Hydi cher chlo Drie (2) Bron Atte | D PURITY OF MA rogen chlori nically pure oride and su ed by phosph mobenzene. ested by ref | de. Prepared from potassium llfuric acid. lorus pentoxide. Eastman Kodak Co. |
| METHOD/APPARATUS/PROCEDURE: The method and apparatus are those of Saylor (1) as modified by O'Brien et al. (2). The main difference is the use of a 1 to 2 day instead of a 5 to 7 day equilibration time. The apparatus consists of two bulbs which are separated by a tap. The | SOURCE AN (1) Hydi cher chlo Drie (2) Bron Atte | D PURITY OF MA rogen chlori nically pure oride and su ed by phosph mobenzene. ested by ref | de. Prepared from potassium llfuric acid. lorus pentoxide. Eastman Kodak Co. |
| METHOD/APPARATUS/PROCEDURE: The method and apparatus are those of Saylor (1) as modified by O'Brien et al. (2). The main difference is the use of a 1 to 2 day instead of a 5 to 7 day equilibration time. The apparatus consists of two bulbs which are separated by a tap. The solvent is partially saturated with the gas, and the solution added to | SOURCE AN (1) Hydi cher chlo Drie (2) Bron Atte | D PURITY OF MA rogen chlori nically pure oride and su ed by phosph mobenzene. ested by ref | de. Prepared from potassium llfuric acid. lorus pentoxide. Eastman Kodak Co. |
| METHOD/APPARATUS/PROCEDURE: The method and apparatus are those of Saylor (1) as modified by O'Brien et al. (2). The main difference is the use of a 1 to 2 day instead of a 5 to 7 day equilibration time. The apparatus consists of two bulbs which are separated by a tap. The solvent is partially saturated with the gas, and the solution added to the lower bulb. The bulbs are partially evacuated, the tap opened, and the whole apparatus put in a | SOURCE AN (1) Hydi cher chlo Drie (2) Bron Atte n D | D PURITY OF MA rogen chlori nically pure oride and su ed by phosph nobenzene. ested by ref , 1.3741. | de. Prepared from potassium llfuric acid. lorus pentoxide. Eastman Kodak Co. |
| METHOD/APPARATUS/PROCEDURE: The method and apparatus are those of Saylor (1) as modified by O'Brien et al. (2). The main difference is the use of a 1 to 2 day instead of a 5 to 7 day equilibration time. The apparatus consists of two bulbs which are separated by a tap. The solvent is partially saturated with the gas, and the solution added to the lower bulb. The bulbs are partially evacuated, the tap opened, | SOURCE AN (1) Hydi cher chlo Drie (2) Bron Atte | D PURITY OF MA rogen chlori nically pure oride and su ed by phosph nobenzene. ested by ref , 1.3741. | de. Prepared from potassium llfuric acid. lorus pentoxide. Eastman Kodak Co. |
| METHOD/APPARATUS/PROCEDURE: The method and apparatus are those of Saylor (1) as modified by O'Brien et a7. (2). The main difference is the use of a 1 to 2 day instead of a 5 to 7 day equilibration time. The apparatus consists of two bulbs which are separated by a tap. The solvent is partially saturated with the gas, and the solution added to the lower bulb. The bulbs are partially evacuated, the tap opened, and the whole apparatus put in a thermostat from 1 to 2 days. | SOURCE AN (1) Hydi cher chlo Drie (2) Bron Atte n D | D PURITY OF MA rogen chlori nically pure oride and su ed by phosph mobenzene. ested by ref , 1.3741. | de. Prepared from potassium alfuric acid. orus pentoxide. Eastman Kodak Co. fractive index, |
| METHOD/APPARATUS/PROCEDURE: The method and apparatus are those of Saylor (1) as modified by O'Brien et al. (2). The main difference is the use of a 1 to 2 day instead of a 5 to 7 day equilibration time. The apparatus consists of two bulbs which are separated by a tap. The solvent is partially saturated with the gas, and the solution added to the lower bulb. The bulbs are partially evacuated, the tap opened, and the whole apparatus put in a thermostat from 1 to 2 days. The tap is closed. The HCl in the | SOURCE AN (1) Hydi cher chlo Drie (2) Bron Atte n D | D PURITY OF MA rogen chlori nically pure oride and su ed by phosph nobenzene. ested by ref , 1.3741. | de. Prepared from potassium alfuric acid. orus pentoxide. Eastman Kodak Co. fractive index, |
| METHOD/APPARATUS/PROCEDURE: The method and apparatus are those of Saylor (1) as modified by O'Brien et al. (2). The main difference is the use of a 1 to 2 day instead of a 5 to 7 day equilibration time. The apparatus consists of two bulbs which are separated by a tap. The solvent is partially saturated with the gas, and the solution added to the lower bulb. The bulbs are partially evacuated, the tap opened, and the whole apparatus put in a thermostat from 1 to 2 days. The tap is closed. The HCl in the upper bulb is quantitatively removed | SOURCE AN (1) Hydi cher chlo Drie (2) Bron Atte n D | D PURITY OF MA rogen chlori nically pure oride and su ed by phosph mobenzene. ested by ref , 1.3741. | de. Prepared from potassium alfuric acid. orus pentoxide. Eastman Kodak Co. fractive index, |
| METHOD/APPARATUS/PROCEDURE: The method and apparatus are those of Saylor (1) as modified by O'Brien et al. (2). The main difference is the use of a 1 to 2 day instead of a 5 to 7 day equilibration time. The apparatus consists of two bulbs which are separated by a tap. The solvent is partially saturated with the gas, and the solution added to the lower bulb. The bulbs are partially evacuated, the tap opened, and the whole apparatus put in a thermostat from 1 to 2 days. The tap is closed. The HCl in the upper bulb is quantitatively removed and titrated with NaOH. The HCl | SOURCE AN (1) Hydi cher chlo Drie (2) Bron Atte n D | D PURITY OF MA rogen chlori nically pure oride and su ed by phosph mobenzene. ested by ref , 1.3741. D ERROR: $\delta T/K = 0$ | de. Prepared from potassium alfuric acid. orus pentoxide. Eastman Kodak Co. fractive index, |
| METHOD/APPARATUS/PROCEDURE: The method and apparatus are those of Saylor (1) as modified by O'Brien et al. (2). The main difference is the use of a 1 to 2 day instead of a 5 to 7 day equilibration time. The apparatus consists of two bulbs which are separated by a tap. The solvent is partially saturated with the gas, and the solution added to the lower bulb. The bulbs are partially evacuated, the tap opened, and the whole apparatus put in a thermostat from 1 to 2 days. The tap is closed. The HCl in the upper bulb is quantitatively removed and titrated with NaOH. The HCl partial pressure is calculated from | SOURCE AN (1) Hydd cher chlo Drie (2) Bron Atte n ² 0 D ESTIMATER | D PURITY OF MA rogen chlori nically pure oride and su ed by phosph mobenzene. ested by ref , 1.3741. D ERROR: &T/K = 0 | de. Prepared from potassium alfuric acid. orus pentoxide. Eastman Kodak Co. fractive index, |
| METHOD/APPARATUS/PROCEDURE: The method and apparatus are those of Saylor (1) as modified by O'Brien et al. (2). The main difference is the use of a 1 to 2 day instead of a 5 to 7 day equilibration time. The apparatus consists of two bulbs which are separated by a tap. The solvent is partially saturated with the gas, and the solution added to the lower bulb. The bulbs are partially evacuated, the tap opened, and the whole apparatus put in a thermostat from 1 to 2 days. The tap is closed. The HCl in the upper bulb is quantitatively removed and titrated with NaOH. The HCl partial pressure is calculated from the bulb volume and the number of | SOURCE AN (1) Hydi cher chlc Dric (2) Bron Atte n ² 0 D ESTIMATER REFERENCE 1. Say | D PURITY OF MA rogen chlori nically pure bride and su ed by phosph mobenzene. ested by ref , 1.3741. D ERROR: $\delta T/K = 0$ CS: lor, J. H. | de. Prepared from e potassium llfuric acid. orus pentoxide. Eastman Kodak Co. Fractive index, |
| METHOD/APPARATUS/PROCEDURE: The method and apparatus are those of Saylor (1) as modified by O'Brien et al. (2). The main difference is the use of a 1 to 2 day instead of a 5 to 7 day equilibration time. The apparatus consists of two bulbs which are separated by a tap. The solvent is partially saturated with the gas, and the solution added to the lower bulb. The bulbs are partially evacuated, the tap opened, and the whole apparatus put in a thermostat from 1 to 2 days. The tap is closed. The HCl in the upper bulb is quantitatively removed and titrated with NaOH. The HCl partial pressure is calculated from the bulb volume and the number of moles of HCl assuming ideal gas | SOURCE AN (1) Hydi cher chlc Dric (2) Bron Atte n ² 0 D ESTIMATER REFERENCE 1. Say | D PURITY OF MA rogen chlori nically pure bride and su ed by phosph mobenzene. ested by ref , 1.3741. D ERROR: $\delta T/K = 0$ CS: lor, J. H. | de. Prepared from potassium alfuric acid. orus pentoxide. Eastman Kodak Co. fractive index, |
| METHOD/APPARATUS/PROCEDURE: The method and apparatus are those of Saylor (1) as modified by O'Brien et al. (2). The main difference is the use of a 1 to 2 day instead of a 5 to 7 day equilibration time. The apparatus consists of two bulbs which are separated by a tap. The solvent is partially saturated with the gas, and the solution added to the lower bulb. The bulbs are partially evacuated, the tap opened, and the whole apparatus put in a thermostat from 1 to 2 days. The tap is closed. The HCl in the upper bulb is quantitatively removed and titrated with NaOH. The HCl partial pressure is calculated from the bulb volume and the number of | SOURCE AN (1) Hydd cher chla Dria (2) Bron Atta n ² 0 D ESTIMATEL REFERENCH 1. Say | D PURITY OF MA rogen chlori nically pure bride and su ed by phosph mobenzene. ested by ref , 1.3741. D ERROR: $\delta T/K = 0$ ES: lor, J. H. Am. Chem. Sc | de. Prepared from e potassium llfuric acid. orus pentoxide. Eastman Kodak Co. Fractive index, |
| METHOD/APPARATUS/PROCEDURE: The method and apparatus are those of Saylor (1) as modified by O'Brien et al. (2). The main difference is the use of a 1 to 2 day instead of a 5 to 7 day equilibration time. The apparatus consists of two bulbs which are separated by a tap. The solvent is partially saturated with the gas, and the solution added to the lower bulb. The bulbs are partially evacuated, the tap opened, and the whole apparatus put in a thermostat from 1 to 2 days. The tap is closed. The HCl in the upper bulb is quantitatively removed and titrated with NaOH. The HCl partial pressure is calculated from the bulb volume and the number of moles of HCl assuming ideal gas behavior. A weighed solution sample | SOURCE AN (1) Hydd cher chlo Drie (2) Bron Atte n ² 0 n D ESTIMATEL REFERENCH 1. Say J. A 2. O'B: Zeux | D PURITY OF MA rogen chlori nically pure pride and su ed by phosph nobenzene. ested by ref , 1.3741. D ERROR: &T/K = 0 ES: lor, J. H. Am. Chem. Sc rien, S. J.; rcher, R. A. | de. Prepared from potassium lfuric acid. norus pentoxide. Eastman Kodak Co. ractive index, 0.02 0.02 Market State Stat |
| METHOD/APPARATUS/PROCEDURE: The method and apparatus are those of Saylor (1) as modified by O'Brien et al. (2). The main difference is the use of a 1 to 2 day instead of a 5 to 7 day equilibration time. The apparatus consists of two bulbs which are separated by a tap. The solvent is partially saturated with the gas, and the solution added to the lower bulb. The bulbs are partially evacuated, the tap opened, and the whole apparatus put in a thermostat from 1 to 2 days. The tap is closed. The HCl in the upper bulb is quantitatively removed and titrated with NaOH. The HCl partial pressure is calculated from the bulb volume and the number of moles of HCl assuming ideal gas behavior. A weighed solution sample is removed from the lower bulb and | SOURCE AN (1) Hydd cher chlo Drie (2) Bron Atte n ² 0 n D ESTIMATEL REFERENCH 1. Say J. A 2. O'B: Zeux | D PURITY OF MA rogen chlori nically pure pride and su ed by phosph nobenzene. ested by ref , 1.3741. D ERROR: &T/K = 0 ES: lor, J. H. Am. Chem. Sc rien, S. J.; rcher, R. A. | de. Prepared from potassium lfuric acid. sorus pentoxide. Eastman Kodak Co. ractive index, 0.02 0.02 0.02 Kenny, C. L. |

| | 311 |
|--|--|
| COMPONENTS: | ORIGINAL MEASUREMENTS: |
| <pre>(1) Hydrogen chloride; HCl; [7647-01-0]</pre> | Gerrard, W.; Mincer, A. M. A.; Wyvill, P. L. |
| (2) Bromobenzene; C ₆ H ₅ Br; [108-86-1] | J. Appl. Chem. <u>1959</u> , 9, 89 - 93. |
| VARIABLES: | PREPARED BY: |
| T/K: 273.45 - 316.75 | |
| Total P/kPa: 101.325 (1 atm) | W. Gerrard |
| | (smoothed data calculated by H.L. Clever) |
| EXPERIMENTAL VALUES: | |
| T/K Mol Ratio | Mol Fraction |
| n _{HCl} /n _{C6} H ₅ Br | *HC1 |
| 273.45 0.0545 | 0.0517 |
| 279.55 0.0469 | 0.0448 |
| 287.15 0.0384 | 0.0370 |
| 296.95 0.0313 | 0.0303 |
| 306.15 0.0228 | 0.0223 0.0149 |
| 316.75 0.0151 | 0.0149 |
| | $\frac{49.228}{(T/100)} = 58.997 \text{ In } (T/100)$ regression line = 1.15 x 10 ⁻³ |
| 1/K -4 | ^x HCl |
| 273.15 | 0.0510 |
| 283.15 | 0.0421 |
| 293.15 303.15 | 0.0328 0.0243 |
| 313.15 | 0.0172 |
| 323.15 | 0.0118 |
| | |
| The mole fraction values were calcula | ted by the compiler. |
| AUXILIARY | INFORMATION |
| METHOD/APPARATUS/PROCEDURE: | SOURCE AND PURITY OF MATERIALS: |
| The solvent was weighed in a bubbler tube. The amount of gas absorbed was determined by reweighing to constant weight. The total pressure was | Hydrogen chloride. Good specimen from a commercial cylinder was dried. |
| barometric, very nearly 1 atm. | (2) Bromobenzene. Carefully purified, and purity rigorously attested. |
| | |
| | ESTIMATED ERROR: |
| | $\delta x/x = 0.02$ |
| | |
| | REFERENCES: |
| | |
| | |
| | |

| COMPONENTS: (1) Hydrogen chloride; HCl; [7647-01-0] | ORIGINAL MEASUREMENTS: O'Brien, S. J.; Byrne, J. B. | | |
|--|---|--|--|
| (2) Iodobenzene; C ₆ H ₅ I; [591-50-4] | J. Am. Chem. Soc. <u>1940</u> , 62, 2063 - 2065. | | |
| | | | |
| | | | |
| VARIABLES: T/K: 298.15 | PREPARED BY: | | |
| P/kPa: 5.57 - 34.96 (41.8 - 262 mmHg) | W. Gerrard | | |
| EXPERIMENTAL VALUES: | | | |
| | Henry's Mol Ratio Mol Fraction | | |
| - · · · · | Constant n_1/n_2 x_1 | | |
| 298.15 41.8 0.0064 | 8.56 0.00131 | | |
| 71.8 0.0118 | 8.47 0.00241 | | |
| 85.8 0.0133 | 8.48 0.00271 8.82 0.00343 | | |
| 113 0.0168 164 0.0247 | 8.82 0.00343 8.75 0.00504 0.00504 | | |
| 262 0.0403 | 8.56 0.0082 0.0082 | | |
| (760 0.117 | 8.58 av. 0.0238 $0.0232)^2$ | | |
| 1 k/atm mol ⁻¹ kg = $(p_{1}/atm)/(m_{1}/m_{2})$ | | | |
| | from the average value of Henry's | | |
| at one atm (101.325 kPa). Note: Iodobenzene was incorrectly named bromobenzene in the original paper. | | | |
| AUXILIARY | INFORMATION | | |
| METHOD / APPARATUS / PROCEDURE : | SOURCE AND PURITY OF MATERIALS: | | |
| | Hydrogen chloride. Prepared from chemically pure potassium chloride and sulfuric acid. | | |
| The apparatus consists of two bulbs which are separated by a tap. The solvent is partially saturated with the gas, and the solution added to the lower bulb. The bulbs are partially evacuated, the tap opened, | (2) Iodobenzene. Eastman Kodak Co. Attested by refractive index, n ²⁰ _D , 1.6192. | | |
| and the whole apparatus put in a thermostat from 1 to 2 days. | ESTIMATED ERROR: | | |
| The tap is closed. The HCl in the upper bulb is quantitatively removed and titrated with NaOH. The HCl | δT/K = 0.02 | | |
| partial pressure is calculated from the bulb volume and the number of moles of HCl assuming ideal gas behavior. A weighed solution sample is removed from the lower bulb and titrated with NaOH. | <pre>REFERENCES: 1. Saylor, J. H. J. Am. Chem. Soc. 1937, 59, 1712. 2. O'Brien, S. J.; Kenny, C. L. Zeurcher, R. A.</pre> | | |
| | J. Am. Chem. Soc. <u>1939</u> , 61, 2504. | | |

| COMPONENTS:ORIGINAL MEASUREMENTS:1. Hydrogen Chloride; HCl; [7647-01-0]Ahmed, W.2. Benzoyl Chloride; C7H5ClO;Thesis, 1970 University of London | |
|--|-------|
| [7647-01-0] 2. Benzoyl Chloride; C ₇ H ₅ ClO; University of London | |
| 2. Benzoyl Chloride; C ₇ H ₅ ClO; Thesis, 1970 University of London | |
| 2. Benzoyl Chloride; C ₇ H ₅ ClO; University of London | |
| | |
| | |
| [98-88-4] | |
| | |
| | |
| VARIABLES: PREPARED BY: | |
| T/K: 253.15 - 293.15 W. Gerrard | |
| 10tal P/KPa: 101.325 (1 atm) | |
| (smoothed data calculated by H.L. Clever | , |
| EXPERIMENTAL VALUES: | |
| T/K Mol Ratio Mol Fraction | |
| ⁿ HC1/ ⁿ C7H5C10 ^X HC1 | |
| | |
| 253.15 0.200 0.167 | |
| 258.15 0.172 0.147 | |
| | |
| 268.15 0.117 0.105 273.15 0.098 0.089 | |
| 278.15 0.090 0.083 | |
| 283.15 0.080 0.074 | |
| 288.15 0.072 0.067 | |
| 293.15 0.067 0.063 | |
| | |
| The mole fraction solubilities were calculated from the mole ratio by the compiler. | Э |
| - | |
| Smoothed Data: $\ln X_{HC1} = -65.829 + 95.702/(T/100) + 28.273 \ln (T/100)$ | |
| Standard Error About Regression Line = 3.05×10^{-3} | |
| | |
| T/K Mol Fraction | |
| x _{HC1} | |
| | |
| 253.15 0.171 | |
| 263.15 0.122 | |
| 273.15 0.0923 | |
| 283.15 0.0740 293.15 0.0624 | |
| | |
| | |
| AUXILIARY INFORMATION | |
| | |
| METHOD/APPARATUS/PROCEDURE: SOURCE AND PURITY OF MATERIALS: | |
| Hydrogen chloride was passed into the 1. Hydrogen chloride. Good qualit | |
| weighed amount of benzoyl chloride in gas was obtained from a cylinde | er. |
| a bubbler tube, as described in the It was passed through concen- | |
| main paper (1). For temperatures trated sulfuric acid and calciu below 268 K the final mixture was chloride. | ım |
| below 268 K the final mixture was chloride. quantitatively treated with water and | |
| the total chloride was estimated by 2. Benzoyl chloride. The best | |
| titration. specimen was purified and | |
| attested. | |
| | |
| | |
| | |
| ESTIMATED ERROR: | |
| $\delta T/K = 0.2$ | |
| $\delta x_1 / x_1 = 0.02$ | |
| | |
| REFERENCES : | |
| | |
| <pre>1. Ahmed, W.; Gerrard, W.; Maladkar, V. K.</pre> | |
| J. Appl. Chem. <u>1970</u> , 20, 109. | |
| | |
| | |
| | |
| | |

| COMPONENTS: | EVALUATOR: |
|---|--|
| Hydrogen Chloride; HCl; | Peter G. T. Fogg |
| [7647-01-0] | Department of Applied Chemistry and Life Sciences, |
| 2. Solvents Containing Nitrogen | Polytechnic of North London, Holloway, London, N7 8DB, U.K. |
| | January 1989 |

CRITICAL EVALUATION:

Solubility of Hydrogen Chloride in Solvents Containing Nitrogen.

Solubility in nitrobenzene has been measured at barometric pressure over a temperature range by Zetkin *et al.*(1) and by Ahmed *et al.*(2). O'Brien (3) measured solubilities at various temperatures over a partial pressure range to 69.8 kPa. The evaluator has estimated solubilities at a partial pressure of 101.3 kPa from O'Brien's measurements by assuming that the change in mole fraction solubility with partial pressure can be approximated by an equation of the the Krichevskii-Il'inskaya type. The evaluator has also estimated mole fraction solubilities at a partial pressure of 101.3 kPa from mole fraction solubilities of total pressures of approximately 101.3 kPa published by Zetkin *et al.* and by Ahmed *et al.* Mole fraction solubilities at a partial pressure of 101.3 kPa not the three sources fit the equation:

 $\ln x_{HC1} = -39.613 + 3208.7/(T/K) + 4.5790 \ln (T/K)$

Standard deviation in values of $x_{\rm HC1} = 5.02 \times 10^{-3}$

The solubility of hydrogen chloride in nitrobenzene in the presence of water for partial pressures of gas up to 133.5 kPa at 298.15 K may be calculated from data published by Wynne-Jones (4). The mole fraction solubility for a partial pressure of 101.3 kPa has been estimated from these data by the evaluator to be 0.070. The value for solubility in dry nitrobenzene from the equation given above is 0.063 ± 0.005 . The presence of water may therefore have little effect on the solubility of hydrogen chloride in nitrobenzene.

Solubility in chloronitrobenzenes and dichloronitrobenzenes were measured by Zetkin $et \ al.(1)$ over temperature ranges. Measurements indicate that substitution of chlorine into the benzene nucleus reduces mole fraction solubility of hydrogen chloride as can be seen in the following table:

Mole fraction solubilities at $P_{HC1} = 101.3$ kPa

333.15 К 373.15 К

| Nitrobenzene (1) | 0.0332 | 0.0196 |
|-----------------------------|--------|--------|
| 1-Chloro-2-nitrobenzene | 0.0250 | 0.0150 |
| 1-Chloro-3-nitrobenzene | 0.0228 | 0.0140 |
| 1-Chloro-4-nitrobenzene | | 0.0175 |
| 1,2-Dichloro-4-nitrobenzene | 0.0206 | 0.0127 |
| 1,3-Dichloro-2-nitrobenzene | 0.0222 | 0.0112 |

Data presented by Zetkin are self-consistent and may be accepted on a tentative basis. No measurements by other workers on these chlorinated compounds are available for comparison.

O'Brien *et al.*(5) measured the solubility of hydrogen chloride over pressure ranges below barometric pressure in 1-methyl-2-nitrobenzene at 298.15 K and in 1-methyl-3-nitrobenzene at 298.15 K and 308.15 K. Mole fraction solubilities for partial pressures of 1.013 bar may be found by extrapolation of measurements at lower pressures. These are slightly higher than corresponding values for nitrobenzene itself as estimated from the smoothing equation given above.

| COMPONE | | EVALUATOR: |
|----------------|--|---|
| | lydrogen Chloride; HCl; 7647-01-0] | Peter G. T. Fogg Department of Applied Chemistry |
| L L | /04/-01-0] | and Life Sciences, |
| 2. 5 | Solvents Containing Nitrogen | Polytechnic of North London, |
| | | Holloway, London, N7 8DB, U.K. |
| | | January 1989 |
| CRITICAL | L EVALUATION: | |
| | Mole fraction solubilities a | $t P_{1} = 101.3 \text{ kPa}$ |
| | | |
| | | 298.15 К 308.15 К |
| | Nitrobenzene | 0.0632 0.0518 |
| | 1-Methyl-2-nitrobenzene 1-Methyl-3-nitrobenzene | 0.0719 0.0767 0.0618 |
| | -Methyl-3-hittobenzene | 0.0707 0.0018 |
| compa | | lnıtrobenzenes are avaılable for ted on a tentative basis until further |
| under | otov et al.(6) measured solubil barometric pressure in the tem owing compounds were studied: | ities in chlorinated methylpyridines perature range 333 K to 473 K. The |
| | 2-(trichloromethyl)pyridine | (A) |
| Į | 2-chloro-6-(trichloromethyl)pyr | |
| | 3,5-dichloro-2-(trichloromethyl 3,4,5-trichloro-2-(dichloromethy | |
| | | |
| | | concentrations except in the case of ted the mole ratio composition of |
| the " | thick pasty substance" which was | s formed. Solvents B, C & D, show a |
| | | mol dm ⁻³) with $1/(T/K)$. Solvent A out 423 K. Between 378 K and 423 K |
| there | is a marked decrease in the mo | lar concentration and mole fraction of |
| hydro | gen chloride. The mole fraction | n of hydrogen chloride in the "pasty |
| subst 393 K | ance at 378 K is 0.28. The mo | le fractions in the liquid phase at 4, 0.063, and 0.026, respectively. |
| This | decline is consistent with decre | easing stability of an ionic compound |
| from | the components. | |
| Molar | concentrations of hydrogen chlo | oride in the four solvents at the same |
| tempe | erature are in the order : $\mathbf{A} > 0$ | C = D > B. This is not in order of nes of B, C, and D are not available |
| | ole fraction solubilities cannot | |
| { | | - |
| | | ability of the measurements which may urther measurements are required for |
| | rmation of the data. | |
| | | |
| REFER | ENCES | |
| 1. | Zetkin, V. I.; Kolesnıkov, I. I | M.; Zakharov, E. V.: |
| | | om_st. (Moscow) <u>1966</u> , 42, (8), 624-626. |
| 2. | Abmed. W.: Gerrard, W.: Maladka | ar, V. K. J. Appl. Chem. <u>1970</u> , 20, |
| | 109-115. | 22, |
| 3. | O'Brien S. T. Kenny C. T. | Zeurcher, R. A. J. Am. Chem. Soc. |
| · · · | | S. J. J. Am. Chem. Soc. <u>1941</u> , 63, |
| | 2709-2712. | · · · |
| 4. | Wynne-Jones, V. F. K. J. Chem | . Soc. <u>1930</u> , 1064 - 1071. |
| | • | |
| 5. | O'Brien, S. J.; Kenny, C. L. C. O'Brien, S. J.; King, C. V. J. | J. Am. Chem. Soc. <u>1940</u> , 62, 1189–1192. . Am. Chem. Soc. <u>1949</u> , 71, 3632–3634. |
| E | | |
| 6. | Kosorotov, V. I.; Stul, B. Ya. Zh. Prikl. Khim. (Leningrad) 19 | 978, 51, 887-889; |
| | J. Appl. Chem. USSR <u>1978</u> , 51, 8 | 3858-860. |
| 1 | | |

| COMPONENTS : | ORIGINAL MEASUREMENTS: | | |
|--|--|--|--|
| <pre>(1) Hydrogen chloride; HCl; [7647-01-0]</pre> | Wynne-Jones, W. F. K. | | |
| (2) Nitrobenzene; C ₆ H ₅ NO ₂ ; [98-95-3] | J. Chem. Soc. <u>1930</u> , 1064 - 1071. | | |
| (3) Water; H ₂ O; [7732-18-5] | | | |
| VARIABLES: | PREPARED BY: | | |
| T/K: 298.15 | W. Gerrard | | |
| $p_1/kPa: 0.404 - 133.3$ (3.03 - 1000 mmHg) | | | |
| EXPERIMENTAL VALUES: | | | |
| T/K Pressure' Water Phase Nit | robenzene HCl Activity Mole Phase Fraction ² | | |
| $p_1/mmHg \qquad m_1/mol kg^{-1} \qquad m_1$ | /mol kg ⁻¹ $10^{-5}a_1$ x_1 | | |
| 298.15 3.03 9.635 | 0.0027 0.0828 0.000332 | | |
| | 0.0029 0.0912 0.000357 | | |
| 8.8/ 11.14/ 12.13 ³ 11.61 | 0.0080 0.242 0.000983 0.0109 0.331 0.00134 | | |
| 26.4 12.84 | 0.0229 0.721 0.00281 | | |
| 48.7 13.84 86.8 14.84 | 0.0396 1.33 0.00485 | | |
| 86.8 14.84 | 0.0707 2.37 0.00862 | | |
| | 0.0773 2.77 0.00942 0.0833 2.93 0.0101 | | |
| | 0.164 5.70 0.0198 | | |
| 303.4 17.19 | 0.223 8.28 0.0267 | | |
| 388. 17.76 | | | |
| 436. 18.05 | 0.292 10.6 0.0347 0.335 11.9 0.0396 0.394 13.4 0.0462 | | |
| 491. 689.(760) ⁶ 19.33 ⁴ 751. 19.52 | 0.394 13.4 0.0462 0.556 ⁵ 18.8 0.0640 | | |
| 751. 19.52 | 0.603 20.5 0.0690 | | |
| 1000. 20.42 | 0.833 27.3 0.0929 | | |
| ¹ Calculated by the compiler from the log $\gamma = \log (a_{\pm}/m_{1}) = \log (a_{1}^{2}/m_{1}) =$ | | | |
| $\log \gamma = \log (a_{\pm}/m_{1}) = \log (a_{1}/m_{1}) =$ | $(10g (p_1/m_1) + 1.716 \text{ which})$ | | |
| rearranges to log $a_1 = \log p_1 + (2)^2$ The mole fraction of HCl in nitrobe This experiment done by the stopper |)(1.718). $[p_1/mmHg \text{ and } m_1/mol kg^{-1}]$ nzene was calculated by the compiler. red bottle method. | | |
| | INFORMATION | | |
| ME THOD / APPARATUS / PROCEDURE : | SOURCE AND PURITY OF MATERIALS: | | |
| An H shaped vessel was used, one liquid being in one limb, and the oth | (1) Hydrogen chloride. The gas was | | |
| in the other limb. Equilibrium was | | | |
| stated to be attained through the | acid (analytical grade) into sulfuric acid. | | |
| vapor phase. The vessel was shaken | Suffutic actu. | | |
| occasionally over a period of 2-5 days. An acid base titration was used | (2) Nitrobenzene. "Pure" quality | | |
| to determine the amount of HCl in | nitrobenzene was shaken with | | |
| weighed samples of each liquid phase. | caustic soda, and distilled from P_2O_5 at 20 mmHg. | | |
| In one experiment the two liquids were shaken in a stoppered bottle. | (3) Water. Not stated. | | |
| * The average of two runs of a sepa- | ESTIMATED ERROR: | | |
| rate experiment in which HCl was passed into water. Author corrected | | | |
| value to 760 mmHg HCl. | $\delta T/K = \pm 0.01$ | | |
| ⁵ The average of three runs of a | | | |
| separate experiment in which HCl was | DEFERENCES | | |
| passed into water saturated nitro- | REFERENCES : | | |
| benzene. Author corrected value to 760 mmHg HC1. | Randall, M.; Young, L. E. J. Am. Chem. Soc. <u>192</u>8, 50, 989. | | |
| ⁶ The author states the molalities are for an HCl pressure of 760 mmHg. | 2. International Critical Tables | | |
| The vapor pressure curve (1,2) and | 2. International Critical Tables Volume III, page 301 | | |
| the equation indicate a lower HCl | McGraw Hill Co., New York, 1928. | | |
| partial pressure. | | | |

| COMPONENTS . | | ORIGINAL MEASUREM | |
|---|--|---|--|
| COMPONENTS: | | | |
| <pre>(1) Hydrogen chloride; HCl; [7647-01-0]</pre> | | Zeurcher, R. A | ; Kenny, C. L.; A. |
| (2) Nitrobenzene; C ₆ H ₅ NO ₂ ; [98-95-3] | | J. Am. Chem. Soc. <u>1939</u> , 61, 2504 - 2507. | |
| VARIABLES: | ····· | PREPARED BY: | |
| T/K: 298.15 P/kPa: 5.98 - 69.81 (0.059 - 0.689 atm) | | W. Gerrard | |
| EXPERIMENTAL VALUES: | | | |
| т/к | Pressure Molali p _l /atm m _l /mol | 4 | Mol Fraction |
| 298.15 | 0.059 0.03 0.213 0.11 0.278 0.14 0.312 0.16 0.428 0.22 | 0 0.0135 5 0.0180 1 0.0198 | 0.00368 0.0133 0.0176 0.0194 0.0269 |
| | 0.654 0.31 0.636 0.32 0.689 0.33 | 9 0.0392 3 0.0397 | 0.0378 0.0382 0.0399 |
| | (1.0 | | $(0.06)^{1}$ |
| The mole by the co | ratio and mole fra mpiler. | ction values we | re calculated |
| | AUXILIARY | INFORMATION | |
| METHOD/APPARATUS/PROCED The method and app identical to those The main differenc 1 to 2 day instead equilibration time The apparatus cons | aratus are almost of Saylor (1). e is the use of a of a 5 to 7 day | chemicall chloride | chloride. Prepared from y pure potassium and sulfuric acid. phosphorus pentoxide. ene. Eastman Kodak Co. |
| which are separate solvent is partial the gas, and the s the lower bulb. T partially evacuate | d by a tap. The ly saturated with olution added to he bulbs are d, the tap opened, | | |
| and the whole appa thermostat from 1 | ratus put in a to 2 days. | ESTIMATED ERROR: | |
| The tap is closed. upper bulb is quan and titrated with | The HCl in the titatively removed NaOH. The HCl | | K = 0.02 |
| partial pressure i the bulb volume an moles of HCl assum behavior. A weigh is removed from th titrated with NaOH | s calculated from d the number of ing ideal gas ed solution sample e lower bulb and | REFERENCES: 1. Saylor, J J. Am. Ch 1712. | . H. em. Soc. <u>1937</u> , 59, |
| | • | | |

| COMPONENTS: | | ORI | GINAL MEASU | IREMENTS : |
|-----------------------------------|---|---|--|--|
| (1) Hydrogen chlor [7647-01-0] | ide; HCl; | | Brien, S. J | |
| (2) Nitrobenzene; [98-95-3] | с _{6^н5^{NO}2;} | | Am. Chem. 3, 2709 - 27 | |
| XPERIMENTAL VALUES | 3 : | | | <u></u> |
| T/K | Pressure P1 ^{/mmHg} | Molality m _l /mol kg ⁻¹ | Mol Ratio n1 ^{/n} 2 | Mol Fraction ^x 1 |
| 293.15 | 56 64 111 160 288 305 | 0.0507 0.0549 0.0896 0.1310 0.239 0.249 | 0.00624 0.00675 0.0110 0.0161 0.0294 0.0306 | 0.00620 0.00670 0.0109 0.0159 0.0286 0.0297 |
| | (760 | | | 0.072)1 |
| 298.15 | 42.4 45.1 102 127 173 171 | 0.0319 0.0332 0.075 0.092 0.126 0.134 | 0.00392 0.00408 0.00923 0.0113 0.0155 0.0165 | 0.00391 0.00407 0.00914 0.0112 0.0153 0.0162 |
| | (760 | | | 0.067)1 |
| 303.15 | 20.7 24.1 74.8 99 144 214 248 318 402 | 0.0140 0.0156 0.047 0.063 0.093 0.132 0.157 0.203 0.253 | 0.00172 0.00192 0.00578 0.00775 0.0114 0.0162 0.0193 0.0250 0.0311 | 0.00172 0.00192 0.00575 0.00769 0.0113 0.0160 0.0189 0.0244 0.0302 |
| | (760 | | | 0.057)1 |
| 313.15 | 4.1 7.5 90.6 95.8 351 391 | 0.0023 0.0038 0.0490 0.0500 0.169 0.201 | 0.00028 0.00047 0.00603 0.00615 0.0208 0.0247 | 0.00028 0.00047 0.00600 0.00611 0.0204 0.0241 |
| | (760 | | | 0.047)1 |

¹ Obtained from a speculative extrapolation of the nonlinear plot of x_1 vs. p_1 up to 101.325 kPa (760 mmHg).

The mole ratio and mole fraction values were calculated by the compiler.

A summary of the author's Henry's constant values is on the next page.

| | Non-Aqueous Solvents | 319 |
|---|---|-----|
| COMPONENTS: ORIGINAL MEASUREMENTS: | | |
| <pre>(1) Hydrogen chloride; HCl; [7647-01-0]</pre> | O'Brien, S. J. J. Am. Chem. Soc. 1941, | |
| (2) Nitrobenzene; C ₆ H ₅ NO ₂ ; [98-95-3] | 63, 2709 - 2712. | |
| VARIABLES: | PREPARED BY: | |
| T/K: 293.15 - 313.15 P/kPa: 0.547 - 53.60 (4.1 - 402 mmHg) | W. Gerrard | |
| EXPERIMENTAL VALUES: See preces | ding page. | |
| T/K Henry's constant, k/atm mo | ol ⁻¹ kg Mol Fraction at 101.325 kPa | |
| Range Mean | n Range Mean | |
| 293.15 1.46 - 1.61 ¹ 1.59 ± 0 | 0.04 0.0710 - 0.0777 0.0718 | i |
| 298.15 1.68 - 1.82 1.77 ± (| 0.05 0.0633 - 0.0682 0.0650 | |
| 303.15 1.95 - 2.09 2.08 ± 0 | 0.04 0.0555 - 0.0593 0.0558 | |
| 313.15 $2.35^{1}-2.73^{1}$ 2.51 ± 0 | 0.12 0.0431 - 0.0497 0.0467 | |
| | | |
| AUXILIARY | INFORMATION | |
| METHOD / APPARATUS / PROCEDURE : | SOURCE AND PURITY OF MATERIALS: | |
| The method and apparatus are those of Saylor (1) as modified by O'Brien et al . (2). The main difference is the use of a 1 to 2 day instead of a 5 to 7 day equilibration time. | (1) Hydrogen chloride. Prepared from chemically pure potassium chloride and sulfuric acid. Dried by phosphorus pentoxide. | |
| The apparatus consists of two bulbs which are separated by a tap. The solvent is partially saturated with the gas, and the solution added to the lower bulb. The bulbs are partially evacuated, the tap opened, | (2) Nitrobenzene. Purified and distilled, m.p. 278.63 K. | |
| and the whole apparatus put in a thermostat from 1 to 2 days. | ESTIMATED ERROR: | |
| The tap is closed. The HCl in the upper bulb is quantitatively removed and titrated with NaOH. The HCl partial pressure is calculated from the bulb volume and the number of moles of HCl assuming ideal gas behavior. A weighed solution sample is removed from the lower bulb and titrated with NaOH. | $\delta T/K = 0.02$ | |
| | <pre>REFERENCES: 1. Saylor, J. H. J. Am. Chem. Soc. <u>1937</u>, 59, 171 2. O'Brien, S. J.; Kenny, C. L. Zeurcher, R. A. J. Am. Chem. Soc. <u>1939</u>, 61, 250</pre> | |

| COMPONENTS: | ORIGINAL MEASUREMENTS: | | |
|---|--|--|--|
| (1) Hydrogen chloride; HCl; [7647-01-0] (2) Nitrobenzene, chloro- | Zetkin, V. I.; Kolesnikov, I. M.; Zakharov, E. V.; Dzhagatspanyan, B. V. Khim. Prom_st. (Moscow) <u>1966</u> , | | |
| and dichloronitrobenzenes | 42 (8), 624 - 626. | | |
| VARIABLES: T/K: 313 - 433 P/kPa : 101.325 (1 atm) | PREPARED BY: W. Gerrard | | |
| EXPERIMENTAL VALUES: | | | |
| T/K Wt% of HCl | $n_{\rm HC1}/n_2$ fraction mole fraction | | |
| Nitrobenzene; C ₆ H ₅ NO ₂ ; 313 1.47 [98-95-3] 333 1.01 353 0.78 373 0.59 393 0.45 413 0.36 433 0.29 | 70.03430.03320.033900.02630.02560.025230.02000.01960.019390.01550.01530.015250.01230.01220.0122 | | |
| $\Delta H^{\circ}/kcal mol^{-1} = -3.61$; $\Delta S^{\circ}/ca$ Smoothing equation: $\ln x_{HC1} = -8.65$ (f Standard error $\ln x_{HC1}$ about the re | 39 + 17.5522/(T/100) or use between 313 K and 433 K) | | |
| 1-Chloro-2-nitro- benzene; C ₆ H ₄ ClNO ₂ ; 333 0.59 [88-73-3] 353 0.45 373 0.35 393 0.28 413 0.23 433 0.19 | 3 0.0256 0.0250 0.0252 9 0.0198 0.0194 0.0192 2 0.0152 0.0150 0.0150 5 0.0123 0.0122 0.0121 2 0.0100 0.0099 0.0099 | | |
| $\Delta H^{\circ}/kcal \text{ mol}^{-1} = -3.21 ; \Delta S^{\circ}/cal K^{-1} \text{ mol}^{-1} = -16.9 $ Smoothing equation: $\ln x_{HC1} = -8.5017 + 16.0531/(T/100)$ (for use between 313 K and 433 K) Standard error in x_{HC1} about the regression line = 1.56×10^{-4} | | | |
| * calculated by the compiler ** smoothing equation and smoothed values were calculated by H.L. Clever § the authors used a van't Hoff type equation to calculate enthalpy and entropy of solution from the mole ratio values. | | | |
| AUXILIARY INFORMATION | | | |
| METHOD/APPARATUS/PROCEDURE | | | |
| Gas was passed into 0.5 mole of component (2) in a flask of 10 cm ³ capacity; a sample was removed every ten minutes for acid-alkali titration. | | | |
| SOURCE AND PURITY OF MATERIALS: | | | |
| (1) Hydrogen chloride. Prepared from sodium chloride, and dried by calcium chloride. | | | |
| (2) Nitrobenzene. Distilled through a column of 20 theoretical plates. 1-Chloro-2-nitrobenzene. Purified by crystallization. 1-Chloro-3-nitrobenzene. Self prepared by the chlorination of nitrobenzene. Purified by distillation and crystallization. 1-Chloro-4-nitrobenzene. Purified by crystallization. 1,2-Dichloro-4-nitrobenzene. Self prepared by chlorination of 1,4-chloronitrobenzene. Purified by distillation and crystallization. 1,3-Dichloro-2-nitrobenzene. Purified by crystallization. | | | |
| | | | |

| COMPONENTS: | ORIGINAL MEASUREMENTS: |
|---|---|
| (1) Hydrogen chloride; HCl; [7647-01-0] (2) Nitrobenzene, chloro- and dichloronitrobenzenes | Zetkin, V. I.; Kolesnikov, I. M.; Zakharov, E. V.; Dzhagatspanyan, B. V. Khim. Prom_st. (Moscow) <u>1966</u> , 42 (8), 624 - 626. |
| | |
| EXPERIMENTAL VALUES: T/K Wt% of HCl | Mole ratio Mole* Smoothed** ⁿ HCl ^{/n} 2 fraction mole fraction [*] HCl [*] HCl |
| 1-Chloro-3-nitro- benzene; C ₆ H ₄ ClNO ₂ ; 353 0.419 [121-73-3] 373 0.329 393 0.237 413 0.192 433 0.150 | 0.0181 0.0178 0.0182 0.0142 0.0140 0.0135 0.0104 0.0103 0.0103 |
| $\Delta H^{\circ}/kcal mol^{-1} = -3.66$; $\Delta S^{\circ}/cal$ Smoothing equation: $\ln x_{HC1} = -9.5528$ (for Standard error in x_{HC1} about the regr | <pre>3 + 19.5784/(T/100) use between 353 K and 433 K)</pre> |
| 1-Chloro-4-nitro- 373 0.412 benzene; C ₆ H ₄ ClNO ₂ ; 393 0.306 [100-00-5] 413 0.232 433 0.183 | 0.0132 0.0130 0.0130 0.0100 0.0099 0.0099 |
| $\Delta H^{\circ}/kcal mol^{-1} = -4.34$; $\Delta S^{\circ}/cal$ Smoothing equation: $\ln x_{HC1} = -9.8883$ (for Standard error in x_{HC1} about the regr | $K^{-1} \text{ mol}^{-1} = -19.65 \$ + 21.7914/(T/100) use between 373 K and 433 K) ression line = 2.71 × 10 ⁻⁵ |
| 1,2-Dichloro-4-nitro- benzene; C ₆ H ₃ Cl ₂ NO ₂ ; 353 0.312 [99-54-7] 373 0.245 393 0.203 413 0.165 433 0.141 | 0.01640.01610.01600.01290.01270.01280.01070.01060.01040.00870.00860.0087 |
| $\Delta H^{\circ}/kcal mol^{-1} = -3.00$; $\Delta S^{\circ}/cal$ Smoothing equation: $\ln x_{HC1} = -8.3733$ (for Standard error in x_{HC1} about the regr | + 14.9693/(T/100) use between 333 K and 433 K) |
| 1,3-Dichloro-2-nitro- benzene; C ₆ H ₃ Cl ₂ NO ₂ ; 353 0.304 [601-88-7] 373 0.217 393 0.158 413 0.122 433 0.095 | 0.0144[sic] ¹ 0.0112 0.01115 0.0083 0.0082 0.0083 0.0064 0.0064 0.0064 |
| ¹ The value appears to be in error. which corresponds to the value of 0 $\Delta H^{\circ}/kcal mol^{-1} = -4.36$; $\Delta S^{\circ}/cal$ Smoothing equation: $\ln x_{HC1} = -10.288$ (for Standard error in x_{HC1} about the regr | $K^{-1} \text{ mol}^{-1} = -20.6 \ $ 2 + 21.6070/(T/100) use between 333 K and 433 K) |
| * calculated by the compiler ** smoothing equation and smoothed v § the authors used a van't Hoff type entropy of solution from the mole | alues were calculated by H.L. Clever equation to calculate enthalpy and ratio values. |

| 322 Hydrogen Chloride in N | on-Aqueous Solvents |
|---|---|
| COMPONENTS: | ORIGINAL MEASUREMENTS: |
| <pre>1. Hydrogen chloride; HCl; [7647-01-0]</pre> | Ahmed, W.; Gerrard, W.; Maladkar, V. K. |
| 2. Nitrobenzene; C ₆ H ₅ NO ₂ ; [98-95-3] | J. Appl. Chem. <u>1970</u> , 20, 109 - 115. |
| VARIABLES: | PREPARED BY: |
| т/к: 253.15 - 293.15 | W. Gerrard |
| Total P/kPa: 101.325 (1 atm) | (smoothed data calculated by H.L. Clever) |
| EXPERIMENTAL VALUES: | tio Mol Fraction |
| _, | |
| $ \frac{{}^{n}\text{HCl}/{}^{n}\text{C}_{6}}{}$ | ^H 5 ^{NO} 2 HCI |
| 253.15 0.24 263.15 0.18 | |
| 273.15 0.14 | |
| 283.15 0.10 293.15 0.08 | |
| | |
| The mole fraction solubilities were c compiler. | |
| | 72/(T/100) - 6.890 ln (T/100) |
| Standard error about | regression line = 1.97×10^{-3} |
| . T/K | Mol Fraction |
| | x _{HC1} |
| 253.15 | 0.198 |
| 263.15 273.15 | 0.155 0.122 |
| 283.15 | 0.0969 |
| 293.15 | 0.0776 |
| | |
| | |
| | |
| AUXILIARY | INFORMATION |
| METHOD/APPARATUS/PROCEDURE: | SOURCE AND PURITY OF MATERIALS: |
| Hydrogen chloride was passed into a | 1. Hydrogen chloride. Obtained from a cylinder containing a good com- |
| known weight of liquid in a bubbler tube at a total pressure measured by | mercial specimen. Was dried by |
| a manometer assembly. The absorbed | passage through concentrated sulfuric acid. |
| gas was weighed by re-weighing the bubbler tube. The temperature was | 2. Nitrobenzene. Best obtainable |
| manually controlled to within 0.2 K. The procedure and apparatus are | specimen was suitably purified, |
| described by Gerrard (1,2). | dried, and fractionally distilled and attested. |
| For temperatures below 268 K a chem- | |
| ical titration was conducted. | POTIMATED EDDOD. |
| | ESTIMATED ERROR: $\delta T/K = 0.2$ |
| | $\delta x/x = 0.015$ |
| | |
| | REFERENCES : |
| | 1. Gerrard, W. J. Appl. Chem. Biotechnol. <u>1972</u> , |
| | 22, 623 - 650. |
| | 2. Gerrard, W. "Solubility of Gases and Liquids" Plenum Press, New York, 1976 |
| L | i |

| COMPONENTS: | | | | | | |
|--|--|---|--|--|--|-----|
| (1) Hudrogon | | | ORIGINAL M | EASUREMENTS : | | |
| (1) Hydrogen [7647-01- | chloride; -0] | HC1; | | S. J.; Ken | • | |
| (2) 1-Methyl- nitrotolu | -2-nitroben 1ene; C ₇ H ₇ N | | J. Am. C 1189 - 1 | hem. Soc. <u>1</u> 192. | .940, 62, | |
| [88-72-2] | | | | | | |
| VARIABLES: | | | PREPARED B | Y: | | |
| T/K: P/kPa: | | .33 40 mmHg) | | W. Gerra | ard | |
| EXPERIMENTAL VAL | UES: | | | | | |
| T/K | Pressure p ₁ /mmHg | Molality m _l /mol kg ⁻¹ | Henry's Constant k ¹ | Mol Ratio n _l /n ₂ | Mol Fraction ^x 1 | _ |
| 298.15 | 31.9 53.1 112 113 224 269 340 | 0.0382 0.0821 0.0839 0.164 0.202 0.259 | L.80 L.82,1.83 ³ L.79 L.78,1.77 ³ L.79,1.80 ³ L.75 L.72,1.73 ⁸ | 0.0113 0.0115 0.0225 0.0277 0.0355 | 0.00319 0.00521 0.0111 0.0114 0.0220 0.0270 0.0343 | |
| | (760 | 0.565 | 1.77 av. | 0.0775 | $0.0719)^{2}$ | |
| - values | as calcula | ted by compile | kPa). er. | | | |
| - values | as calcula | ted by compile | | | | |
| - values | as calcula | | | | | |
| METHOD/APPARATUS The method ar Saylor (1) as <i>al</i> . (2). The use of a 1 to 7 day equilib The apparatus which are sep solvent is pa the gas, and the lower bul | /PROCEDURE: nd apparatu s modified e main diff o 2 day ins paration tim s consists parated by artially sa the soluti lb. The bu acuated, th | AUXILIARY s are those or by O'Brien <i>et</i> erence is the tead of a 5 to e. of two bulbs a tap. The turated with on added to lbs are e tap opened, put in a | INFORMATION SOURCE AND (1) Hydr from chlo Drie (2) 1-Me Koda | PURITY OF MA ogen chlori chemically ride and su d by phosph thyl-2-nitr k Co. Atte x, n ²⁰ , 1.5 | de. Prepared pure potassium alfuric acid. morus pentoxide cobenzene. Eastr ested by refract | nan |

| COMPORENTS: (1) Hydrogen chloride; HCl; [7647-01-0] (2) 1-Aethyl-3-nitrobenzene or m- nitrotoluens; C,H,NO ₂ ; [99-08-1] VARIABLES: T/K: 298.15 P/KPa: 1.85 - 22.27 P/KPa: 1.85 - 0.22.37 N. Gerrard T/K: 298.15 13.9 0.016 1.58 0.0016 0.0016 1.60 0.0016 1.60 0.0016 1.60 0.0016 1.60 0.0016 0.0017 0.0016 0.0016 0.0016 0.0016 0.0016 0.0012 0.0124 0.0126 0.0127 132 0.039 0.0126 0.0127 132 0.039 0.0126 0.0127 14 Values calculated by compiler. AUXILIARY INFORMATION METHOD/APFAALUS/FROCEDURE: The method ad apparatus are those of 1.9 Mydrogen chloride. Prepared from chemically pure potassium cit. (2) The main difference is the solution adde to the bulb volume and the number of moles of KI assuming ideal gas bahavior. A weighed solution asample is removed from the buw bulb and thermostat from the number of moles of KI assuming ideal gas bahavior. A weighed solution sample is removed from the lower bulb and thrated with NaOH. The Theoremical solution adde from the bulb volume and the number of moles of KI assuming ideal gas bahavior. A weighed solution sample the removed from the lower bulb and thermostat from the burb solutin sample the | | |
|--|--|--|
| <pre>(2) 1-Methyl-3-nitrobenzene or m- nitrotoluene; C₇H₇NO₂; [99-06-1]</pre> 1189 - 1192. | (1) Hydrogen chloride; HCl; | O'Brien, S. J.; Kenny, C. L. |
| T/K: 298.15 P/kP2: 1.85 - 22.27 (13.9 - 167 mmHg) EXPERIENTAL VALUES: T/K Pressure Molality Henry's Mol Ratio Mol Fraction $\frac{p_1/mmHg}{m_1/mol kg^{-1}}$ Constant n_1/n_2 x_1 $\frac{p_1/mmHg}{k_1}$ 0.0116 1.58 0.0016 0.0016 44.3 0.0334 1.69,1.70 ³ 0.047 0.0047 56.7 0.0433 1.70 0.0060 0.0060 116 0.0939 1.71 0.0126 0.0124 122 0.0939 1.71 0.0126 0.0127 132 0.1037 1.68 0.0142 0.0140 (760 0.606 1.65 av. 0.0831 0.0767) ² ¹ k/atm mol ⁻¹ kg ² Value calculated by the compiler from the average value of Henry's constant. gives a range of 0.0742 to 0.0818 for the mole fraction solubility at one atm (101.325 kPa). ³ Values recalculated by compiler. METHOD/APPARATUS/PROCEDURE: The mothod and apparatus are those of a 1 to 2 day instead of a 5 to 7 day equilibration time. The apparatus consists of two bulbs which are separated by a tap. The apparatus put in a thermostat from 1 to 2 days. The tap is closed. The HCl in the bulbs are partially evacuated, the tap opend, and the wolke of the solution added to that wolk apparatus put in a thermostat from 1 to 2 days. The tap is closed. The HCl in the bulbs are partially evacuated, the tap opend and the number of moles of HCl assuming ideal gas behavior. A weighed solution sample is removed from the lower bulb and the number of moles of HCl assuming ideal gas behavior. A weighed solution sample is removed from the lower bulb and the number of moles of HCl assuming ideal gas behavior. A weighed solution sample is removed from the lower bulb and the number of moles of HCl assuming ideal gas behavior. A weighed solution sample is removed from the lower bulb and the number of moles of HCl assuming ideal gas behavior. A weighed solution sample is removed from the lower bulb and the number of moles of HCl assuming ideal gas behavior. A weighed solution sample is removed from the lower bulb and the number of moles of HCl assuming ideal gas behavior. A weighed solution sample is removed from the lower bulb and the number of moles of HCl assuming ideal gas beha | nitrotoluene; C ₇ H ₇ NO ₂ ; | |
| T/K: 298.15 P/kP2: 1.85 - 22.27 (13.9 - 167 mmHg) EXPERIENTAL VALUES: T/K Pressure Molality Henry's Mol Ratio Mol Fraction $\frac{p_1/mmHg}{m_1/mol kg^{-1}}$ Constant n_1/n_2 x_1 $\frac{p_1/mmHg}{k_1}$ 0.0116 1.58 0.0016 0.0016 44.3 0.0334 1.69,1.70 ³ 0.047 0.0047 56.7 0.0433 1.70 0.0060 0.0060 116 0.0939 1.71 0.0126 0.0124 122 0.0939 1.71 0.0126 0.0127 132 0.1037 1.68 0.0142 0.0140 (760 0.606 1.65 av. 0.0831 0.0767) ² ¹ k/atm mol ⁻¹ kg ² Value calculated by the compiler from the average value of Henry's constant. gives a range of 0.0742 to 0.0818 for the mole fraction solubility at one atm (101.325 kPa). ³ Values recalculated by compiler. METHOD/APPARATUS/PROCEDURE: The mothod and apparatus are those of a 1 to 2 day instead of a 5 to 7 day equilibration time. The apparatus consists of two bulbs which are separated by a tap. The apparatus put in a thermostat from 1 to 2 days. The tap is closed. The HCl in the bulbs are partially evacuated, the tap opend, and the wolke of the solution added to that wolk apparatus put in a thermostat from 1 to 2 days. The tap is closed. The HCl in the bulbs are partially evacuated, the tap opend and the number of moles of HCl assuming ideal gas behavior. A weighed solution sample is removed from the lower bulb and the number of moles of HCl assuming ideal gas behavior. A weighed solution sample is removed from the lower bulb and the number of moles of HCl assuming ideal gas behavior. A weighed solution sample is removed from the lower bulb and the number of moles of HCl assuming ideal gas behavior. A weighed solution sample is removed from the lower bulb and the number of moles of HCl assuming ideal gas behavior. A weighed solution sample is removed from the lower bulb and the number of moles of HCl assuming ideal gas behavior. A weighed solution sample is removed from the lower bulb and the number of moles of HCl assuming ideal gas behavior. A weighed solution sample is removed from the lower bulb and the number of moles of HCl assuming ideal gas beha | | |
| $P/kPa: 1.85 - 22.27$ (13.9 - 167 mmHg)W. GerrardEFFERMENTAL VALUES:T/KPressure $p_1/mmHg$ Molality $m_1/mol kg^{-1}$ Constant n_1/n_2 n_1/n_2 x_1 298.1513.90.0161.580.0160.001614.30.03431.69,1.70°0.00470.004756.70.04381.670.01260.01241220.09391.710.01290.01271320.10371.680.01420.0146(7600.6061.65 av.0.08310.0767)²*k/atm mol ⁻¹ kg*Values calculated by the compiler from the average value of Henry's constant.0.0712 to 0.0818 for the mole fraction solubility at one atm (101.325 kPa).*Values recalculated by compiler.SOURCE AND FURITY OF MATERIALS:The method and apparatus are those of a 1 to 2 day instead of a 5 to 7 day equilibration time.SOURCE AND FURITY OF MATERIALS: (1) Hydrogen chloride. Prepared from chemically pure potassium chloride and sultric acid. Dried by phosphorus pentoxide.The apparatus consists of two bulbs which are separated by a tap. The apparatus consists of two bulbs the jopened, and the wolfe apparatus put in a thermostat from 1 to 2 days.SOURCE AND FURITY OF MATERIALS: (2) 1-Methyl-3-nitrobenzene.Eastman Kodak Co. Attested by refractive index, n_D^{+} , 1.5479.STIMITED EREOR:Colspan=1 to 2 colspan=1 | | PREPARED BY: |
| EXPERIMENTAL VALUES: T/K Pressure Molality Henry's Mol Ratio Mol Fraction $\frac{P_1/mmHg}{298.15}$ Molality Henry's Mol Ratio Mol Fraction $\frac{P_1/mmHg}{13.9}$ Molality Henry's Mol Ratio Mol Fraction $\frac{P_1/mmHg}{13.9}$ Molality Henry's Mol Ratio Mol Fraction $\frac{P_1/mmHg}{13.9}$ Molality Henry's Mol Ratio Mol Fraction $\frac{P_1/mmHg}{13.2}$ Molality Henry's Molality Mola Mole Mole Mole Mole Mole Mole Mole Mole | P/kPa: 1.85 - 22.27 | W. Gerrard |
| T/KPressureMolalityHenry'sMol RatioMol Fraction $P_1/mmHg$ $m_1/mol kg^{-1}$ $Constantn_1/n_2n$ | (13.9 - 107 multig) | |
| $\frac{P_1/mmHg}{299.15} = \frac{m_1/mol kg^{-1}}{13.9} = \frac{\cos tant}{h} \frac{m_1/m_2}{m_1/m_2} = \frac{x_1}{x_1}$ $\frac{p_1/mmHg}{44.3} = 0.0343 = 1.69, 1.70^3 = 0.0016 = 0.0016$ $\frac{142}{56.7} = 0.0438 = 1.70 = 0.0047 = 0.0047$ $\frac{166}{122} = 0.0393 = 1.71 = 0.0126 = 0.0124$ $\frac{132}{132} = 0.1037 = 1.68 = 0.0142 = 0.0140$ $\frac{167}{167} = 0.1385 = 1.54, 1.59^3 = 0.0190 = 0.0186$ $\frac{(760}{(760)} = 0.606 = 1.65 \text{ av.} = 0.0831 = 0.0767)^2$ $\frac{1}{k/atm mol^{-1} kg}$ $\frac{1}{k/atm$ | EXPERIMENTAL VALUES: | |
| 298.15 13.9 0.0116 1.58 0.0017 298.15 13.9 0.0116 1.58 0.0017 0.0017 116 0.0318 1.67 0.0129 0.0121 122 0.0391 1.71 0.0129 0.0127 132 0.1037 1.68 0.0142 0.0140 167 0.1385 1.54,1.59 ³ 0.0190 0.0186 (760 0.606 1.65 av. 0.0831 0.0767) ² 1 k/atm mol ⁻¹ kg * Yalue calculated by the compiler from the average value of Henry's constant gives a range of 0.0742 to 0.0818 for the mole fraction solubility at one atm (101.325 kPa). AUXILARY INFORMATION METHOD/APPARATUS/PROCEDURE: The method and apparatus are those of Saylor (1) as modified by O'Brien et at. (2). The main difference is the use of a 1 to 2 day instead of a 5 to 7 day equilibration time. The apparatus consists of two bulbs which are separated by a tap. The solution added to the lower bulb. The bulbs are partially evacuated, the tap opened, and the solution added to the lower bulb. The bulbs are partial pressure is calculated from the Collar the collar of the lower bulb and titrated with NOR. Strike 0.02 REFERENCES: Thetap is closed. The H | T/K Pressure Molality | |
| 44.3 0.0343 1.69,1.70 ³ 0.0047 0.0047 116 0.0318 1.70 0.0060 0.0060 112 0.0339 1.71 0.0126 0.0127 132 0.0339 1.71 0.0120 0.0127 132 0.1385 1.54,1.59 ³ 0.0190 0.0186 (760 0.606 1.65 av. 0.00831 0.0767) ² * Value calculated by the compiler from the average value of Henry's constant. use of the high and low values of Henry's constant gives a range of 0.0742 to 0.0818 for the mole fraction solubility at one atm (101.325 kPa). * Values recalculated by compiler. SOURCE AND FURITY OF MATERIALS; The method and apparatus are those of Saylor (1) as modified by O'Brien et al. (2). The main difference is the use of a 1 to 2 day instead of a 5 to 7 day equilibration time. SOURCE AND FURITY OF MATERIALS; The aparatus consists of two bulbs which are separated by a tap. The solvent is partially saturated with hach. The bulbs are partially evacuated, the tap opened, and the solution added to the lower bulb. The bulbs are partial pressure is calculated from the HCl in the upper bulb is quantitatively removed and the number of moles of HCl assuming ideal gas behavior. A weighed solution sample is removed from the lower bulb and titrated with NAOH. The HCl in samule is removed from the lower bulb and titrated with NAOH. Str/K = 0.02 | $ \frac{p_1/mmHg}{m_1/mol kg^{-1}}$ | $\frac{\text{Constant}}{k^{1}} \frac{n_{1}/n_{2}}{2} \frac{x_{1}}{2}$ |
| 55.7 0.0438 1.70 0.0060 0.0060 112 0.0918 1.67 0.0129 0.0127 132 0.1037 1.68 0.0142 0.0140 167 0.1385 1.54,1.59 ³ 0.0190 0.0186 (760 0.606 1.65 av. 0.0831 0.0767) ² (760 0.601 1.65 av. 0.0818 for the mole fraction solubility at one atm (101.325 kPa). (710 Suppote Suppote Suppote Suppote Suppote Suppote Suppote Suppote Suppared Suppote Suppote Suppote Suppote Suppared Suppote Suppote Supp | 298.15 13.9 0.0116 | 1.58 0.0016 0.0016 |
| 55.7 0.0438 1.70 0.0060 0.0060 112 0.0918 1.67 0.0129 0.0127 132 0.1037 1.68 0.0142 0.0140 167 0.1385 1.54,1.59 ³ 0.0190 0.0186 (760 0.606 1.65 av. 0.0831 0.0767) ² (760 0.601 1.65 av. 0.0818 for the mole fraction solubility at one atm (101.325 kPa). (710 Suppote Suppote Suppote Suppote Suppote Suppote Suppote Suppote Suppared Suppote Suppote Suppote Suppote Suppared Suppote Suppote Supp | | 1.69,1.70 ³ 0.0047 0.0047 |
| 122 0.0939 1.71 0.0129 0.0127 132 0.1037 1.68 0.0142 0.0140 167 0.1385 1.54,1.59 ³ 0.0190 0.0186 (760 0.606 1.65 av. 0.0831 0.0767) ² ¹ k/atm mol ⁻¹ kg Value calculated by the compiler from the average value of Henry's constant. (JOS2 Constant. Use of the high and low values of Henry's constant gives a range of 0.0742 to 0.0818 for the mole fraction solubility at one atm (101.325 kPa). Values recalculated by compiler. AUXILIARY INFORMATION METHOD/APPARATUS/PROCEDURE: The method and apparatus are those of Saylor (1) as modified by O'Brie et al. (2). The main difference is the use of a 1 to 2 day instead of a 5 to 7 day equilibration time. The apparatus consists of two bulbs which are separated by a tap. The solvent is partially saturated with had, at the value apparatus put in a thermostat from 1 to 2 days. The tap is closed. The HCl in the upper bulb is quantitatively removed and the number of moles of HCl assuming ideal gas behavior. A weighed solution sample is removed from the lower bulb and titrated with NAOH. REFERENCES: 1. Saylor, J. H. J. Am. Chem. Soo. 1937, 59, 1712. 2. O'Brien, | 56.7 0.0438 | |
| 132 0.1037 1.68 0.0142 0.0140 167 0.1385 1.54,1.59 ³ 0.0190 0.0186 (760 0.606 1.65 av. 0.0081 0.0767) ² ¹ k/atm mol ⁻¹ kg ² Value calculated by the compiler from the average value of Henry's constant. 0.0142 0.0186 gives a range of 0.0742 to 0.0018 for the mole fraction solubility at one atm (101.325 kPa). 3 Values recalculated by compiler. AUXILIARY INFORMATION METHOD/APPARATUS/PROCEDURE: The method and apparatus are those of 32 to 7 day equilibration time. The apparatus consists of two bulbs which are separated by a tap. The solvent is partially saturated with the gas, and the solution added to the lower bulb. The bulbs are partially evacuated, the tap opened, and the whole appratus put in a thermostat from 1 to 2 days. The tap is closed. The HCl in the upper bulb is quantitatively removed and thr anumber of moles of HCl assuming ideal gas behavior. A weighed solution sample is removed from the lower bulb and titrated with NAOH. REFERENCES: 1. Saylor, J. H. J. Am. Chem. Soc. 1937, 59, 1712. | | |
| 167 0.1385 1.54,1.59 ³ 0.0190 0.0186 (760 0.606 1.65 av. 0.0031 0.0767) ² ¹ k/atm mol ⁻¹ kg * ² Value calculated by the compiler from the average value of Henry's constant gives a range of 0.0742 to 0.0018 for the mole fraction solubility at one atm (101.325 kPa). * * Values recalculated by compiler. * * Values recalculated by compiler. * METHOD/APPARATUS/PROCEDURE: 1.152,112,112,112,112,112,112,112,112,112, | | |
| (760 0.606 1.65 av. 0.0831 0.0767) ² ¹ k/atm mol ⁻¹ kg ¹ k/atm mol ⁻¹ kg ² Value calculated by the compiler from the average value of Henry's constant gives a range of 0.0742 to 0.0818 for the mole fraction solubility at one atm (101.325 kPa). ³ Values recalculated by compiler. AUXILIARY INFORMATION METHOD/APPARATUS/PROCEDURE: The method and apparatus are those of 32 kJor (1) as modified by O'Brien et al. (2). The main difference is the alse of a 1 to 2 day instead of a 5 to 7 day equilibration time. The apparatus consists of two bulbs which are separated by a tap. The solvent is partially saturated with the gas, and the solution added to the lower bulb. The bulbs are paratus from 1 to 2 days. The tap is closed. The HCl in the upper bulb is quantitatively removed an titrated with NAOH. REFERENCES: Closed. The HCl in the upper bulb is guantitatively removed from the lower bulb and titrated with NAOH. REFERENCES: Closed. The HCl in the upper bulb is quantitatively removed from the lower bulb and titrated with NAOH. REFERENCES: (Am. Chem. Soc. 1937, 59, 1712. | | |
| ¹ k/atm mol ⁻¹ kg ¹ k/atm mol ⁻¹ kg ² Value calculated by the compiler from the average value of Henry's constant gives a range of 0.0742 to 0.0818 for the mole fraction solubility at one atm (101.325 kPa). ³ Values recalculated by compiler. ³ Values recalculated by compiler. AUXILIARY INFORMATION METHOD/APPARATUS/PROCEDURE: The method and apparatus are those of Saylor (1) as modified by 0'Brien et al. (2). The main difference is the use of a 1 to 2 day instead of a 5 to 7 day equilibration time. The apparatus consists of two bulbs which are separated by a tap. The solvent is partially saturated with the gas, and the solution added to the lower bulb. The bulbs are partially evacuated, the tap opened, and the whole apparatus put in a thermostat from 1 to 2 days. The tap is closed. The HCl in the upper bulb is quantitatively removed and titrated with NaOH. REFERENCES: 1. Saylor, J. H. o'. Am. Chem. Soc. 1937, 59, 1712. 2. O'Brien, S. J.; Kenny, C. L. Zeurcher, R. A. | 167 0.1385 | 1.54,1.59° 0.0190 0.0186 |
| ² Value calculated by the compiler from the average value of Henry's constant gives a range of 0.0742 to 0.0818 for the mole fraction solubility at one atm (101.325 kPa). ³ Values recalculated by compiler. ⁴ Values recalculated by compiler. ⁵ Values recalculated by compiler. ⁵ Values recalculated by compiler. ⁶ Values recalculated by O'Brien et al. (2). The main difference is the use of a 1 to 2 day instead of a 5 to 7 day equilibration time. ⁶ The apparatus consists of two bulbs which are separated by a tap. The solvent is partially saturated with et ap opened, and the whole apparatus put in a thermostat from 1 to 2 days. ⁶ The tap is closed. The HCl in the upper bulb is quantitatively removed and titrated with NaOH. The HCl assuming ideal gas behavior. A weighed solution sample is removed from the lower bulb and titrated with NAOH. ⁶ C'Brien, S. J.; Kenny, C. L. Zeurcher, R. A. | (760 0.606 | 1.65 av. 0.0831 0.0767) ² |
| METHOD/APPARATUS/PROCEDURE:SOURCE AND PURITY OF MATERIALS:The method and apparatus are those of Saylor (1) as modified by 0'Brien et al. (2). The main difference is the use of a 1 to 2 day instead of a 5 to 7 day equilibration time.SOURCE AND PURITY OF MATERIALS: from chemically pure potassium chloride and sulfuric acid. Dried by phosphorus pentoxide.The apparatus consists of two bulbs which are separated by a tap. The apparatus consists of two bulbs which are separated by a tap. The solvent is partially saturated with the gas, and the solution added to the lower bulb. The bulbs are partially evacuated, the tap opened, and the whole apparatus put in a thermostat from 1 to 2 days.SOURCE AND PURITY OF MATERIALS: from chemically pure potassium chloride and sulfuric acid. Dried by phosphorus pentoxide.The tap is closed. The tap is closed. The tap is closed. The HCl in the upper bulb is quantitatively removed and titrated with NaOH.Source AND PURITY OF MATERIALS: (1) Hydrogen chloride. Dried by phosphorus pentoxide.References: δ T/K = 0.02References: 1. Saylor, J. H. J. Am. Chem. Soc. 1937, 59, 1712.2. O'Brien, S. J.; Kenny, C. L. Zeurcher, R. A. | constant. Use of the high and gives a range of 0.0742 to 0.0 at one atm (101.325 kPa). | d low values of Henry's constant 0818 for the mole fraction solubility |
| The method and apparatus are those of Saylor (1) as modified by O'Brien <i>et</i> a1. (2). The main difference is the use of a 1 to 2 day instead of a 5 to 7 day equilibration time. The apparatus consists of two bulbs which are separated by a tap. The solvent is partially saturated with the gas, and the solution added to the lower bulb. The bulbs are partially evacuated, the tap opened, and the whole apparatus put in a thermostat from 1 to 2 days. The tap is closed. The HCl in the upper bulb is quantitatively removed and titrated with NaOH. The HCl partial pressure is calculated from the bulb volume and the number of moles of HCl assuming ideal gas behavior. A weighed solution sample is removed from the lower bulb and titrated with NaOH. | AUXILIA | RY INFORMATION |
| Saylor (1) as modified by O'Brien <i>et</i> al. (2). The main difference is the use of a 1 to 2 day instead of a 5 to 7 day equilibration time. The apparatus consists of two bulbs which are separated by a tap. The solvent is partially saturated with the gas, and the solution added to the lower bulb. The bulbs are partially evacuated, the tap opened, and the whole apparatus put in a thermostat from 1 to 2 days. The tap is closed. The HCl in the upper bulb is quantitatively removed and titrated with NaOH. The HCl partial pressure is calculated from the bulb volume and the number of moles of HCl assuming ideal gas behavior. A weighed solution sample is removed from the lower bulb and titrated with NaOH. | METHOD/APPARATUS/PROCEDURE: | SOURCE AND PURITY OF MATERIALS: |
| <pre>partially evacuated, the tap opened, and the whole apparatus put in a thermostat from 1 to 2 days. The tap is closed. The HCl in the upper bulb is quantitatively removed and titrated with NaOH. The HCl partial pressure is calculated from the bulb volume and the number of moles of HCl assuming ideal gas behavior. A weighed solution sample is removed from the lower bulb and titrated with NaOH.</pre> ESTIMATED ERROR: ESTIMATED ERROR: ESTIMATED ERROR: ********************************* | Saylor (1) as modified by O'Brien et al. (2). The main difference is the use of a 1 to 2 day instead of a 5 to 7 day equilibration time. The apparatus consists of two bulbs which are separated by a tap. The solvent is partially saturated with the gas, and the solution added to | (1) Hydrogen chloride. Prepared from chemically pure potassium chloride and sulfuric acid. Dried by phosphorus pentoxide. (2) 1-Methyl-3-nitrobenzene. Eastman Kodak Co. Attested by refractive index, n₂⁰, 1.5479. |
| thermostat from 1 to 2 days. The tap is closed. The HCl in the upper bulb is quantitatively removed and titrated with NaOH. The HCl partial pressure is calculated from the bulb volume and the number of moles of HCl assuming ideal gas behavior. A weighed solution sample is removed from the lower bulb and titrated with NaOH. REFERENCES: 1. Saylor, J. H. J. Am. Chem. Soc. <u>1937</u> , 59, 1712. 2. O'Brien, S. J.; Kenny, C. L. Zeurcher, R. A. | partially evacuated, the tap opened | |
| upper bulb is quantitatively removed and titrated with NaOH. The HCl partial pressure is calculated from the bulb volume and the number of moles of HCl assuming ideal gas behavior. A weighed solution sample is removed from the lower bulb and titrated with NaOH. REFERENCES: 1. Saylor, J. H. J. Am. Chem. Soc. 1937, 59, 1712. 2. O'Brien, S. J.; Kenny, C. L. Zeurcher, R. A. | | ESTIMATED ERROR: |
| ł | upper bulb is quantitatively removed and titrated with NaOH. The HCl partial pressure is calculated from the bulb volume and the number of moles of HCl assuming ideal gas behavior. A weighed solution sample is removed from the lower bulb and | <pre>d REFERENCES: 1. Saylor, J. H. J. Am. Chem. Soc. <u>1937</u>, 59, 1712. e 2. O'Brien, S. J.; Kenny, C. L. Zeurcher, R. A.</pre> |

| Hyd | drogen Chloride in I | Non-Aqueous Solvents | 325 |
|--|--|--|------|
| COMPONENTS : | · · · · · · · · · · · · · · · · · · · | ORIGINAL MEASUREMENTS: | |
| <pre>(1) Hydrogen chloride; [7647-01-0]</pre> | ; HCl; | O'Brien, S. J.; King, C. V. | |
| (2) 1-Methyl-3-nitrobe m-nitro toluene; (| enzene or C7 ^H 7 ^{NO} 2; | J. Am. Chem. Soc. <u>1949</u> , 71, 3632 - 3634. | |
| [99-08-1] | | | |
| VARIABLES: | | PREPARED BY: | |
| T/K: 298.15, P/kPa: 101.325 | | W. Gerrard | |
| EXPERIMENTAL VALUES: | | | |
| т/к | Constant ¹ | I Ratio Mol Fraction n_1/n_2 x_1 | |
| 298.15 | $\frac{1}{1.65 \pm 0.05^3}$ | 0.0830 0.0768 0.0830 ² 0.0767 ² | |
| 308.15 | 2.08 + 0.04 0 | 0.0654 0.0614 0.0659 ² 0.0618 ² | |
| ¹ k/atm mc | ol ⁻¹ kg = (p ₁ /atm | | |
| | - | by the compiler. | |
| | | O'Brien, S. J.; Kenny, C. L. | |
| J. Am. (| Chem. Soc. 1940, | 62, 1189. | |
| All of the mole ratio values were calculated by the compiler. | | | |
| The experimental measurements were probably carried out at pressures below one-half atm partial pressure of HCl. The Henry's constant values are the mean of from 2 to 6 values followed by the average deviation of the mean. | | | |
| From the solution | slope of log x_1 is -3.90 k cal m | vs. $1/T$. The enthalpy of $no1^{-1}(-16.32 \text{ kJ mol}^{-1})$. | |
| <u></u> | AUXILIARY | INFORMATION | |
| METHOD/APPARATUS/PROCEDURE: | | SOURCE AND PURITY OF MATERIALS: | |
| The method and apparat Saylor (1) as modified <i>al</i> . (2). The main dif use of a 1 to 2 day in 7 day equilibration ti | by O'Brien <i>et</i> ference is the stead of a 5 to | Probably prepared from potassi chloride and sulfuric acid as | um |
| The apparatus consists which are separated by solvent is partially s the gas, and the solut the lower bulb. The b partially evacuated, t | a tap. The aturated with ion is added to ulbs are he tap opened, | (2) 1-Methyl-3-nitrobenzene. Eastman Kodak Co. Dried and distilled. | |
| and the whole apparatu thermostat from 1 to 2 | | ESTIMATED ERROR: | |
| The tap is closed. Th upper bulb is quantita and titrated with NaOH partial pressure is ca | tively removed . The HCl | δ τ /K = 0.02 | |
| the bulb volume and the moles of HCl assuming behavior. A weighed so is removed from the lo | e number of ideal gas olution sample | REFERENCES: 1. Saylor, J. H. J. Am. Chem. Soc. <u>1937</u> , 59, 17 | 12. |
| titrated with NaOH. | | O'Brien, S. J.; Kenny, C. L. Zeurcher, R. A. J. Am. Chem. Soc. <u>1939</u>, 61, 25 | 604. |
| | | | |

| COMPONENTS : | ORIGINAL MEASUREMENTS: Kosorotov, V. I.; Stul, B. Ya.; |
|--|---|
| <pre>(1) Hydrogen chloride; HCl; [7647-01-0]</pre> | Dzhagatspanya, R. V. Zh. Prikl. Khim. (Leningrad) <u>1978</u> , |
| (2) 2-(Trichloromethyl)pyridine; | 51, 887 - 889. |
| C ₆ H ₄ Cl ₃ N; [4377-37-1] | J. Appl. Chem. USSR (Engl. Transl.) <u>1978</u> , 51, 858 - 860. |
| VARIABLES: $T/K = 378.15 - 473.15$ | PREPARED BY: |
| $p_1/kPa = 101.325$ (1 atm) | W. Gerrard |
| EXPERIMENTAL VALUES: | |
| т/к нус | drogen Chloride Solubility c ₁ /mol dm ⁻³ |
| 378.15 | 0.391 |
| 393.15 408.15 | 2.3 0.50 |
| 423.15 | 0.20 |
| 443.15 473.15 | 0.15 0.103 |
| | · · · · · · · · · · · · · · · · · · · |
| $n_1/n_2.$ | is mole ratio, |
| high". At 378.15 K (105°C) the syst | nd 393.15 K the solubilities are "very em consisted of a "thick pasty sub- that temperature was given as a mole |
| In the author's diagram the plot of straight from 473 to 423 K, at which No parameters for the straight line | point the line rose steeply to 393 K. |
| AUXILIAR | / INFORMATION |
| METHOD/APPARATUS/PROCEDURE: | SOURCE AND PURITY OF MATERIALS: |
| The liquid was saturated with gas at atmospheric pressure. The amount of gas absorbed was determined by "a back titration. The results were | (1) Hydrogen chloride. Obtained |
| subsequently reduced to 760 mmHg pressure." | (2) 2-(Trichloromethyl)pyridine. Self prepared, and purified. Purity assessed as 95-99% by chromatography. |
| | |
| | ESTIMATED ERROR: |
| | |
| | REFERENCES : |
| | |
| | |

| Hydrogen Chloride in | Non-Aqueous Solvents 327 |
|--|--|
| COMPONENTS: | ORIGINAL MEASUREMENTS: |
| <pre>(1) Hydrogen chloride; HCl; [7647-01-0]</pre> | Kosorotov, V. I.; Stul, B. Ya.; Dzhagatspanya, R. V. |
| (2) 2-Chloro-6-(trichloromethyl)- pyridine; C ₆ H ₃ Cl ₄ N; [1929-82-4] | 2h. Prikl. Khim. (Leningrad) <u>1978</u> , 51, 887 - 889. |
| | J. Appl. Chem. USSR (Engl. Transl.) <u>1978</u> , 51, 858 - 860. |
| VARIABLES: | PREPARED BY: |
| T/K = 363.15 - 423.15 $p_1/kPa = 101.325$ (1 atm) | W. Gerrard |
| EXPERIMENTAL VALUES: | |
| i Su | gen Chloride olubility 1 ^{/mol dm⁻³} |
| 363.15 0 | .062 |
| | .046 .037 |
| | .032 |
| It was stated that the plot of log [line. The equation | solubility] vs. l/T was a straight |
| $\log(c_1/p_1) = (\Delta)$ | H/2.303 RT) - A |
| was given with $p_1 =$ the HCl partial p | pressure in atm. |
| $\Delta H/kcal mol^{-1} =$ | 3.4 |
| A = | 3.23 |
| | |
| AUXILIARY | INFORMATION |
| METHOD/APPARATUS/PROCEDURE: | SOURCE AND PURITY OF MATERIALS: |
| The liquid was saturated with gas at atmospheric pressure. The amount of gas absorbed was determined by "a back titration. The results were subsequently reduced to 760 mmHg pressure." | (1) Hydrogen chloride. Obtained from a cylinder, and dried by sulfuric acid. (2) 2-Chloro-6-(trichloromethyl)- pyridine. Self prepared and purified. Purity assessed as 95-99% by chromatography. |
| | ESTIMATED ERROR: |
| | REFERENCES: |
| | |

| 328 Hydrogen Chio | nue m | Non-Aqueous Solvents |
|---|----------------|---|
| COMPONENTS : | | ORIGINAL MEASUREMENTS: |
| (1) Hydrogen chloride; HCl; [7647-01-0] | | Kosorotov, V. I.; Stul, B. Ya.; Dzhagatspanya, R. V. |
| <pre>(2) 3,5-Dichloro-2-(trichlorome pyridine; C₆H₂Cl₅N; [1128-]</pre> | | 51, 887 - 889. |
| | | J. Appl. Chem. USSR (Engl. Transl.) <u>1978</u> , 51, 858 - 860. |
| VARIABLES: | | PREPARED BY: |
| T/K = 333.15 - 423.15 $p_1/kPa = 101.325$ (1 atm) | | W. Gerrard |
| EXPERIMENTAL VALUES: | | |
| т/к | S | gen Chloride olubility /mol dm ⁻³ |
| 333.15 | | 0.30 |
| 363.15 | | 0.10 |
| 393.15 423.15 | | 0.07 0.051 |
| It was stated that the plot of line. The equation | log [: | solubility] vs. l/T was a straight |
| $\log(c_{\star}/p_{\star})$ | = (∆I | H/2.303 RT) - A |
| was given with $p_1 =$ the HCl par | | |
| ΔH/kcal mo | $1^{-1} =$ | 3.6 |
| | Α = | 3.15 |
| | •• | |
| | | |
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| | | |
| | | |
| KUA | (ILIARY | INFORMATION |
| METHOD /APPARATUS / PROCEDURE : | | SOURCE AND PURITY OF MATERIALS: |
| The liquid was saturated with g | | (1) Hydrogen chloride. Obtained |
| atmospheric pressure. The amou gas absorbed was determined by back titration. The results we | "a | from a cylinder, and dried by sulfuric acid. |
| subsequently reduced to 760 mmH | | (2) 3,5-Dichloro-2-(trichloromethyl)- |
| pressure." | | pyridine. Self prepared, and purified. Purity assessed as |
| | | 95-99% by chromatography. |
| | | |
| | | |
| | | ESTIMATED ERROR: |
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| | | REFERENCES : |
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| | | |

| Hydrogen Chloride in i | Non-Aqueous Solvents | 329 |
|--|--|---------|
| COMPONENTS : | ORIGINAL MEASUREMENTS: | |
| <pre>(1) Hydrogen chloride; HCl; [7647-01-0]</pre> | Kosorotov, V. I.; Stul, B. Ya.; Dzhagatspanya, R. V. | |
| (2) 3,4,5-Trichloro-2-(dichloro- methyl)-pyridine; C ₆ H ₂ Cl ₅ N; | 2h. Prikl. Khim. (Leningrad) <u>1978</u> , 51, 887 - 889. | |
| [7041-22-7] | J. Appl. Chem. USSR (Engl. Transl. <u>1978</u> , 51, 858 - 860. | .) |
| VARIABLES: | PREPARED BY: | |
| T/K = 363.15 - 408.15 $p_1/kPa = 101.325$ (1 atm) | W. Gerrard | |
| EXPERIMENTAL VALUES: | ······································ | |
| T/K Hyd: | rogen Chloride Solubility 2,/mol dm ⁻³ | |
| 363.15 | 0.1 | |
| 378.15 | 0.08 | |
| 393.15 408.15 | 0.07 0.052 | |
| It was stated that the plot of log [s line. The equation | solubility] vs. l/T was a straight | |
| $\log(c_1/p_1) = (\Delta H/2)$ | 2.303 RT) - A | |
| was given with p_1 = the HCl partial p | pressure in atm. | |
| $\Delta H/kcal mol^{-1} = 3$ | 6 | |
| A = 3. | 15 | |
| | | |
| AUXILIARY | INFORMATION | - |
| METHOD/APPARATUS/PROCEDURE: | SOURCE AND PURITY OF MATERIALS: | |
| The liquid was saturated with gas at atmospheric pressure. The amount of gas absorbed was determined by "a back titration. The results were | (1) Hydrogen chloride. Obtained from a cylinder, and dried by sulfuric acid. | |
| subsequently reduced to 760 mmHg pressure." | (2) 3,4,5-Trichloro-2-(dichloro- methyl)-pyridine. Self pre- pared, and purified. Purity assessed as 95-99% by chromatography. | |
| | ESTIMATED ERROR: | |
| | REFERENCES : | <u></u> |

| COMPONENTS : | | EVALUATOR: |
|-----------------------|---------------------------|---|
| 1. Hydroge [7647-0 | en Chloride; HCl; 1-0] | Peter G. T. Fogg Department of Applied Chemistry and Life Sciences, |
| 2. Solvent | s Containing Sulfur | Polytechnic of North London, Holloway, London, N7 8DB, U.K. |
| | | January 1989 |
| | | I |

CRITICAL EVALUATION:

The Solubility of Hydrogen Chloride in Solvents Containing Sulfur.

The solubilities of hydrogen chloride in a wide range of sulfur compounds have been measured by Gerrard and co-workers (1-3) at a total pressure equal to barometric pressure and at one or more temperatures.

The mole fraction solubility in sulfuric acid at 273.15 K and 1.013 bar is low (< 0.0196) but is appreciably higher in the butyl esters of sulfonic acids in which one of the hydroxyl groups in sulfuric acid has been replaced by an alkyl or aryl group and the other hydroxyl group esterified. Solubility is greater in alkyl sulfonic acids than in benzenesulfonic acid. Substitution of a methyl group into the benzene nucleus of benzenesulfonic acid increases the solubility. Substitution of a chlorine atom lowers the solubility.

Mole fraction solubilities are high in sulfones in which both hydroxyl groups of sulfuric acid have been replaced by alkyl groups. Solubility is appreciably lower but still above the reference line value in benzene sulfuryl chloride in which one group has been replaced by the phenyl group and the other by chlorine. Solubility falls below the reference line in the case of sulfuryl chloride in which both hydroxyl groups have been replaced by chlorine.

The available mole fraction solubility data are in the order :

sulfuric acid < sulfuryl chloride < benzene sulfonyl chloride <
methanesulfonyl chloride < ethanesulfonyl chloride < chlorosulfonic acid
butyl ester < 2-propanesulfonyl chloride < 4-chlorobenzenesulfonic acid,
butyl ester < benzenesulfonic acid, butyl ester < 4-methylbenzenesulfonic
acid, butyl ester < methanesulfonic acid, butyl ester < ethanesulfonic
acid, butyl ester < tetrahydrothiophene-1,1-dioxide (tetramethylene
sulfone) < 1,1'-sulfonylbispropane (dipropyl sulfone) < 1,1'-sulfonylbispropane
(dibutyl sulfone) < 2,2'-sulfonylbispropane
(diisopropyl sulfone)</pre>

There is a discrepancy between the mole fraction solubility in sulfuryl chloride at 273.15 K and a total pressure of 1.013 bar from Ahmed's (3) data (0.043), and that from Charalambous *et al.*(2) (0.031). There is also a discrepancy between data from these two sources for mole fraction solubility at 298.15 K and this total pressure in benzenesulfonyl chloride. The value from Charalambous *et al.* is 0.0403 but the value from an extrapolation of Ahmed's data is 0.046.

In general the data for sulfuric acid and its derivatives fall into a consistent overall pattern and there is no reason to doubt the reliability of this pattern. Further work is needed to confirm the precise magnitude of solubilities in this class of solvents.

The solubility in thionyl chloride, at a total pressure equal to barometric, was measured by Ahmed in the temperature range 248.15 K to 273.15 K and by Domeniconi *et al.*(4) at 298.15 K. Extrapolation of Ahmed's data indicates a mole fraction solubility of 0.0095 at 298.15 K. This is in sharp contrast to the value of 0.0195 from the data published by Domeniconi *et al.* Further work on this system is required.

The measurement of the solubility in liquid hydrogen sulfide by Quam & Wilkinson (5) must be considered to be semi-quantitative. The solubility in several solvents, in which one or both hydrogen atoms have been replaced by an alkyl or the phenyl group, have been measured by Frazer and Gerrard (1). Data for 273.15 K and a total pressure of 101.3 kPa indicate that the mole fraction solubilities in the compounds studied lie above the reference line value corresponding to Raoult's law and are in the order :

benzenethiol < 1-butanethiol < 1,1'-thiobisbenzene < 2-propanethiol <
1,1'-thiobisbutane < 1,1'-thiobispropane.</pre>

| COMPONENTS: | EVALUATOR: | |
|---|---|--|
| <pre>1. Hydrogen Chloride; HCl; [7647-01-0]</pre> | Peter G. T. Fogg Department of Applied Chemistry and Life Sciences, | |
| 2. Solvents Containing Sulfur | Polytechnic of North London, Holloway, London, N7 8DB, U.K. | |
| | January 1989 | |

CRITICAL EVALUATION:

Frazer & Gerrard (1) also reported solubilities in thiophene and tetrahydrothiophene at 273.15 K and a total pressure equal to barometric. In line with the behaviour of other sulfur compounds, the solubility was markedly greater in tetrahydrothiophene than in the unsaturated thiophene.

The data for thiols, thioethers, thiophene and tetrahydrothiophene published by Frazer & Gerrard are self consistent and likely to be reliable. However further measurements on these systems are needed for confirmation of data.

Solubilities at a total pressure equal to barometric pressure have been reported by Ahmed (3) for dissolution in sulfur dioxide over the temperature range 218.15 K to 253.15 K and by Chesterman (6) for dissolution in carbon disulfide at 298.15 K. Data for these two solvents require confirmation by other workers.

REFERENCES

1. Frazer, M. J.; Gerrard, W. Nature, <u>1964</u>, 204, 1299-1300.

- Charalambous, J.; Frazer, M. J.; Gerrard, W. J. Chem. Soc. <u>1964</u>, 1520-1521.
- 3. Ahmed, W. Thesis, 1970, University of London.
- 4. Domeniconi, M.; Klinedınst, K.; Marıncıc, N.; Schlaıkjer, C.; Staniewicz, R.; Swette, L. ONR Contract & N00014-76-C-0524 Interim Report Jan. <u>1976</u> - Oct. <u>1977</u>.
- Quam, G. N. J. Am. Chem. Soc. <u>1925</u>, 47, 103-108.;
 Quam, G. N.; Wilkinson, J. A. J. Am. Chem. Soc. <u>1925</u>, 47, 989-994.
- 6. Chesterman, D. R. J. Chem. Soc. <u>1935</u>, 906-910.

| COMPONENTS: | ORIGINAL MEASUREMENTS: |
|---|--|
| <pre>(1) Hydrogen chloride; HCl; [7647-01-0]</pre> | Charalambous, J.; Frazer, M. J.; Gerrard, W. |
| (2) Organic compounds of sulfur | J. Chem. Soc. <u>1964</u> , 1520 - 1521. |
| VARIABLES: | PREPARED BY: |
| T/K: 273.15, 298.15 Total P/kPa : 101.3 (barometric, nearly 1 atm) | W. Gerrard |
| EXPERIMENTAL VALUES: | T/K Mole ratio Mole n _{HCl} /n ₂ fraction* [×] HCl |
| Sulfuric acid; H ₂ O ₄ S; [7664-93-9] | 273.15 <0.020 <0.0196 |
| Dichlorosulfuric acid, (<i>sulfuryl chloride</i>); Cl ₂ O ₂ S; | 273.15 0.032 0.0310 |
| [7791-25-5] ² ² The solvent was too volatile at 298.1 | 5 K for a measurement to be taken. |
| Methanesulfonyl chloride; CH ₃ ClO ₂ S; [124-63-0] | 298.15 0.044 0.0421 |
| The observation was restricted to tha was solid at 273.15 K. The solvent | t for 298.15 K because the system structure is CH ₃ SO ₂ C1. |
| Ethanesulfonyl chloride; C ₂ H ₅ ClO ₂ S; [594-44-5] The solvent structure is C ₂ H ₅ SO ₂ Cl. | 273.15 0.098 0.089 298.15 0.056 0.053 |
| 2-Propanesulfonyl chloride; $C_{3}H_{7}ClO_{2}S_{10147-37-2}$ The solvent was too volatile at 298.1 The solvent structure is $iC_{3}H_{7}SO_{2}Cl$. * calculated by the compiler | |
| AUXILIARY | INFORMATION |
| METHOD/APPARATUS/PROCEDURE | SOURCE AND PURITY OF MATERIALS: |
| The amount of hydrogen chloride absorbed at a total pressure, very nearly 1 atm, was measured by weighing the absorption vessel as described by Gerrard and Macklen (1), except that a U-tube was used instead of a bubbler tube. | Hydrogen chloride. Good specimen, dried by sulfuric acid. Ethanesulfonic acid, butyl ester: self prepared. Benzenesulfonic acid, butyl ester: self prepared. 4-Methylbenzene sulfonic acid, |
| In the case of the sulfones the gas was passed into the melt for 0.5 hour, and the system was cooled to the recorded temperature. Even after this treatment the 1,1'-sulfonylbisbutane/HCl system was solid at 273.15 K. | 4-Methylbehzene sulfonic acid, butyl ester: self prepared. 4-Chlorobenzenesulfonic acid, butyl ester: self prepared. 2-Propanesulfonyl chloride: prepared by the chlorination of the disulfide. Other solvents were commercial specimens. All solvents were carefully purified and rigorously attested. ESTIMATED ERROR: |
| | |
| | REFERENCES : |
| | Gerrard, W.: Macklen, E. D. J. Appl. Chem. <u>1956</u>, 6, 241. |

| COMPONENTS: | ORIGINAL MEASUREMENTS: |
|---|---|
| | |
| <pre>(1) Hydrogen chloride; HCl; [7647-01-0]</pre> | Charalambous, J.; Frazer, M. J.; Gerrard, W. |
| (2) Organic compounds of sulfur | J. Chem. Soc. <u>1964</u> , 1520 - 1521. |
| EXPERIMENTAL VALUES: | T/K Mole ratio Mole n _{HCl} /n ₂ fraction* ^x HCl |
| Benzenesulfonyl chloride; C ₆ H ₅ ClO ₂ S; [98-09-9] | 298.15 0.042 0.0403 |
| Even after the gas had been passed int the system was solid at 273.15 K. The | to the melt at higher temperatures, e solvent structure is C ₆ H ₅ SO ₂ Cl. |
| Chlorosulfuric acid, butyl ester, (<i>butyl chlorosulfate</i>); C ₄ H ₉ ClO ₃ S; [763-23-5] The solvent structure is Cl-SO ₂ -OC ₄ H ₉ . | 273.15 0.117 0.105 298.15 0.057 0.0539 |
| Methanesulfonic acid, butyl ester, (butyl methanesulfonate); C ₅ H ₁₂ O ₃ S; | 273.15 0.510 0.338 298.15 0.255 0.203 |
| [1912-32-9] The structure is $CH_3 - SO_2 - OC_4H_9$. | |
| Ethanesulfonic acid, butyl ester, (butyl ethanesulfonate); C ₆ H ₁₄ O ₃ S; [14245-63-7] The structure is C ₂ H ₅ -SO ₂ -OC ₄ H ₉ . | 273.15 0.630 0.387 298.15 0.316 0.240 |
| Benzenesulfonic acid, butyl ester, (butyl benzenesulfonate); $C_{10}H_{14}O_{3}S$; [80-44-4] The structure is $C_{6}H_{5}-SO_{2}-OC_{4}H_{9}$. | 273.15 0.419 0.295 298.15 0.213 0.176 |
| 4-Methylbenzenesulfonic acid, butyl ester, (butyl p-toluenesulfonate); C ₁₁ H ₁₆ O ₃ S; [778-28-9] The structure is p-CH ₃ -C ₆ H ₄ -SO ₂ -OC ₄ H ₉ . | 273.15 0.445 0.308 298.15 0.249 0.199 |
| 4-Chlorobenzenesulfonic acid, butyl ester, (butyl p-chlorobenzene- sulfonate); C ₁₀ H ₁₃ ClO ₃ S; [6421-41-6] | 273.15 0.210 0.174 298.15 0.083 0.0766 |
| The structure is $p-Cl-C_6H_4-SO_2-OC_4H_9$. 1,1'-Sulfonylbispropane, (dipropyl- sulfone); $C_6H_14O_2S$; [598-03-8] | 273.15 1.010 0.502 298.15 0.622 0.383 |
| The structure is $(C_3^{H_7})_2^{SO_2}$ 2,2'-Sulfonylbispropane, (diisopropyl- sulfone); $C_6^{H_1} 4^{O_2}S$; [595-50-6] The structure is $(iC_3^{H_7})_2^{SO_2}$ | - 273.15 1.174 0.540 298.15 0.712 0.416 |
| 1,1'-Sulfonylbisbutane, $(dibutyl sulfone)$; C ₈ H ₁₈ O ₂ S; [598-04-9] The structure is $(C_4H_9)_2SO_2$. | 298.15 0.627 0.385 |
| Tetrahydrothiophene-1,1-dioxide, (tetramethylene sulfone); $C_4H_8O_2S$; [126-33-0] The structure is CH_2-CH_2 $I_2O_2CH_2-CH_2$ | 273.15 0.763 0.463 298.15 0.402 0.287 |
| * calculated by the compiler | |

333

| COMPONENTS: | ORIGINAL ME | EASUREMENTS: | |
|--|--|---|---|
| <pre>(1) Hydrogen chloride; HCl; [7647-01-0]</pre> | Frazer, M. | J.; Gerrard, | ₩. |
| <pre>(2) Thiols, thioethers, thiophene and tetrahydrothiophene</pre> | Nature <u>1964</u> | <u>4</u> , 204, 1299 - | - 1300 |
| VARIABLES: | PREPARED BY | ζ: | |
| T/K: 273.15 Total P/kPa : 101.3 (barometric, nearly 1 atm) | W. Ge | errard | |
| EXPERIMENTAL VALUES: | | | <u></u> |
| | T/K | Mole ratio ⁿ HCl ^{/n} 2 | Mole fraction* ^x HCl |
| 2-Propanethiol, (2-propylmercaptan); C ₃ H ₈ S; [75-33-2] | 273.15 | 0.225 | 0.184 |
| 1-Butanethiol, (<i>l-butylmercaptan</i>); C ₄ H ₁₀ S; [109-79-5] | 273.15 | 0.125 | 0.111 |
| Benzenethiol, (thiophenol, mercapto- benzene); C ₆ H ₆ S; [108-98-5] | 273.15 | 0.093 | 0.085 |
| 2,2'-Thiobispropane, (diisopropyl sulfide); C ₆ H ₁₄ S; [625-80-9] | 273.15 | 0.659 | 0.397 |
| 1,1'-Thiobisbutane, (dibutyl sulfide) C ₈ H ₁₈ S; [544-40-1] | ; 273.15 | 0.640 | 0.390 |
| 1,1'-Thiobisbenzene, (diphenyl sulfid C ₁₂ H ₁₀ S; [139-66-2] | le); 273.15 | 0.144 | 0.126 |
| Thiophene; C ₄ H ₄ S; [110-02-1] | 273.15 | 0.034 | 0.0329 |
| Tetrahydrothiophene; C ₄ H ₈ S; [110-01-0 | 273.15 | 0.673 | 0.402 |
| * calculated by the compiler | | | |
| | | | |
| | INFORMATION | | |
| METHOD/APPARATUS/PROCEDURE | | PURITY OF MAT | |
| The gas was passed into a weighed amount of solvent (about 2 g) in a | | chloride. Se y purifed. | elf made and |
| U-tube kept at 273.15 K. The pres- sure was atmospheric, approximately 1 atm. The maximum amount of gas absorbed was determined by weighing. | 2. Sulfur co were chec gas-liqu: each meas the gas with wate recovered | ompounds. The cked by boilin id chromatogra surement of so was removed by er, the liquid d and identific compound. | ng points and aphy. After olubility y treatment d was |
| | ESTIMATED EN | RROR: | |
| | REFERENCES: | ······ | |
| | VPI PVPMCP9 ; | | |
| | | | |

| COMPONENTS : | ORIGINAL MEASUREMENTS: |
|--|---|
| <pre>1. Hydrogen Chloride; HCl; [7647-01-0</pre> | Ahmed, W. |
| 2 Sulfuryl Chloride: Cl O St | Thesis, 1970 University of London |
| <pre>2. Sulfuryl Chloride; Cl₂O₂S; [7791-25-5]</pre> | University of London |
| [//91-25-5] | |
| | |
| VARIABLES: | PREPARED BY: |
| T/K: 248.15 - 288.15 Total P/kPa: 101.325 (1 atm) | W. Gerrard (smoothed data calculated by H.L. Clever) |
| EXPERIMENTAL VALUES: | |
| T/K Mol R | |
| ⁿ HC1/ ⁿ C | 1202s XHCI |
| | .27 0.113 |
| 253.15 0.1 | .09 0.0983 |
| | 075 0.0698 045 0.0431 |
| | 024 0.0234 |
| 288.15 0.0 | 0.0157 |
| The mole fraction solubilities were c compiler. | alculated from the mole ratio by the |
| | 02.781/(T/100) - 126.317 ln (T/100) |
| | Regression Line = 1.38×10^{-3} |
| | |
| T/K | Mol Fraction |
| | x _{HC1} |
| 243.15 | 0.119 |
| 253.15 | 0.0998 |
| 263.15 | 0.0705 |
| 273.15 283.15 | 0.0428 0.0229 |
| 293.15 | 0.0109 |
| | |
| | |
| AUXILIARY | INFORMATION |
| METHOD/APPARATUS/PROCEDURE: | SOURCE AND PURITY OF MATERIALS: |
| Hydrogen chloride was passed into a | 1. Hydrogen chloride. Good quality |
| weighed amount of sulfuryl chloride in a bubbler tube as described in the | gas was obtained from a cylinder. |
| main paper (1). The final liquid was | |
| treated quantitatively with water. | chloride. |
| Total acid and total chloride were determined by titrations. | 2. Sulfuryl chloride. Best specimen |
| | was purified and attested. |
| | |
| | |
| | ESTIMATED ERROR: |
| | $\delta T/K = 0.2$ |
| | $\delta X_1 / X_1 = 0.02$ |
| | |
| | REFERENCES: |
| | 1. Ahmed, W.; Gerrard, W.; |
| | Maladkar, V. K. |
| | J. Appl. Chem. <u>1970</u> , 20, 109. |
| | |
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| COV/DOVIDVING - | |
|---|--|
| COMPONENTS: | ORIGINAL MEASUREMENTS: |
| 1. Hydrogen Chloride; HCl; | Ahmed, W. |
| [7647-01-0] | |
| | Thesis, 1970 |
| 2. Benzenesulfonyl Chloride; | University of London |
| C ₆ H ₅ ClO ₂ S; [98-09-9] | |
| 652 | |
| | |
| | |
| VARIABLES: | PREPARED BY: |
| m/v_{2} 252 15 - 202 15 | |
| T/K: 253.15 - 293.15 | W. Gerrard |
| Total P/kPa: 101.325 (1 atm) | (smoothed data calculated by H.L. Clever) |
| | (Smoothed data cartaided by mpr orever, |
| EXPERIMENTAL VALUES: | |
| T/K Mol Ra | tio Mol Fraction |
| ⁿ HC1/ ⁿ C6H | 5C102S XHC1 |
| | 5 2 102 |
| 253.15 0.26 | 2 0.208 |
| 258.15 0.19 | |
| 263.15 0.15 | |
| 268.15 0.13 | |
| 273.15 0.09 | |
| 278.15 0.08 | |
| 283.15 0.07 | |
| 288.15 0.06 | |
| 293.15 0.05 | |
| | |
| The mole fraction solubilities were c | alculated from the mole ratio by the |
| compiler. | - |
| Smoothed Data: $\ln X_{max} = -42.713 + 6$ | 7.585/(T/100) + 15.537 ln (T/100) |
| HCl , | (1,100) + 13.337 III (1,100) |
| Standard Error About | Regression Line = 3.38×10^{-3} |
| | $\frac{1}{10}$ |
| | |
| T/K | Mol Fraction |
| | x _{HCl} |
| | |
| 253.15 | 0.205 |
| 263.15 | 0.136 |
| 273.15 | 0.0946 |
| 283.15 | 0.0690 |
| 293.15 | 0.0524 |
| | |
| | |
| AUXILIARY | INFORMATION |
| | |
| METHOD/APPARATUS/PROCEDURE: | SOURCE AND PURITY OF MATERIALS: |
| Hydrogen chloride was passed into a | 1. Hydrogen chloride. Good quality |
| weighed specimen of the sulfur com- | I = |
| | gas was obtained from a cylinder |
| pound in a bubbler tube as described | gas was obtained from a cylinder. |
| pound in a bubbler tube as described in the main paper (1). For temper- | It was passed through concen- |
| in the main paper (1). For temper- | It was passed through concen- trated sulfuric acid and calcium |
| in the main paper (1). For temper- atures below 268 K the final mixture | It was passed through concen- |
| in the main paper (1). For temper- atures below 268 K the final mixture was quantitatively treated with | It was passed through concen- trated sulfuric acid and calcium chloride. |
| in the main paper (1). For temper- atures below 268 K the final mixture was quantitatively treated with water and the total chloride esti- | It was passed through concen- trated sulfuric acid and calcium chloride. 2. Benzenesulfonyl chloride. The |
| in the main paper (1). For temper- atures below 268 K the final mixture was quantitatively treated with | It was passed through concen- trated sulfuric acid and calcium chloride. |
| in the main paper (1). For temper- atures below 268 K the final mixture was quantitatively treated with water and the total chloride esti- | It was passed through concentrated sulfuric acid and calcium chloride. 2. Benzenesulfonyl chloride. The best specimen was purified and |
| in the main paper (1). For temper- atures below 268 K the final mixture was quantitatively treated with water and the total chloride esti- | It was passed through concentrated sulfuric acid and calcium chloride. 2. Benzenesulfonyl chloride. The best specimen was purified and |
| in the main paper (1). For temper- atures below 268 K the final mixture was quantitatively treated with water and the total chloride esti- | It was passed through concentrated sulfuric acid and calcium chloride. 2. Benzenesulfonyl chloride. The best specimen was purified and |
| in the main paper (1). For temper- atures below 268 K the final mixture was quantitatively treated with water and the total chloride esti- | It was passed through concentrated sulfuric acid and calcium chloride. 2. Benzenesulfonyl chloride. The best specimen was purified and |
| in the main paper (1). For temper- atures below 268 K the final mixture was quantitatively treated with water and the total chloride esti- | It was passed through concentrated sulfuric acid and calcium chloride. 2. Benzenesulfonyl chloride. The best specimen was purified and attested. |
| in the main paper (1). For temper- atures below 268 K the final mixture was quantitatively treated with water and the total chloride esti- | <pre>It was passed through concen- trated sulfuric acid and calcium chloride. 2. Benzenesulfonyl chloride. The best specimen was purified and attested. ESTIMATED ERROR:</pre> |
| in the main paper (1). For temper- atures below 268 K the final mixture was quantitatively treated with water and the total chloride esti- | It was passed through concentrated sulfuric acid and calcium chloride. 2. Benzenesulfonyl chloride. The best specimen was purified and attested. |
| in the main paper (1). For temper- atures below 268 K the final mixture was quantitatively treated with water and the total chloride esti- | <pre>It was passed through concen- trated sulfuric acid and calcium chloride. 2. Benzenesulfonyl chloride. The best specimen was purified and attested. ESTIMATED ERROR:</pre> |
| in the main paper (1). For temper- atures below 268 K the final mixture was quantitatively treated with water and the total chloride esti- | <pre>It was passed through concen- trated sulfuric acid and calcium chloride. 2. Benzenesulfonyl chloride. The best specimen was purified and attested. ESTIMATED ERROR:</pre> |
| in the main paper (1). For temper- atures below 268 K the final mixture was quantitatively treated with water and the total chloride esti- | <pre>It was passed through concen- trated sulfuric acid and calcium chloride. 2. Benzenesulfonyl chloride. The best specimen was purified and attested. ESTIMATED ERROR:</pre> |
| in the main paper (1). For temper- atures below 268 K the final mixture was quantitatively treated with water and the total chloride esti- | It was passed through concen- trated sulfuric acid and calcium chloride. 2. Benzenesulfonyl chloride. The best specimen was purified and attested. ESTIMATED ERROR: $\delta T/K = 0.2$ $\delta X_1/X_1 = 0.02$ REFERENCES: 1. Ahmed, W.; Gerrard, W.; |
| in the main paper (1). For temper- atures below 268 K the final mixture was quantitatively treated with water and the total chloride esti- | It was passed through concen- trated sulfuric acid and calcium chloride. 2. Benzenesulfonyl chloride. The best specimen was purified and attested. ESTIMATED ERROR: $\delta T/K = 0.2$ $\delta X_1/X_1 = 0.02$ REFERENCES: 1. Ahmed, W.; Gerrard, W.; Maladkar, V. K. |
| in the main paper (1). For temper- atures below 268 K the final mixture was quantitatively treated with water and the total chloride esti- | <pre>It was passed through concen- trated sulfuric acid and calcium chloride. 2. Benzenesulfonyl chloride. The best specimen was purified and attested. ESTIMATED ERROR:</pre> |
| in the main paper (1). For temper- atures below 268 K the final mixture was quantitatively treated with water and the total chloride esti- | It was passed through concen- trated sulfuric acid and calcium chloride. 2. Benzenesulfonyl chloride. The best specimen was purified and attested. ESTIMATED ERROR: $\delta T/K = 0.2$ $\delta X_1/X_1 = 0.02$ REFERENCES: 1. Ahmed, W.; Gerrard, W.; Maladkar, V. K. |
| in the main paper (1). For temper- atures below 268 K the final mixture was quantitatively treated with water and the total chloride esti- | It was passed through concen- trated sulfuric acid and calcium chloride. 2. Benzenesulfonyl chloride. The best specimen was purified and attested. ESTIMATED ERROR: $\delta T/K = 0.2$ $\delta X_1/X_1 = 0.02$ REFERENCES: 1. Ahmed, W.; Gerrard, W.; Maladkar, V. K. |
| in the main paper (1). For temper- atures below 268 K the final mixture was quantitatively treated with water and the total chloride esti- | It was passed through concen- trated sulfuric acid and calcium chloride. 2. Benzenesulfonyl chloride. The best specimen was purified and attested. ESTIMATED ERROR: $\delta T/K = 0.2$ $\delta X_1/X_1 = 0.02$ REFERENCES: 1. Ahmed, W.; Gerrard, W.; Maladkar, V. K. |

| COMPONENTS: | ORIGINAL MEASUREMENTS: |
|--|--|
| <pre>1. Hydrogen Chloride; HCl; [7647-01-0]</pre> | Ahmed, W. |
| | Thesis, 1970 |
| 2. Thionyl chloride; Cl ₂ OS; | University of London |
| [7719-09-7] | |
| | |
| VARIABLES: | PREPARED BY: |
| T/K: 248.15 - 273.15 | W. Gerrard |
| Total P/kPa: 101.325 (1 atm) | (smoothed data calculated by H.L. Clever) |
| EXPERIMENTAL VALUES: | |
| T/K Mol Ra | |
| ⁿ HCl/ ⁿ C | 1 ₂ 0s ^X HCl |
| 248.15 0.11 | |
| 253.15 0.09 | |
| | |
| 273.15 0.03 | |
| The mole fraction solubilities were c compiler. | alculated from the mole ratio by the |
| _ | $22 862/(\pi/100) = 62 202 1 = (\pi/100)$ |
| | 33.863/(T/100) - 62.293 ln (T/100) |
| Standard Error About | Regression Line = 1.11×10^{-3} |
| | Mol Fraction |
| | x _{HCl} |
| | · |
| 243.15 253.15 | 0.121 0.0868 |
| 263.15 | 0.0579 |
| 273.15 | 0.0365 |
| | |
| | |
| | |
| | |
| | |
| AUXILIARY | INFORMATION |
| METHOD /APPARATUS / PROCEDURE : | SOURCE AND PURITY OF MATERIALS: |
| Hydrogen chloride was passed through | 1. Hydrogen chloride. Good quality |
| a weighed amount of liquid in a bub- | gas was obtained from a cylinder. |
| bler tube as described in the main | It was passed through concen- |
| paper (1). The final liquid was quantitatively treated with water. | trated sulfuric acid and calcium chloride. |
| The sulfurous acid and total chloride | |
| were determined by titrations. Repeated observations ensured that | 2. Thionyl chloride. The best specimen was purified and |
| saturation has been reached. | attested. |
| | |
| | |
| | ESTIMATED ERROR: |
| | $\delta T/K = 0.2$ |
| | $\delta x_1 / x_1 = 0.01$ |
| | |
| | REFERENCES : |
| | 1. Ahmed, W.; Gerrard, W.; |
| | Maladkar, V. K. J. Appl. Chem. <u>1970</u> , 20, 109. |
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| COMPONENTS: | | ORIGINAL MEASUREME | |
| (1) Hydrogen chlor [7647-01-0] | | Marincic, N.; S Staniewicz, R.; | |
| (2) Thionyl chlor: [7719-09-7] | ide; SOCl ₂ ; | | N00014-76-C-0524 Jan. <u>1976</u> - Oct. <u>1977</u> . |
| VARIABLES: T/K: 298 P: Atmo | ospheric | PREPARED BY: | . L. Clever |
| | | | |
| at the same | nges observed on pa e flow rate for one t(298 ± 2) K. | | |
| Gas | Experiment | Weight Change g | Average weight change/ g |
| Argon | 1 2 3 4 | -0.0590 -0.0500 -0.0546 -0.0608 | |
| | | | -0.0561 |
| Hydrogen | ·1 | 0.3433 | |
| chloride | 2 3 | 0.3463 0.3652 | |
| | | | 0.3516 |
| Mol HCl dm ⁻³ SOCl ₂ = $(0.3516 + 0.0561)g$ HCl/ $(36.45 g$ mol ⁻¹ $)(0.040 l$ = 0.28_0 The HCl was also bubbled through a solution which was 2 mol AlCl ₃ dm ⁻³ SOCl ₂ solution. The weight change indicated only the change expected for the HCl solubility in SOCl ₂ . | | | |
| | | INFORMATION | |
| METHOD APPARATUS / PROCE | DURE : | SOURCE AND PURITY | OF MATERIALS: |
| gravimetrically. | | (1) Hydrogen cl Inc. Electi | nloride. Matheson Co., conic grade. |
| to determine the from the passage of anhydrous HCl, pre was passed through | saturated with SOC1 h an 0.040 dm ⁻³ or one hour and the | (2) Thionyl chi Fractional 2' metal in a humidity). of IR absor | loride. Mobay (?). distillation from Li dry room (3 % relative The material was devoid rptions above 2500 cm ⁻¹ cm quartz cell. |
| of 5 x 10^{-7} (ohm) | pecific conductivit cm) ⁻¹ and no change noted upon saturati | - | |
| the solution with tion of the disso cm ⁻¹ . On heating solution to about | HCl. The IR absorp lved HCl is at 2800 the HCl saturated 323 K the 2800 cm ⁻ Apparently the HCl | | ST/K = 2 SM/M = 0.025 (Compiler) |
| between HC1 and Al | | or | |
| | e carried out in a between 2 to 3 ppm | | |

| COMPONENTS : | ORIGINAL MEASUREMENTS: |
|---|---|
| <pre>(1) Hydrogen chloride; HCl; [7647-01-0] (2) Hydrogen sulfide; H₂S; [7783-06-4] VARIABLES:</pre> | Quam, G. N. J. Am. Chem. Soc. <u>1925</u> , 47, 103 - 8. Quam, G. N.; Wilkinson, J. A. J. Am. Chem. Soc. <u>1925</u> , 47, 989 - 94. PREPARED BY: |
| T/K = 194.7 p/kPa = 101.3 (l atm) | H. L. Clever |
| EXPERIMENTAL VALUES: | |
| Temperature t/°C T/K | Mol Fraction |
| -78.5 194.7 | 0.432 |
| The compiler estima from the statement was determined at t a diethylether + so bath. | that the solubility he temperature of |
| AUXILIARY | INFORMATION |
| METHOD /APPARATUS / PROCEDURE : | SOURCE AND PURITY OF MATERIALS; |
| Sealed tube. Solubility at temperature of ether + solid carbon dioxide bath. Since HCl boils about 6 degrees | tion. (2) Hydrogen sulfide. Prepared by the action of hydrochloric acid |
| lower temperature than the solubility experiment, it is assumed that the result is for gaseous HCL. | on iron sulfide. Freed of HCl, arsine, and moisture. |
| | ESTIMATED ERROR: |
| | REFERENCES: |
| | |

| n Non-Aqueous Solvents |
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| ORIGINAL MEASUREMENTS: |
| Ahmed, W. |
| Thesis, 1970 University of London |
| PREPARED BY: W. Gerrard (smoothed data calculated by H.L. Clever) |
| |
| Ratio Mol Fraction $\frac{\sqrt{^{n}SO_{2}}}{\frac{^{X}HCl}{293}} \frac{^{X}HCl}{0.267}$.293 0.227 .234 0.190 .185 0.156 .096 0.0876 .057 0.0539 .018 0.0177 calculated from the mole ratio by the 620.308/(T/100) - 280.090 ln (T/100) t Regression Line = 2.42 x 10 ⁻² Mol Fraction $\frac{^{X}HCl}{0.242}$ 0.242 0.170 0.0223 |
| RY INFORMATION |
| SOURCE AND PURITY OF MATERIALS: |
| <pre>1. Hydrogen chloride. Good quality gas was obtained from a cylinder. It was passed through concen- trated sulfuric acid and calcium chloride. 2. The best specimen was passed through tubes at 263 K, and liquefied at the required temperature. ESTIMATED ERROR:</pre> |
| |

| COMPONENTS : | ORIGINAL MEASUREMENTS: |
|---|--|
| (1) Hydrogen chloride; HCl; | Chesterman, D. R. |
| [7647-01-0] | J. Chem. Soc. 1935, 906 - 910. |
| (2) Carbon disulfide; CS ₂ ; [75-15-0] | <i>o. chem. 500.</i> <u>1935</u> , 900 - 910. |
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| VARIABLES: | PREPARED BY: |
| т/к: 298.15 | I WIND DI |
| Total P/kPa: 101 (∿1 atm) | W. Gerrard |
| | |
| EXPERIMENTAL VALUES: | • |
| | lubility Mol Fraction |
| Pressure q HCL | lubility Mol Fraction g ⁻¹ Solution x ₁ |
| p/mmHg | |
| | |
| 298.15 766 | 0.004 0.008 |
| | |
| | ty value was calculated by |
| the compiler. | |
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| AUXILIARY | INFORMATION |
| METHOD/APPARATUS/PROCEDURE: | SOURCE AND PURITY OF MATERIALS: |
| | (1) Hydrogen chloride. Prepared |
| The apparatus was that used for the conductivity. A sample of the | from conc. sulfuric acid and pure |
| saturated solution was removed, | sodium chloride. Passed through |
| weighed, the hydrogen chloride was | sulfuric acid and over P ₂ O ₅ . |
| reacted with excess standard base | 2 5 |
| which is back titrated with a standard acid solution. | (2) Carbon disulfide. Was stated to be the purest obtainable. |
| Standard acto Solution. | Undried, b.p./°C (759 mmHg) = |
| | 46 - 47. |
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| | ESTIMATED ERROR: |
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| | REFERENCES ; |
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| COMPONENTS: | EVALUATOR: | |
|--|---|--|
| <pre>1. Hydrogen Chloride; HCl; [7647-01-0]</pre> | Peter G. T. Fogg Department of Applied Chemistry and Life Sciences, | |
| 2. Solvents Containing Boron | Polytechnic of North London, Holloway, London, N7 8DB, U.K. | |
| | January 1989 | |
| CRITICAL EVALUATION: | | |
| Solubility of Hydrogen Chloride in Solvents Containing Boron. | | |
| Solubilities in various boron compounds over temperature ranges at barometric pressure have been measured by Gerrard and his co-workers (1-3). The data are self-consistent and likely to be reliable but there are no data by other workers for comparison. | | |
| Solubilities in the triethyl, tributyl and tripentyl esters of boric acid were investigated over a temperature range of 199.15 K to 321.15 K. As with many solvents containing oxygen, mole fraction solubilities are higher than reference line values corresponding to the Raoult's law equation i.e. ratio of partial pressure of hydrogen chloride to vapor pressure of liquid hydrogen chloride at the same temperature. | | |
| Mole fraction solubilities in dioxaboroles are lower than in the non-cyclic borates. The solubility increases with size of the substituent alkoxy group. The presence of a benzene ring lowers the solubility. Mole fraction solubilities at 101.3 kPa and 293.15 K are as follows : | | |
| <pre>(reference line value 2-butoxy-1,3,2-dioxaborolane 2-methoxy -1,3,2-benzodioxaborole 2-ethoxy-1,3,2-benzodioxaborole 2-propoxy-1,3,2-benzodioxaborole 2-butoxy-1,3,2-benzodioxaborole 2-pentoxy-1,3,2-benzodioxaborole</pre> | 0.024) 0.123 0.0853 0.109 0.115 0.118 0.119 | |
| Mole fraction solubilities in solvents of investigated, are appreciably lower. Va follows : | containing chlorine and boron, which were clues corresponding to 293.15 K are as | |
| butoxydichloroborane dichlorophenylborane | 0.0213 0.0451 (extrapolated) | |
| Mole fraction solubilities in boron trichloride, at a partial pressure of hydrogen chloride of 101.3 kPa, fall below the reference line in the temperature range of 208.15 K to 263.15 K. Measurements have not been made outside this range. | | |
| REFERENCES | | |
| Gerrard, W.; Mincer, A. M. A.; Wyvill, P. L. J. Appl. Chem. <u>1959</u>, 9, 89-93; <u>1960</u>, 10, 115-121. | | |
| 2. Ahmed, W.; Gerrard, W.; Maladkar, V. K. J. Appl. Chem. <u>1970</u> , 20, 109–115. | | |
| 3. Ahmed, W. Thesis, <u>1970</u> , University | v of London. | |
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| COMPONENTS: | ORIGINAL MEASUREMENTS: |
| (1) Hydrogen chloride; HCl; | Gerrard, W.; Mincer, A. M. A.; |
| [7647-01-0] | Wyvill, P. L. |
| (2) David paid twistbul astan an | |
| (2) Boric acid triethyl ester or | J. Appl. Chem. <u>1960</u> , 10, 115-121. |
| triethyl borate; C ₆ H ₁₅ BO ₃ ; | |
| [150-46-9] | |
| | |
| VARIABLES: | PREPARED BY: |
| т/к: 230.65 - 317.35 | |
| Total P/kPa: 101.325 (1 atm) | W. Gerrard |
| | (smoothed data calculated by H.L. Clever) |
| | |
| EXPERIMENTAL VALUES: T/K Mol Rat | |
| | $-BO_{-}$ x_{1} |
| | <u>1503</u> |
| 230.65 1.782 | 0.641 |
| 273.95 0.454 | 0.312 |
| 274.15 0.446 | 0.308 |
| 278.55 0.388 282.15 0.340 | 0.280 0.254 |
| 282.15 0.340 286.15 0.287 | 0.223 |
| 292.95 0.224 | 0.183 |
| 302.75 0.156 | 0.135 |
| 312.15 0.120 | 0.107 |
| 317.35 0.0985 | |
| The compiler calculated the mole fract | |
| | |
| Smoothed Data: $\ln x_1 = 58.003 - 71.60$ |)5/(T/100) - 32.786 ln (T/100) |
| Standard error about t | the regression line is 3.72×10^{-3} |
| | |
| T/K M | All Fraction |
| | x1 |
| 233.15 | 0.630 |
| 243.15 | 0.562 |
| 253.15 | 0.480 |
| 263.15 | 0.395 |
| 273.15 | 0.315 |
| 283.15 293.15 | 0.244 0.185 |
| 303.15 | 0.138 |
| 313.15 | 0.101 |
| 323.15 | 0.0734 |
| | |
| AUXILIARY | INFORMATION |
| | |
| METHOD/APPARATUS/PROCEDURE: | SOURCE AND PURITY OF MATERIALS: |
| The liquid component was weighed in | (1) Hydrogen chloride. Good specimen |
| a bubbler tube. The amount of gas | from a commercial cylinder was |
| absorbed was determined by re- | dried. |
| weighing to constant weight. The total pressure was barometric, very | (2) Boric acid triethyl ester. |
| nearly 1 atm (101.325 kPa). | Carefully purified, and purity |
| HEATTA T GOW (TAT. 252 VLd). | rigorously attested. |
| The hydrogen chloride absorbed at | rigoroubry accepted. |
| 230.65 K was determined by attaching | |
| the bubbler-tube to a flask containing | 7 |
| water, and allowing the assembly to | 1 |
| warm to room temperature, after which | |
| the chloride ion content was estimated | ESTIMATED ERROR: |
| by a Volhard titration. | ESTIMATED ERKOR: |
| 1 | |
| | $\delta x_1 / x_1 = 0.02$ |
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| | PEPEDENCES . |
| | REFERENCES: |
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| COMPONENTS: | ORIGINAL MEASUREMENTS: |
|---|--|
| <pre>(1) Hydrogen chloride; HCl; [7647-01-0]</pre> | Gerrard, W.; Mincer, A. M. A.; Wyvill, P. L. |
| <pre>(2) Boric acid, tripentyl ester or tripentyl borate; C₁₅H₃₃BO₃; [621-78-3]</pre> | J. Appl. Chem. <u>1960</u> , 10, 115-121. |
| VARIABLES: | PREPARED BY: |
| T/K: 273.15 - 321.15 | W. Gerrard |
| Total P/kPa: 101.325 (1 atm) | (smoothed data calculated by H.L. Clever) |
| | (shoothed data calculated by h.L. clevel) |
| EXPERIMENTAL VALUES: T/K MOL R | atio Mol Fraction |
| | |
| ⁿ HCl ^{/n} C _l | 5 ¹ 33 ¹⁰ 3 |
| 273.15 0.4 | |
| | |
| 283.65 0.3 290.95 0.2 | |
| 301.95 0.1 | |
| 308.15 0.1 | |
| 314.25 0.1 | 22 0.109 |
| 321.15 0.1 | 08 0.0975 |
| The compiler calculated the mole frac | tion values. |
| | /(T/100) - 8.950 ln (T/100) |
| | $(1/100)^{-3}$ |
| | the regression line is 6.67×10^{-3} |
| T/K | Mol Fraction |
| | ^x 1 |
| 273.15 | 0.339 |
| 283.15 | 0.256 |
| 293.15 | 0.195 |
| 303.15 313.15 | 0.149 0.115 |
| 323.15 | 0.0897 |
| | |
| AUXILIARY | INFORMATION |
| METHOD APPARATUS/PROCEDURE: The liquid component was weighed in a bubbler tube. The amount of gas absorbed was determined by re- weighing to constant weight. The total pressure was barometric, very nearly 1 atm (101.325 kPa). | SOURCE AND PURITY OF MATERIALS: (1) Hydrogen chloride. Good specimen from a commercial cylinder was dried. (2) Boric acid, tripentyl ester. Carefully purified and purity rigorously attested. |
| | ESTIMATED ERROR: $\delta x_1 / x_1 = 0.025$ REFERENCES: |
| |] |

| Hydrogen Chioride in | Non-Aqueous Solvents 345 | |
|--|--|--|
| COMPONENTS: (1) Hydrogen chloride; HCl; [7647-01-0] | ORIGINAL MEASUREMENTS: Gerrard, W.; Mincer, A. M. A.; Wyvill, P. L. | |
| (2) Organic derivatives of boric acid. | J. Appl. Chem. <u>1959</u> , 9, 89-93. | |
| VARIABLES: | PREPARED BY: | |
| T/K: See below Total P/kPa : 101.325 (1 atm) | W. Gerrard | |
| EXPERIMENTAL VALUES: T/K | Mole ratio Mole* Smoothed** HCl ^{/n} borate fraction mole fraction ^x HCl ^x HCl | |
| Boric acid, tributyl ester, 199.15 (tributyl borate, 203.15 tributoxyborane); C _{1.2} H _{2.7} BO ₂ ; 213.15 | 0.850 | |
| tributoxyborane); C ₁₂ H ₂₇ BO ₃ ; 213.15 [688-74-4] 219.15 223.15 233.15 | 2.568 0.720 0.709 | |
| 233.15 | | |
| 243.15 | 0.549 | |
| 253.15 | | |
| 255.15 | | |
| 263.15 273.15 | | |
| 281.55 | | |
| 283.15 | 0.253 | |
| 287.05 | | |
| 293.15 298.75 | | |
| 303.15 | | |
| 304.15 | | |
| 305.45 | | |
| 312.15 | | |
| 313.15 319.35 | | |
| 323.15 | 0.081 | |
| Smoothing equation: $\ln x_{HC1} = -29.9216 + 47.0282/(T/100) + 51.5412 \ln(T/100) - 14.7289 (T/100K)$ Standard error in x_{HC1} about the regression line = 1.03×10^{-2} * calculated by the compiler ** smoothing equation and smoothed values were calculated by H.L. Clever | | |
| AUXILIARY | INFORMATION | |
| METHOD/APPARATUS/PROCEDURE: The liquid component was weighed in a bubbler tube. The amount of gas absorbed was determined by reweighing to constant weight. The total pressure was barometric, very nearly 1 atm (101.325 kPa). | SOURCE AND PURITY OF MATERIALS: (1) Hydrogen chloride: good specimen from a commercial cylinder was dried. (2) Borates : carefully purified, and purity rigourously attested. | |
| For determination at temperatures below 273 K, a chemical titration was carried out. After the maximum | ESTIMATED ERROR: $\delta T/K = \pm 2$ below 273 K | |
| absorption at the stated temperature, the bubbler was attached to a flask | $\delta x_{\rm HCl} / x_{\rm HCl} = \pm 0.005 \text{ to } 0.01$ | |
| containing one dm ³ of water, and allowed to warm slowly to room temperature (12 hours). The contents of the bubbler tube were then added to the water, and the total chloride ion was determined by the Volhard method. A low temperature, Teddington-type YM thermostat was used for temperatures | NOTE: The smoothing equation for boric acid, tributyl ester deviates from the data. It is 4% low at 283 K, 5% high at 303 K, and 6.5% low at 320 K. Estimated error for this system: $\delta x_{\rm HC1}/x_{\rm HC1} = \pm 0.04$ | |
| below 273 K, the control being to ±2 K. | REFERENCES: | |

| Hydrogen | Chloride | in Non-Aqueous | Solvents |
|----------|----------|----------------|----------|
|----------|----------|----------------|----------|

| <pre>COMPONENTS: (1) Hydrogen chloride; HCl; [7647-01-0] (2) Organic derivatives of boric acid.</pre> | Wyvill, P. | ; Mincer, A. M. | |
|--|---|--|--|
| EXPERIMENTAL VALUES: T/K | Mole ratio HCl ^{/n} borate | fraction mole | oothed** fraction ^x HCl |
| 2-Butoxy-1,3,2-dioxaborolane, 273.15 (cyclic ethylene butyl 273.25 borate); C ₆ H ₁₃ BO ₃ ; [1124-68-1] 277.65 283.15 | 0.262 0.220 | 0.208 0.180 | 0.206 |
| 283.95 287.05 290.15 293.15 297.55 | 0.184 0.168 0.150 0.141 0.124 | 0.155 0.144 0.130 0.124 0.110 | 0.123 |
| 303.15 308.45 313.15 313.75 | 0.0922 0.0806 | 0.0844 0.0746 | 0.0957 0.0753 |
| | | 0.0657) - 7.925 ln(T/ ine = 1.78 × 10 | |
| 2-Methoxy-1,3,2-benzodioxa- 273.15 borole, (cyclic o-phenylene 273.35 methyl borate); C7H7BO3; 273.95 [72035-41-7] 277.65 | 0.184 0.177 0.153 | 0.155 0.150 0.133 | 0.155 |
| 281.15 283.15 292.85 293.15 | 0.135 0.0967 | 0.119 0.0882 | 0.114 0.0853 |
| 299.15 303.15 304.95 311.45 | 0.0819 0.0647 0.0572 | 0.0757 0.0608 0.0541 | 0.0651 |
| 313.15 319.15 323.15 | 0.0438 | 0.0420 | 0.0399 |
| Standard error in x_{HC1}^{HC1} about the | + 24.009/(T/ regression 1 | ine = 2.14×10 | |
| 2-Ethoxy-1,3,2-benzodioxa- borole, (cyclic o-phenylene 273.45 ethyl borate); C ₈ H ₉ BO ₃ ; 280.65 [72035-40-6] 283.15 286.65 | 0.217 0.173 0.141 | 0.178 0.147 0.124 | 0.177 0.139 |
| 292.65 293.15 303.15 303.65 | 0.125 | 0.111 | 0.109 0.0847 |
| 313.15 319.15 323.15 | 0.0718 0.0580 | 0.0670 0.0548 | 0.0655 0.0505 |
| Smoothing equation: $\ln x_{HC1} = 31.213 - Standard error in x_{HC1}$ about the * calculated by the compiler | regression 1 | ine = 2.64 × 10 | - 3 |
| ** smoothing equation and smoothed val | ues were cal | culated by H.L. | Clever |

| COMPONENTS: (1) Hydrogen chloride; HCl; [7647-01-0] (2) Organıc derivatives of boric | Gerrard, W Wyvill, P. | EASUREMENTS: .; Mincer, A. M L. hem. <u>1959</u> , 9, 8 | |
|--|---|--|---|
| EXPERIMENTAL VALUES: | r/K Mole ratio "HCl ^{/n} borate | | moothed** e fraction ^x HCl |
| borole, (cyclic o-phenylene 27 propyl borate); C ₉ H ₁₁ BO ₃ ; 27 | 73.15 73.65 0.225 78.65 0.191 | 0.184 0.160 | 0.183 |
| 28 | 33.15 34.65 0.160 93.15 | 0.138 | 0.145 |
| 29 | 95.15 0.120 98.45 0.115 | 0.107 0.103 | |
| 30 | 03.15 08.15 0.0900 13.15 | 0.0826 | 0.0904 |
| 31 | 19.65 0.0634 23.15 | 0.0596 | 0.0556 |
| | .967 - 29.156/(T/ the regression | | |
| borole, (cyclic o-phenylene 27 | 73.15 0.242 76.45 0.215 | 0.195 0.177 | 0.195 |
| [3488-87-7] 1013 3 28 | 33.15 33.65 0.171 93.15 | 0.146 | 0.150 0.118 |
| 29 | 93.65 0.132 00.75 0.110 | 0.117 0.0991 | 0.118 |
| 30 | 03.15 07.15 0.0981 | 0.0893 | 0.0937 |
| 31 | 13.15 14.15 0.0814 19.65 0.0679 | 0.0753 0.0636 | 0.0758 |
| 32 | 23.15 | | 0.0621 |
| Smoothing equation: $\ln x_{HCl} = -9$. Standard error in x_{HCl} about | .027 + 20.188/(T/ the regression | line = 2.14×1 | 0 - 3 |
| dioxaborole, (cyclic 27 | 73.15 73.45 0.237 30.95 0.187 | 0.192 0.158 | 0.196 |
| C _{11^H15^{BO}3} ; [72035-38-2] 28 28 | 33.15 38.45 0.154 | 0.133 | 0.151 |
| 29 | 93.15 99.95 0.117 03.15 | 0.105 | 0.119 |
| 30 | 08.55 0.0960 13.15 | 0.0876 | 0.0770 |
| 32 | 19.15 0.0700 23.15 | 0.0654 | 0.0632 |
| Smoothing equation: $\ln x_{HC1} = -8$. Standard error in x_{HC1} about | 928 + 19.929/(T/ the regression | 100) line = 2.90 × 1 | 0-3 |
| dioxaborole, (cyclic 27 | 73.15 75.15 0.232 32.65 0.192 | 0.188 0.161 | 0.196 |
| $\begin{bmatrix} C_{14}H_{21}BO_3; [72035-37-1] & 28 \end{bmatrix}$ | 33.15 90.65 0.153 | 0.133 | 0.158 |
| 29 | 93.15 98.25 0.127 | 0.113 | 0.127 |
| 30 |)3.15)5.85 0.1050 0.75 0.0917 | 0.0950 0.0840 | 0.101 |
| 31 31 | 3.15 9.65 0.0730 | 0.0680 | 0.0785 |
| 32 Smoothing equation: ln x _{HCl} = 31. Standard error in x _{HCl} about HCl | 23.15 603 - 37.452/(T/ the regression 1 | 100) - 19.426 l line = 7.57 × 1 | 0.0625 n(T/100) 0 ⁻⁺ |
| * calculated by the compiler ** smoothing equation and smoothe | | | |

| COMPONENTS: | ORIGINAL MEASUREMENTS: |
|--|---|
| <pre>(1) Hydrogen chloride; HCl; [7647-01-0]</pre> | Gerrard, W.; Mincer, A. M. A.; Wyvill, P. L. |
| (2) Butoxydichloroborane; C ₄ H ₉ BCl ₂ O; [16339-30-3] | J. Appl. Chem. <u>1960</u> , 10, 115-121. |
| VARIABLES : | PREPARED BY: |
| T/K: 277.75 - 294.15 | |
| Total P/kPa: 101.325 (1 atm) | W. Gerrard |
| | (smoothed data calculated by H.L. Clever) |
| EXPERIMENTAL VALUES: | |
| | |
| 277.75 0.067 284.35 0.047 | |
| 294.15 0.019 | |
| | |
| The compiler calculated the mole frac | tion values. |
| Smoothed Data: $\ln x_1 = -24.564 + 60.$ | 734/(T/100) |
| - | regression line is 6.53×10^{-3} |
| | |
| T/K | Mol Fraction ^x 1 |
| , | |
| 273.15 283.15 | 0.0444 |
| 293.15 303.15 | 0.0214 0.0109 |
| | 0.0109 |
| | |
| AUXILIARY | INFORMATION |
| METHOD APPARATUS/PROCEDURE: | SOURCE AND PURITY OF MATERIALS: |
| The liquid component was weighed in a bubbler tube. The amount of gas absorbed was determined by re- weighing to constant weight. The total pressure was barometric, very nearly 1 atm (101.325 kPa). | Hydrogen chloride. Good specimen from a commercial cylinder was dried. Butoxydichloroborane. Carefully purified, and purity rigorously |
| | attested. |
| Solvent name is n-butyl dichloroboronite in paper. | ESTIMATED ERROR: |
| | $\delta x_1 / x_1 = 0.05$ |
| | REFERENCES : |
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| nyaroger | | Non-Aqueous Solvents 349 | |
|---|---|--|--|
| COMPONENTS : | | ORIGINAL MEASUREMENTS: | |
| <pre>1. Hydrogen Chloride; HCl; [7647-01-0]</pre> | | Ahmed, W. | |
| <pre>2. Dichlorophenylborane; C [873-51-8]</pre> | 6 ^H 5 ^{BC1} 2; | Thesis, 1970 University of London | |
| VARIABLES: T/K: 258.15 - Total P/kPa: 101.325 | | PREPARED BY: W. Gerrard (smoothed data calculated by H.L. Clever) | |
| EXPERIMENTAL VALUES: | | | |
| T/K | Mol Ratio | | |
| 258.15 263.15 268.15 273.15 278.15 283.15 | 0.100 0.092 0.082 0.073 0.066 0.059 | 0.084 0.076 0.068 0.062 | |
| The mole fraction solubili compiler. | ties were c | alculated from the mole ratio by the | |
| Smoothed Data: $\ln X_1 = 30$ | .195 - 37.2 | 94/(T/100) - 19.128 ln (T/100) | |
| - | | | |
| The standa | rd error ab | out the regression line = 5.96×10^{-4} | |
| - | Т/К МО | l Fraction X _{HCl} | |
| | 253.15 | 0.0999 | |
| | 263.15 | 0.0834 | |
| | 273.15 283.15 | 0.0686 0.0559 | |
| | 293.15 | 0.0451 | |
| | | | |
| | | | |
| | | | |
| | AUXILIARY | INFORMATION | |
| METHOD / APPARATUS / PROCEDURE : | | SOURCE AND PURITY OF MATERIALS: | |
| Hydrogen chloride was passe weighed amount of the borar bubbler tube as described i paper (1). For temperature 268 K the final mixture was tatively treated with water total chloride determined b tion. | ne in a in the main es below s quanti- c, and the | Hydrogen chloride. Good quality gas was obtained from a cylinder. It was passed through concentrated sulfuric acid and calcium chloride. Dichlorophenylborane. The borane was an internal specimen, prepared by another group. It was rigorously purified and attested. | |
| | | ESTIMATED ERROR: $\delta T/K = 0.2$ $\delta X_1/X_1 = 0.01$ REFERENCES: 1. Ahmed, W.; Gerrard, W.; Maladkar, V. K. J. Appl. Chem. <u>1970</u> , 20, 109. | |
| | | | |

| COMPONENTS : | ORIGINAL MEASUREMENTS: | |
|--|--|--|
| <pre>1. Hydrogen Chloride; HCl; [7647-01-0]</pre> | Ahmed, W. | |
| 2. Trichloroborane; BCl ₃ ; | Thesis, 1970 University of London | |
| [10294-34~5] | | |
| | | |
| VARIABLES: | PREPARED BY: | |
| T/K: 208.15 ~ 258.15 Total P/kPa: 101.325 (1 atm) | W. Gerrard (smoothed data calculated by H.L. Clever) | |
| EXPERIMENTAL VALUES: | | |
| T/K Mol R. ⁿ HCl/ ^r | · · · · · · · · · · · · · · · · · · · | |
| | | |
| 208.15 0.09 213.15 0.08 | | |
| 223.15 0.05 | | |
| 233.15 0.03 243.15 0.02 | 1 | |
| 253.15 0.01 258.15 0.01 | .9 0.0186 | |
| ······································ | | |
| The mole fraction solubilities were c compiler. | - | |
| Smoothed Data: $\ln x_{HC1} = -20.864 + 3$ | 0.290/(T/100) + 5.325 ln (T/100) | |
| Standard Error About | Regression Line = 2.47×10^{-3} | |
| т/к | Mol Fraction | |
| 1/ K | x _{HC1} | |
| | | |
| 203.15 0.113 213.15 0.0726 | | |
| 223.15 233.15 | 0.0490 0.0346 | |
| 243.15 | 0.0253 | |
| 253.15 263.15 | 0.0192 0.0150 | |
| | | |
| AUXILIARY | INFORMATION | |
| METHOD / APPARATUS / PROCEDURE : | SOURCE AND PURITY OF MATERIALS: | |
| Trichloroborane was distilled into | 1. Hydrogen chloride. Good quality | |
| the bubbler tube at low temperature. Hydrogen chloride was passed through | was obtained from a cylinder. It was passed through concen- | |
| for 2 hours. The final liquid was | trated sulfuric acid and calcium | |
| quantitatively treated with an aqueous solution of sodium hydroxide. | chloride. | |
| Borate and total chloride were | 2. Trichloroborane. The purest | |
| determined by titrations. See the main paper (1). | obtainable specimen was obtained from a sealed ampoule at low | |
| | temperature. | |
| | ESTIMATED ERROR: | |
| | | |
| | $\delta T/K = 0.2$ $\delta X_1/X_1 = 0.02$ | |
| | | |
| | REFERENCES: | |
| | 1. Ahmed, W.; Gerrard, W.; Maladkar, V. K. | |
| | J. Appl. Chem. <u>1970</u> , 20, 109. | |
| | | |
| | | |
| | | |

| nyarogen Unioriae in i | Non-Aqueous Solvents 351 |
|--|--|
| COMPONENTS : | ORIGINAL MEASUREMENTS: |
| <pre>1. Hydrogen chloride; HCl; [7647-01-0]</pre> | Ahmed, W.; Gerrard, W.; Maladkar, V. K. |
| 2. Trichloroborane; BCl ₃ ; [10294-34-5] | J. Appl. Chem. <u>1970</u> , 20, 109 - 115. |
| VARIABLES: | PREPARED BY: |
| T/K: 223.15 - 263.15 Total P/kPa: 101.325 (1 atm) | W. Gerrard (smoothed data calculated by H.L. Clever) |
| EXPERIMENTAL VALUES: | |
| Standard error about | $ \begin{array}{cccccccccccccccccccccccccccccccccccc$ |
| AUXILIARY | INFORMATION |
| METHOD/APPARATUS/PROCEDURE: | SOURCE AND PURITY OF MATERIALS: |
| Hydrogen chloride was passed into a known weight of liquid in a bubbler tube at a total pressure measured by a manometer assembly. The tempera- ture was manually controlled to within 0.2 K. The procedure and apparatus are described by Gerrard (1, 2). The absorbed gas was determined by a chemical titration for boron and chloride. | Hydrogen chloride. Obtained from a cylinder containing a good commerical specimen. Was dried by passage through con- centrated sulfuric acid. Trichloroborane. Best ob- tainable specimen was suitably purified, dried, and fraction- ally distilled, and attested. |
| | ESTIMATED ERROR: |
| | $\delta T/K = 0.2$ $\delta X/X = 0.005$ |
| | <pre>REFERENCES: 1. Gerrard, W. J. Appl. Chem. Biotechnol. <u>1972</u>, 22, 623 - 650. 2. Gerrard, W. "Solubility of Gases and Liquids" Plenum Press, New York, 1976</pre> |

| COMPONENTS: 1. Hydrogen Chloride; HCl; [7647-01-0] | EVALUATOR: Peter G. T. Fogg Department of Applied Chemistry and Life Sciences, |
|--|---|
| 2. Solvents Containing Phosphorus | Polytechnic of North London, Holloway, London, N7 8DB, U.K. |
| | January 1989 |

CRITICAL EVALUATION:

The Solubility of Hydrogen Chloride in Solvents Containing Phosphorus.

Solubilities in a variety of solvents containing phosphorus have been measured by Gerrard and his co-workers (1-4) over temperature ranges at barometric pressure. Data are self-consistent but, only in the case of tributyl phosphate can comparison be made with measurements by other workers. Borissov & Ionin (5) have published a small diagram showing a plot of the logarithm of the mole ratio solubility at 298.15 K and 101.3 kPa in five trialkyl esters against the carbon number of the alkyl group. In the case of tributyl ester the corresponding mole fraction solubility is about 0.6 which may be compared with a value of 0.684 by extrapolation of measurements by Gerrard *et al*.

REFERENCES

- Gerrard, W.; Mincer, A. M. A.; Wyvill, P. L. J. Appl. Chem. 1959, 9, 89-93; 1960, 10, 115-121.
- Ahmed, W.; Gerrard, W.; Maladkar, V. K. J. Appl. Chem. <u>1970</u>, 20, 109-115.
- 3. Cook, T. M. Thesis, 1966, University of London.
- 4. Ahmed, Thesis, 1970, University of London.
- 5. Borissov, R. S.; Ionin, M. V. Tr. Gor'k. Politekh. Inst. <u>1973</u>, 29, 11-15.

| COMPONENTS: | ORIGINAL MEASUREMENTS: |
|---|---|
| <pre>1. Hydrogen chloride; HCl; [7647-01-0]</pre> | Ahmed, W.; Gerrard, W.; Maladkar, V. K. |
| 2. Phosphorous trichloride; PCl ₃ ; [7719-12-2] | J. Appl. Chem. <u>1970</u> , 20, 109 - 115. |
| | |
| VARIABLES: | PREPARED BY: |
| Т/К: 213.15 - 273.15 | |
| Total P/kPa: 101.325 (1 atm) | ii. Gerrard (smoothed data calculated by H.L. Clever) |
| EXPERIMENTAL VALUES: | |
| T/K Mol Rat | |
| ⁿ HCl/ ⁿ P | |
| 213.15 0.24 | 0.194 |
| 223.15 0.13 | 0.115 |
| 233.15 0.09 243.15 0.063 | 0.0826 0.0593 |
| 253.15 0.048 | |
| 263.15 0.033 | 0.0319 |
| 273.15 0.027 | 0.0263 |
| The mole fraction solubilities were ca compiler. | lculated from the mole ratio by the |
| | .360/(T/100) + 7.575 ln (T/100) |
| Standard error about r | egression line 4.54×10^{-3} |
| T/K M | ol Fraction |
| | ^х ис1 |
| 213.15 | 0.188 |
| 223.15 | 0.121 |
| 233.15 | 0.0826 |
| 243.15 253.15 | 0.0587 |
| 253.15 | 0.0434 0.0332 |
| 273.15 | 0.0262 |
| AUXILIARY | INFORMATION |
| METHOD/APPARATUS/PROCEDURE: | SOURCE AND PURITY OF MATERIALS: |
| Hydrogen chloride was passed into a | (1) Obtained from a cylinder con- |
| known weight of liquid in a bubbler | taining a good commercial speci- |
| tube at a total pressure measured by | men. Was dried by passage |
| a manometer assembly. The absorbed gas was weighed by re-weighing the | through concentrated sulfuric acid. |
| bubbler tube. The temperature was | |
| manually controlled to within 0.2 K. | (2) Best obtainable specimen was suitably purified, dried, and |
| The procedure and apparatus are described by Gerrard (1, 2). | fractionally distilled, and |
| | attested. |
| For temperatures below 253 K, a chemical titration was conducted. | |
| | ESTIMATED ERROR: |
| | |
| | $\delta T/K = 0.2$ $\delta X/X = 0.02$ |
| | REFERENCES : |
| | Gerrard, W. J. Appl. Chem. Biotechnol. <u>1972</u>, 22, 623 - 650. |
| | 2. Gerrard, W. "Solubility of Gases and Liquids" |
| | Plenum Press, New York, 1976 |

| <pre>COMPONENTS: 1. Hydrogen Chloride; HCl; [7647-01-0] 2. Phosphoryl Chloride; Cl₃OP; [10025-87-3]</pre> | ORIGINAL MEASUREMENTS: Ahmed, W. Thesis, 1970 University of London PREPARED BY: |
|---|--|
| T/K: 273.15 - 288.15 Total P/kPa: 101.325 (1 atm) | W. Gerrard (smoothed data calculated by H.L. Clever) |
| EXPERIMENTAL VALUES: | |
| T/K Mol Ra nHCl/ ⁿ C 273.15 0.32 278.15 0.20 283.15 0.13 288.15 0.12 The mole fraction solubilities were c | $\begin{array}{c} 1_{3} OP & X_{HC1} \\ \hline 0 & 0.242 \\ 8 & 0.172 \\ 7 & 0.120 \\ 5 & 0.111 \end{array}$ |
| compiler. | |
| | 2.613/(T/100) Regression Line = 1.1×10^{-2} Mol Fraction XHCl 0.231 0.133 0.080 |
| AUXILIARY METHOD/APPARATUS/PROCEDURE: Hydrogen chloride was passed into a weighed amount of phosphoryl chloride in a bubbler tube as described in the main paper (1). The gas absorbed was weighed; and the result was checked by quantitative treatment with water followed by titrations of total chloride and acid. | |
| | ESTIMATED ERROR: $\delta T/K = 0.2$ $\delta X_1/X_1 = 0.02$ REFERENCES: 1. Ahmed, W.; Gerrard, W.; Maladkar, V. K. J. Appl. Chem. 1970, 20, 109. |

| Hydrogen Chloride in I | Non-Aqueous Solvents 35 |
|---|---|
| COMPONENTS: | ORIGINAL MEASUREMENTS: |
| <pre>1. Hydrogen Chloride; HCl; [7647-01-0]</pre> | Ahmed, W. Thesis, 1970 |
| 2. Phenylphosphonous Dichloride; C ₆ ^H 5 ^{Cl} 2 ^P ; [644-97-3] | University of London |
| VARIABLES: | PREPARED BY: |
| T/K: 268.15 - 283.15 Total P/kPa: 101.325 (1 atm) | W. Gerrard |
| , | (smoothed data calculated by H.L. Clever) |
| EXPERIMENTAL VALUES: | |
| T/K Mol Rat | tio Mol Fraction |
| ⁿ HCl/ ⁿ C ₆ H | 5C12P XHC1 |
| 268.15 0.14 | |
| 273.15 0.12 | 5 0.111 |
| 278.15 0.11 283.15 0.10 | |
| | |
| The mole fraction solubilities were ca compiler. | alculated from the mole ratio by the |
| Smoothed Data: $\ln X_{101} = -59.555 + 81$ | 6.494/(T/100) + 25.568 ln (T/100) |
| | regression line = 8.41×10^{-5} |
| | |
| T/K Ma | ol Fraction |
| | X _{HC1} |
| 263.15 | 0.143 |
| 273.15 | 0.111 |
| 283.15 293.15 | 0.0910 0.0780 |
| | |
| | |
| AUXILIARY | INFORMATION |
| METHOD/APPARATUS/PROCEDURE: | SOURCE AND PURITY OF MATERIALS: |
| | 1. Hydrogen Chloride. Good quality |
| Hydrogen chloride was passed into the phosphine in a bubbler tube as | gas was obtained from a cylinder. It was passed through concen- |
| described in the main paper (1). | trated sulfuric acid and calcium chloride. |
| | Phenylphosphonous dichloride. The best specimen was rigorously purified and attested. |
| | |
| | ESTIMATED ERROR: |
| | $\delta x_1 / x_1 = 0.005$ |
| | |
| | REFERENCES : |
| | <pre>1. Ahmed, W.; Gerrard, W.; Maladkar, V. K. J. Appl. Chem. <u>1970</u>, 20, 109.</pre> |
| | |

| COMPONENTS : | ORIGINAL MEASUREMENTS: |
|--|---|
| 1. Hydrogen Chloride; HCl; | Ahmed, W. |
| [7647-01-0] | |
| 2. Phenylphosphonic dichloride; | Thesis, 1970 University of London |
| $C_6H_5Cl_2OP; [824-72-6]$ | University of London |
| | |
| | |
| | |
| VARIABLES: T/K: 273.15 - 288.15 | PREPARED BY: |
| Total P/kPa: 101.325 (1 atm) | W. Gerrard |
| | (smoothed data calculated by H.L. Clever) |
| | · · · · · · · · · · · · · · · · · · · |
| EXPERIMENTAL VALUES: | |
| T/K Mol Ra | |
| ⁿ HCl/ ⁿ C ₆ I | H _c Cl _o OP ^X HCl |
| | |
| 273.15 0.7 | |
| 278.15 0.5 283.15 0.4 | |
| 288.15 0.4 | |
| | |
| The mole fraction solubilities were a compiler. | calculated from the mole ratio by the |
| | |
| Smoothed Data: $\ln X_1 = -326.855 + 45$ | 56.641/(T/100) + 158.028 ln (T/100) |
| - | |
| The standard error al | bout the regression line = 6.04×10^{-4} |
| · <u>T/K</u> | Mol Fraction |
| | x _{HC1} |
| | HCI |
| 273.15 | 0.413 |
| 283.15 | 0.331 |
| 293.15 | 0.325 |
| | |
| | |
| | |
| | |
| | |
| AUXILIARY | INFORMATION |
| | |
| METHOD /APPARATUS / PROCEDURE : | SOURCE AND PURITY OF MATERIALS: |
| Hydrogen chloride was passed into a weighed amount of the phosphorus | 1. Hydrogen chloride. Good quality |
| compound in a bubbler tube, as | gas was obtained from a cylinder. It was passed through concentrated |
| described in the main paper (1). | sulfuric acid and calcium |
| | chloride. |
| | |
| | 2. Phenylphosphonic dichloride. The best quality specimen was purified |
| | and attested. |
| | |
| | |
| | |
| | ESTIMATED ERROR: |
| | $\delta T/K = 0.2$ |
| | $\delta x_1 / x_1 = 0.005$ |
| | |
| | REFERENCES : |
| | |
| | <pre>1. Ahmed, W.; Gerrard, W.; Maladkar, V. K.</pre> |
| | |
| | J. Appl. Chem. 1970. 20. 109. |
| | J. Appl. Chem. <u>1970</u> , 20, 109. |
| | J. Appl. Chem. <u>1970</u> , 20, 109. |
| | J. Appl. Chem. <u>1970</u> , 20, 109. |

| COMPONENTS: | ORIGINAL MEASUREMENTS: |
|--|---|
| <pre>1. Hydrogen Chloride; HCl; [7647-01-0]</pre> | Ahmed, W. |
| | Thesis, 1970 |
| 2. Phenylphosphonothioic Dichloride; | University of London |
| C ₆ ^H 5 ^{C1} 2 ^{PS;} [3497-00-5] | |
| | |
| VARIABLES: | PREPARED BY: |
| T/K: 263.15 - 278.15 | FREFARED BI; |
| Total P/kPa : 101.325 (1 atm) | W. Gerrard |
| · · · | (smoothed data calculated by H.L. Clever) |
| EXPERIMENTAL VALUES: | |
| T/K Mol Ra | Atio Mol Fraction |
| | |
| ⁿ HCl/ ⁿ C ₆ H | <u><u><u></u></u><u><u></u><u></u><u></u><u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u></u></u></u> |
| 263.15 0.17 | |
| 268.15 0.15 273.15 0.13 | |
| 278.15 0.11 | |
| | |
| The mole fraction solubilities were c compiler. | alculated from the mole ratio by the |
| - | |
| Smoothed Data: ln X _{HCl} = 42.041 - 51 | .456/(T/100) - 25.227 ln (T/100) |
| Standard Error About | Regression Line = 1.33×10^{-3} |
| | Keyression line - 1.55 x 10 |
| т/к | Mol Fraction |
| | x _{HC1} |
| | A 17 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 |
| 263.15 | |
| 273.15 283.15 | 0.117 0.0918 |
| | |
| | |
| | |
| | |
| | |
| ΑΠΥΤΙΤΑΟΥ | TNEODNATION |
| | INFORMATION |
| METHOD/APPARATUS/PROCEDURE: | SOURCE AND PURITY OF MATERIALS: |
| Hydrogen chloride was passed into a | 1. Hydrogen Chloride. Good quality |
| weighed amount of the phosphorus | gas was obtained from a cylinder. |
| compound in a bubbler tube as described in the main paper (1). | It was passed through concen- trated sulfuric acid and calcium |
| For temperatures below 268 K the | chloride. |
| final mixture was quantitatively | |
| treated with water and the total chloride titrated. | 2. Phenylphosphonothioic Dichloride. |
| | The best available specimen was rigorously purified and |
| | attested. |
| | |
| 1 | ESTIMATED ERROR: |
| | $\delta T/K = 0.2$ |
| | $\delta X_1 / X_1 = 0.005$ |
| | 1 L |
| | REFERENCES : |
| | |
| | 1. Ahmed, W.; Gerrard, W.; Maladkar, V. K. |
| | J. Appl. Chem. <u>1970</u> , 20, 109. |
| | |
| | |
| | |
| | |

| 358 Hydrogen Chloride in Non-Aqueous Solvents | | | |
|--|---|--|--|
| COMPONENTS : | ······································ | ORIGINAL MEASUREMENTS: | |
| <pre>(1) Hydrogen chloride; HCl; [7647-01-0]</pre> | | Borissov, R. S.; Ionin, M. V. | |
| (2) Phosphoric esters | c acid, trialkyl | Tr. Gor'k. Politekh. Inst. <u>1973</u> , 29, 11 - 15. | |
| VARIABLES: | | PREPARED BY: | |
| T/K = | = 298.15 = 101.325 | W. Gerrard | |
| EXPERIMENTAL VALU | ES: | | |
| | Temperature Mol Ra | tio Mol Fraction | |
| | T/K n ₁ /n | 2 ^x 1 | |
| | Phosphoric acid, trim $C_{3}H_{9}O_{4}P$; [512-56-1] | ethyl ester; | |
| | 298.15 0.6 | 6 0.398 | |
| | Phosphoric acid, trie C ₆ H ₁₅ O ₄ P; [78-40-0] | thyl ester; | |
| | 298.15 1.0 | | |
| | Phosphoric acid, trip C ₉ H ₂₁ O ₄ P; [513-08-6] | ropyl ester; | |
| | 298.15 1.5 | 85 0.613 | |
| Phosphoric acid, tributyl ester; C ₁₂ H ₂₇ O ₄ P; [126-73-8] | | | |
| | 298.15 1.6 | 6 0.624 | |
| | Phosphoric acid, tris C ₁₂ H ₂₇ O ₄ P; [126-71-6] | (2-methylpropyl) ester; | |
| | 298.15 1.6 | 6 0.624 | |
| AUXILIARY INFORMATION | | | |
| METHOD/APPARATUS/PROCEDURE: | | SOURCE AND PURITY OF MATERIALS: | |
| Not described. | | (1) Hydrogen chloride. Not stated. | |
| Numerical data were not reported. The compiler has read the mole ratio values from a small diagram showing a plot of log (mole ratio) vs . number of carbon atoms in R of (RO) ₃ PO. The corresponding mole fraction, x_1 , was calculated by the compiler. | | They were twice distilled from | |
| | | ESTIMATED ERROR: | |
| | | | |

REFERENCES:

| | 1011-Adacods 2017etits 353 |
|---|--|
| COMPONENTS: | ORIGINAL MEASUREMENTS: |
| <pre>1. Hydrogen Chloride; HCl; [7647-01-0]</pre> | Gerrard, W.; Mincer, A. M. A.; Wyvill, P. L. |
| <pre>2. Phosphoric acid tributyl ester; C₁₂^H27^O4^P; [126-73-8]</pre> | J. Appl. Chem. <u>1959</u> , 9, 89 - 93. |
| | |
| VARIABLES: | PREPARED BY: |
| T/K: 197.15 - 279.15 | W. Countral |
| Total P/kPa: 101.325 (1 atm) | W. Gerrard |
| | (smoothed data calculated by H.L. Clever) |
| EXPERIMENTAL VALUES: | io Mol Fraction |
| ⁿ HCl/ ⁿ C ₁₂ ^H | H ₂₇ O ₄ P ^X HC1 |
| | 2/ 4 |
| 197.15 8.74 211.15 6.65 | |
| 233.15 4.47 | |
| 273.95 2.79 | |
| 279.15 2.54 | |
| | 59/(T/100) - 1.559 ln (T/100) -3 |
| | Regression Line = 4.39×10^{-3} |
| T/K N | Aol Fraction |
| | X _{HC1} |
| 193.15 | 0.906 |
| 203.15 213.15 | 0.885 0.864 |
| 223.15 | 0.842 |
| 233.15 | 0.820 |
| 243.15 | 0.798 |
| 253.15 263.15 | 0.776 0.755 |
| 273.15 | 0.734 |
| 283.15 | 0.713 |
| At higher temperatures there is react The mole fraction values were | |
| | |
| AUXILIARI | INFORMATION |
| METHOD/APPARATUS/PROCEDURE: The solvent was weighed in a bubbler tube. The amount of gas absorbed at temperatures above 273 K was deter- | SOURCE AND PURITY OF MATERIALS: 1. Hydrogen Chloride. Good specimen from a commercial cylinder was dried. |
| mined by reweighing to constant | 2 Dhoanhorig agid tuikutul astar |
| weight. The total pressure was barometric, very nearly 1 atm | 2. Phosphoric acid tributyl ester. Carefully purified, and purity |
| (101.325 kPa). | rigorously attested. |
| For determinations below 273 K, a chemical titration was carried out. After the maximum absorption at the stated temperature, the bubbler tube | |
| was attached to a flask containing 1 dm ³ of water, and allowed to warm | ESTIMATED ERROR: |
| slowly (12 hours) to room temperature. | |
| The contents of the bubbler tube were | |
| then added to the water, and the total | |
| chloride ion was determined by the Volhard method. | |
| | REFERENCES: |
| A low temperature, Teddington type YM thermostat was used for tempera- | |
| tures below 273 K, the control being | |
| within ± 2 K. | |
| Other solvent name Tributyl phosphate | |
| 1 | 1 |

| COMPONENTS: | ORIGINAL MEASUREMENTS: | | |
|--|---|--|--|
| 1. Hydrogen Chloride; HCl; | Cook, T. M. | | |
| [7647-01-0] | Thesis 1066 | | |
| 2. Phosphorous acid di-2-propenyl | Thesis, <u>1966</u> University of London | | |
| ester or diallyl hydrogen | chiversitey of bondom | | |
| phosphite; C ₆ H ₁₁ O ₃ P; [23679-20-1] | | | |
| 0 11 3 | | | |
| | | | |
| VARIABLES: T/K: 277.95 - 287.15 | PREPARED BY: | | |
| Total P/kPa: 101.325 (1 atm) | W. Gerrard | | |
| | (smoothed data calculated by H.L. Clever) | | |
| | | | |
| EXPERIMENTAL VALUES: T/K Mol Rat | io Mol Fraction | | |
| | | | |
| ⁿ HCl/ ⁿ C ₆ H | ll ⁰ 3 ^P HCl | | |
| 277.95 1.594 | | | |
| 281.15 1.535 | | | |
| 282.65 1.495 | 0.599 | | |
| 282.75 1.492 | 0.599 | | |
| 283.15 1.478 | 0.596 | | |
| 287.15 1.384 | 0.581 | | |
| | ad he the compiler | | |
| The mole fraction values were calculat | ted by the compiler. | | |
| Smoothed Data: $\ln X_{mo1} = 62.508 - 84$ | .847/(T/100) - 31.762 ln (T/100) | | |
| | | | |
| Standard Error About 1 | Regression Line = 1.18×10^{-3} | | |
| · · · · · · · · · · · · · · · · · · · | | | |
| T/K I | All Fraction | | |
| | X _{HC1} | | |
| | | | |
| 273.15 | 0.625 | | |
| 283.15 293.15 | 0.597 0.551 | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| AUXILIARY | INFORMATION | | |
| METHOD / APPARATUS / PROCEDURE : | SOURCE AND PURITY OF MATERIALS: | | |
| | 1. Hydrogen chloride. Sample of best | | |
| The data were cited by Gerrard (1). | quality was self prepared, and was | | |
| Hydrogen chloride was passed into a | passed through concentrated sul- | | |
| bubbler tube containing a weighed | furic acid and calcium chloride. | | |
| amount of solvent at the specified | 2. Phosphorous acid, di-2-propenyl ester. Fractionally distilled, | | |
| temperature until the increase in | - | | |
| weight was constant at the | boiling point (10 mmHg) = $110-114^{\circ}C$, | | |
| barometric pressure (2). | and refractive index, $n_D^{25}=1.4443$, | | |
| | $d_A^{20} = 1.0841.$ | | |
| | -4 | | |
| | | | |
| | ESTIMATED ERROR: | | |
| | $\delta x_1 / x_1 = 0.005$ | | |
| | T. T. T. T. | | |
| | | | |
| | REFERENCES : | | |
| | 1. Gerrard, W. | | |
| | J. Chim. Phys. <u>1964</u> , 61, 73; | | |
| | Solubility of Gases in Liquids, | | |
| 1 | Plenum Press, New York, 1976. | | |
| | 2. Ahmed, W.; Gerrard, W.; Maladkar V.K. J. Appl. Cham | | |
| | Maladkar, V. K. J. Appl. Chem. <u>1970</u> , 20, 109. | | |
| | | | |

| , , | |
|---|---|
| COMPONENTS: | ORIGINAL MEASUREMENTS: |
| 1. Hydrogen Chloride; HCl; | Gerrard, W.; Mincer, A. M. A.; |
| [7647-01-0] | Wyvill, P. L. |
| <pre>2. Phosphorous acid triphenyl ester; C₁₈^H15^O3^P; [101-02-0]</pre> | J. Appl. Chem. <u>1959</u> , 9, 89 - 93. |
| | |
| VARIABLES: | PREPARED BY: |
| T/K: 274.45 - 324.15 | |
| Total P/kPa: 101.325 (1 atm) | W. Gerrard (smoothed data calculated by H.L. Clever) |
| | (smoothed data catculated by h.b. clevel) |
| EXPERIMENTAL VALUES: T/K Mol Rat | tio Mol Fraction |
| -, | |
| | <u> </u> |
| 274.45 0.79 | |
| 290.35 0.600 293.65 0.574 | |
| 298.65 0.52 | |
| 304.15 0.48 | |
| 310.95 0.44 | |
| 313.15 0.43 | |
| 324.15 0.36 | L3 0.265 |
| | .851/(T/100) - 7.707 ln (T/100) |
| Standard Error about 1 | Regression Line = 1.30×10^{-3} |
| T/K I | 101 Fraction |
| | X _{HC1} |
| 273.15 | 0.448 |
| 283.15 293.15 | 0.406 0.367 |
| 303.15 | 0.331 |
| 313.15 | 0.299 |
| 323.15 | 0.269 |
| 333.15 | 0.242 |
| | |
| | |
| The mole fraction values were | calculated by the compiler. |
| AUXILIARY | INFORMATION |
| METHOD/APPARATUS/PROCEDURE: | SOURCE AND PURITY OF MATERIALS: |
| | |
| The solvent was weighed in a bubbler tube. The amount of gas absorbed was | 1. Hydrogen Chloride. Good specimen from a commercial cylinder was |
| determined by reweighing to constant | dried. |
| weight. The total pressure was | |
| barometric, very nearly 1 atm | 2. Phosphorous acid triphenyl ester. |
| (101.325 kPa). | Carefully purified, and purity rigorously attested. |
| | Ingorousiy accesced. |
| | |
| | |
| | |
| | |
| 1 | ESTIMATED ERROR: |
| | $\delta x_1 / x_1 = 0.005$ |
| 1 | |
| 1 | |
| | |
| | REFERENCES: |
| Other solvent name | REFERENCES: |
| Other solvent name triphenyl phosphite (IUPAC) | REFERENCES : |
| | REFERENCES : |
| | REFERENCES: |
| | REFERENCES: |
| | REFERENCES: |

| 362 Hydrogen Chloride II | Non-Aqueous Solvents | |
|--|---|--|
| COMPONENTS: | ORIGINAL MEASUREMENTS: | |
| <pre>(1) Hydrogen chloride; HCl; [7647-01-0]</pre> | Gerrard, W.; Mincer, A. M. A.; Wyvill, P. L. | |
| <pre>(2) Phosphorochloridic acid mono- phenyl ester; C₆H₆ClO₃P or C₆H₅OP(O)Cl₂; [13929-83-4]</pre> | J. Appl. Chem. <u>1960</u> , 10, 115-121. | |
| | | |
| VARIABLES: T/K: 273.15 - 311.95 | PREPARED BY: | |
| Total P/kPa: 101.325 (1 atm) | W. Gerrard | |
| | (smoothed data calculated by H.L. Clever) | |
| EXPERIMENTAL VALUES: | | |
| T/K Mol Rat ⁿ HCl ^{/n} C ₆ H ₆ | | |
| 273.15 0.488 | | |
| 282.15 0.372 | 0.271 | |
| 291.75 0.293 298.05 0.251 | | |
| 303.45 0.210 | | |
| 311.95 0.163 | 0.140 | |
| The compiler calculated the mole frac | tion values. | |
| Smoothed Data: $\ln x_1 = 58.681 - 75.2$ | 68/(T/100) - 32.094 ln (T/100) | |
| Standard error about | the regression line is 4.19 $\times 10^{-3}$ | |
| т/К | Mol Fraction | |
| | <u> </u> | |
| 273.15 283.15 | | |
| 293.15 | | |
| 303.15 | | |
| 313.15 | 0.137 | |
| | | |
| | | |
| AUXILIARY | INFORMATION | |
| METHOD / APPARATUS / PROCEDURE : | SOURCE AND PURITY OF MATERIALS; | |
| The liquid component was weighed in | (1) Hydrogen chloride. Good specimen | |
| a bubbler tube. The amount of gas | from a commercial cylinder was | |
| absorbed was determined by re- weighing to constant weight. The | dried. | |
| total pressure was barometric, very | (2) Phosphorochloridic acid, mono- | |
| nearly 1 atm (101.325 kPa). | phenyl ester. Carefully | |
| | purified, and purity rigorously attested. | |
| | | |
| | | |
| | | |
| Columnt name is shown showners | ESTIMATED ERROR: | |
| Solvent name is phenyl phosphoro- chloridate in paper, IUPAC name is | | |
| phenyl hydrogen phosphorochloridate. | $\delta x_1 / x_1 = 0.01$ | |
| | | |
| | REFERENCES : | |
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|---|---|
| COMPONENTS: | ORIGINAL MEASUREMENTS: |
| <pre>(1) Hydrogen chloride; HCl; [7647-01-0]</pre> | Gerrard, W.; Mincer, A. M. A.; Wyvill, P. L. |
| (2) Phosphorochloridic acid, diphenyl ester; C ₁₂ H ₁₀ ClO ₃ P or | J. Appl. Chem. <u>1960</u> , 10, 115-121. |
| (C ₆ H ₅ O) ₂ P(O)Cl; [2524-64-3] | |
| VARIABLES: | PREPARED BY: |
| т/к: 273.15 - 313.45 | |
| Total P/kPa: 101.325 (1 atm) | W. Gerrard |
| | (smoothed data calculated by H.L. Clever) |
| EXPERIMENTAL VALUES: | |
| T/K Mol Ra | |
| ⁿ HCl ^{/n} C ₁₂ H | 10^{10} P x_1 |
| | |
| 273.15 0.77 | |
| 279.15 0.66 285.15 0.58 | |
| 290.25 0.51 | 3 0.339 |
| 298.15 0.40 | |
| 307.55 0.30 | |
| 313.45 0.24 | 6 0.197 |
| The compiler calculated the mole frac | tion values. |
| - | |
| Smoothed Data: $\ln x_1 = 94.089 - 125.$ | 672/(T/100) - 48.682 ln (T/100) |
| Standard error about | the regression line is 3.08×10^{-3} |
| | |
| T/K | Mol Fraction |
| | x_1 |
| 273.15 | 0.433 |
| 283.15 | |
| 293.15 | 0.320 |
| 303.15 | |
| 313.15 | 0.199 |
| | |
| | |
| | |
| AUXILIARY | INFORMATION |
| METHOD / APPARATUS / PROCEDURE : | SOURCE AND PURITY OF MATERIALS; |
| The liquid component was weighed in | (1) Hydrogen chloride. Good specimen |
| a bubbler tube. The amount of gas | from a commercial cylinder was |
| absorbed was determined by re- | dried. |
| weighing to constant weight. The | |
| total pressure was barometric, very | (2) Phosphorochloridic acid, diphenyl ester. Carefully purified, and |
| nearly 1 atm (101.325 kPa). | purity rigorously attested. |
| | Furty regeroused accorden. |
| | |
| | |
| | |
| | |
| | ESTIMATED ERROR: |
| Solvent IUPAC name in paper is | $\delta x_1 / x_1 = 0.005$ |
| diphenyl phosphorochloridate. | 1, "1 "1 "1 |
| | |
| | REFERENCES: |
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| COMPONENTS: | ORIGINAL MEASUREMENTS: | | |
|---|--|--|--|
| <pre>1. Hydrogen Chloride; HCl; [7647-01-0]</pre> | Gerrard, W.; Mincer, A. M. A.; Wyvill, P. L. | | |
| <pre>2. 2,2,2-Trichloroethanol phosphite (3:1); C₆H₆Cl₉O₃P; [1069-93-8]</pre> | J. Appl. Chem. <u>1959</u> , 9, 89 – 93. | | |
| | | | |
| VARIABLES: | PREPARED BY: | | |
| T/K: 273.35 - 313.95 Total P/kPa: 101.325 (1 atm) | W. Gerrard | | |
| | (smoothed data calculated by H.L. Clever) | | |
| EXPERIMENTAL VALUES: | | | |
| T/K Mol Rat | | | |
| ⁿ HCl/ ⁿ C6 ^H 6 | Cl ₉ 0 ₃ P ^X HCl | | |
| 273.35 0.55 | 72 0.358 | | |
| 290.25 0.39 294.05 0.35 | | | |
| 294.05 0.35 295.15 0.34 | | | |
| 300.65 0.30 | 29 0.232 | | |
| 302.55 0.28 | | | |
| 306.15 0.26 310.55 0.25 | | | |
| 313.95 0.25 | | | |
| Smoothed Data: $\ln X_{HC1} = -5.817 + 13$ | .129/(T/100) | | |
| Standard Error About | Regression Line = 6.58×10^{-3} | | |
| | Mol Fraction | | |
| | × _{HC1} | | |
| 273.15 | 0.364 | | |
| 283.15 | 0.307 | | |
| 293.15 | 0.262 | | |
| 303.15 313.15 | 0.226 0.197 | | |
| 323.15 | 0.173 | | |
| | | | |
| | | | |
| | | | |
| The mole fraction values were | calculated by the compiler | | |
| ······································ | | | |
| AUXILIARY | INFORMATION | | |
| METHOD / APPARATUS / PROCEDURE : | SOURCE AND PURITY OF MATERIALS: | | |
| The solvent was weighed in a bubbler | 1. Hydrogen Chloride. Good specimen | | |
| tube. The amount of gas absorbed | from a commercial cylinder was | | |
| was determined by reweighing to | dried. | | |
| constant weight. The total pres- sure was barometric, very nearly | 2. 2,2,2-Trichloroethanol phosphite | | |
| 1 atm (101.325 kPa). | (3:1). Carefully purified, and | | |
| | purity rigorously attested. | | |
| | | | |
| | | | |
| | | | |
| | ESTIMATED ERROR: | | |
| | | | |
| | $\delta x_1 / x_1 = 0.02$ | | |
| | | | |
| | REFERENCES : | | |
| Other solvent name | | | |
| Tris(2,2,2-trichloroethyl) phosphite | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| L | dana and a second s | | |

| COMPO | NENTS: | EVALUATOR: |
|-------|--|---|
| 1. | Hydrogen Chloride; HCl; [7647-01-0] | Peter G. T. Fogg Department of Applied Chemistry and Life Sciences, |
| 2. | Solvents Containing Silicon | Polytechnic of North London, Holloway, London, N7 8DB, U.K. |
| | | January 1989 |

CRITICAL EVALUATION:

The Solubility of Hydrogen Chloride in Solvents Containing Silicon.

Gerrard et al.(1) measured solubilities in four tetraalkyl esters of silicic acid over temperature ranges at a total pressure equal to 101.3 kPa. Solubility over a pressure and temperature range in one of these esters, the tetra(4-methyl-2-pentyl) ester, was reported by these authors in a later publication (2). Solubilities are very high under the conditions of measurement. The later measurements show that, at a total pressure of 101.3 kPa, mole fraction solubilities are not very sensitive to changes in pressure (see fig. 1). It follows that mole fraction solubilities at a total pressure of 101.3 kPa may be equated with mole fraction solubilities at a partial pressure of 101.3 kPa for the purpose of comparison of data with those for different systems.

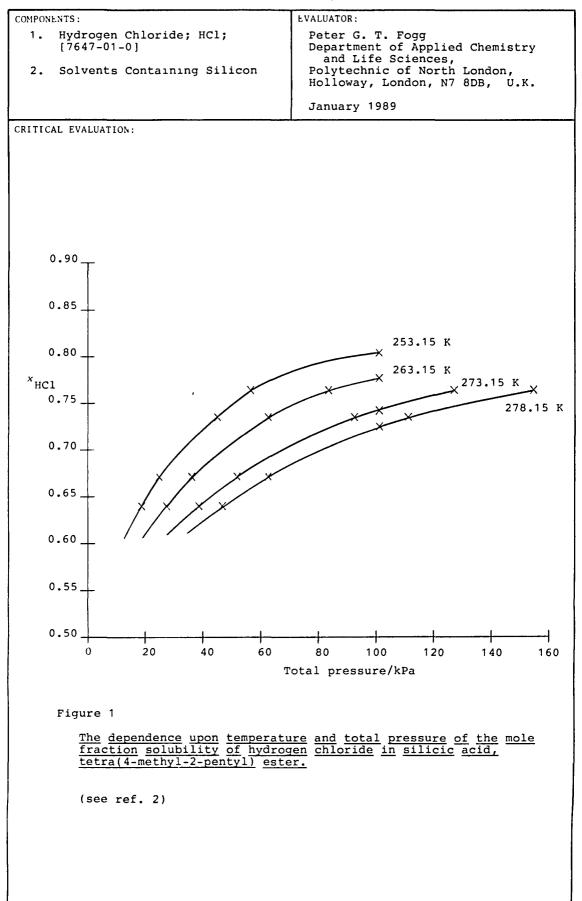
Mole fraction solubilities at a total pressure of 101.3 kPa in the tetraethyl, tetrapropyl and tetra(4-methyl-2-pentyl) esters are close to each other over the temperature ranges in which comparison can be made. Mole fraction solubilities in the tetramethyl ester are close to those in the tetra(4-methyl-2-pentyl) ester at temperatures less than about 240 K. Solubilities in all four esters show a marked decrease with increase in temperature at temperatures above about 283.15 K but this decrease is especially marked in the case of the tetramethyl ester (see fig. 2).

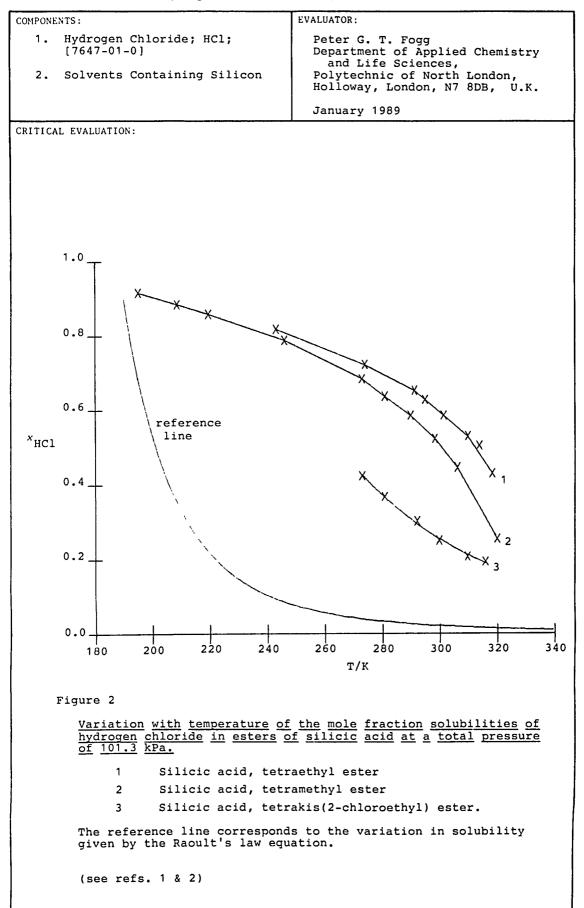
Gerrard *et al.*(2) also measured solubilities in the tetrakis(2-chloroethyl) ester. Mole fraction solubilities at a total pressure of 101.3 kPa are again higher compared with the reference line based upon the Raoult's law equation but the presence of chlorine reduces solubility relative to the tetraethyl ester (see fig. 2).

Measurements of solubilities in the esters of silicic acid discussed above are consistent over wide temperature ranges. The only measurements available for comparison are those of the solubilities in the tetraethyl ester at three temperatures by Ditsent and co-workers which were cited by Gorshkov *et al.*(3). They correspond to lower solubilities than found by Gerrard *et al.* Details are not available. They should not be considered to cast serious doubt on the reliability of Gerrard's data.

Data published by Gorshkov *et al.*(3) show that the solubility of hydrogen chloride in triethoxy silane is also very high with a mole fraction solubility of about 0.6 at 293.15 K. The solubility was, however, found by an indirect method based upon kinetic measurements because of chemical reaction of hydrogen chloride with the solvent. This work must be considered to have only semi-quantitative significance.

Ahmed, Gerrard & Maladkar (4) measured solubilities in tetrachlorosilane over the temperature range 243.15 K to 293.15 K at a total pressure of 101.3 kPa. Solubilities are very low compared with those reported for dissolution in alkyl esters of silicic acid. The solvent is appreciably volatile at the higher temperatures of measurement (25.5 kPa at 293.15 K) and will make a significant contribution to the total pressure. The evaluator has estimated the mole fraction solubility at a partial pressure of 101.3 kPa from the solubility data at each temperature given by Ahmed *et al.* Rau (5) has measured solubilities in the same solvent over partial pressure ranges to a maximum of 0.298 kPa in the temperature range 290 K to 410.5 K. Mole fraction solubilities for a partial pressure of 101.3 kPa are inconsistent with solubilities for lower temperatures from data by Ahmed *et al.* Further work on this system is required.





| COMPO | NENTS: | EVALUATOR: | |
|-------|--|---|--|
| | Hydrogen Chloride; HCl; [7647-01-0] Solvents Containing Silicon | Peter G. T. Fogg Department of Applied Chemistry and Life Sciences, Polytechnic of North London, Holloway, London, N7 8DB, U.K. | |
| | | January 1989 | |
| CRITI | CAL EVALUATION: | | |
| REFE | CRENCES | | |
| 1. | Gerrard, W.; Mincer, A. M. A.; Wyvill, P. L. <i>J. Appl. Chem.</i> <u>1959</u> , 9, 89-93. | | |
| 2. | Gerrard, W.; Mincer, A. M. A.; Wyvill, P. L. J. Appl. Chem. <u>1960</u> , 10, 115–121. | | |
| 3. | Gorshkov, A. S.; Reibakh, M. S.; Tsirlin, A. M. Zh. Prikl. Khim. (Leningrad) <u>1967</u>, 40, 151-155. J. Appl. Chem. USSR <u>1967</u>, 40, 131-135. | | |
| 4. | Ahmed, W.; Gerrard, W.; Maladkar, V. K. J. Appl. Chem. <u>1970</u> , 20, 109-115. | | |
| 5. | Rau, H. J. Chem. Thermodyn. <u>1982</u> , 14, 77-82. | | |
| | | | |
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| · • | |
|---|--|
| COMPONENTS: | ORIGINAL MEASUREMENTS: |
| <pre>1. Hydrogen Chloride; HCl; [7647-01-0]</pre> | Gerrard, W.; Mincer, A. M. A.; Wyvill, P. L. |
| <pre>2. Silicic acid tetramethyl ester; C4H12O4Si; [681-84-5]</pre> | J. Appl. Chem. <u>1959</u> , 9, 89 - 93. |
| | |
| VARIABLES: T/K: 195.15 - 320.15 Total P/kPa: 101.325 (l atm) | PREPARED BY: W. Gerrard |
| | |
| EXPERIMENTAL VALUES: | io Mol Fraction |
| | |
| ⁿ HCl/ ⁿ C ₄ H | |
| 195.15 11.03 | |
| 208.65 7.70 219.65 6.08 | |
| | |
| 273.15 2.15 | |
| 281.15 1.74 | |
| 290.15 1.40 | |
| 298.55 1.09 | |
| 306.35 0.80 | |
| 320.15 0.34 | 0.254 |
| The mole fraction values were | calculated by the compiler. |
| | INFORMATION |
| | |
| METHOD/APPARATUS/PROCEDURE: The solvent was weighed in a bubbler tube. The amount of gas absorbed at temperatures above 273 K was deter- mined by reweighing to constant weight. The total pressure was barometric, very nearly 1 atm (101.325 kPa). | SOURCE AND PURITY OF MATERIALS: 1. Hydrogen Chloride. Good specimen from a commercial cylinder was dried. 2. Silicic acid tetramethyl ester. Carefully purified, and purity rigorously attested. |
| For determinations below 273 K, a chemical titration was carried out. After the maximum absorption at the stated temperature, the bubbler tube was attached to a flask containing 1 dm ³ of water, and allowed to warm slowly (12 hours) to room temperature. | ESTIMATED ERROR: $\delta T/K = 2$ below 273 K |
| The contents of the bubbler tube were then added to the water, and the total chloride ion was determined by the Volhard method. | $\delta x_1 / x_1 = 0.03$ REFERENCES: |
| A low temperature, Teddington type YM thermostat was used for tempera- tures below 273 K, the control being within ± 2 K. | |
| Other solvent names are Tetramethyl orthosilicate Tetramethoxysilane | |

| COMPONENTS : | | | ORIGINAL MEASURE | MENTS: | |
|--|---|--|---|-------------------------|------------|
| | Hydrogen Chloride; HCl; [7647-01-0] | | Gerrard, W.; Mincer, A. M. A.; Wyvill, P. L. | | |
| 2. Silicic a $C_8^{H_{20}O_4^{Si}}$ | cid tetraethyl ; [78-10-4] | ester; | J. Appl. Che | m. <u>1959</u> , 9, 89 | - 93. |
| | | | | | |
| VARIABLES : | | | PREPARED BY: | | |
| | 243.15 - 318 | . 55 | FREFARED DI: | | |
| | 101.325 (1 a | | W | . Gerrard | |
| , | | | (smoothed data | a calculated by H | L. Clever) |
| | | | | | |
| EXPERIMENTAL VA | LUES: T/K | Mol Rat | | | |
| | | ⁿ HCl/ ⁿ C ₈ H | oo₄si ^X HC | 1 | |
| | 243.15 | | 0.8 | 18 | |
| | 274.15 | | | | |
| | 291.45 | 1.872 | 2 0.6 | 52 | |
| | 295.15 | | | | |
| 1 | 301.65 310.05 | | | | |
| | 310.05 | | | | |
| | 318.55 | | | | |
| | | | ······································ | | |
| Smoothed Dat | - | | |) + 402.1428 11 | n (T/100K) |
| | -75 | .5649 (T/100 |)K) | | |
| | Standard er | ror about re | gression line | $= 1.28 \times 10^{-2}$ | |
| | Т/К М | ol Fraction | T/K | Mol Fraction | |
| | | x_1 | | x_1 | |
| { | 243.15 | 0.819 | 293.15 | 0.646 | |
| 1 | 253.15 | 0.819 | 303.15 | 0.580 | |
| | 263.15 | 0.737 | 313.15 | 0.494 | |
| | 273.15 | 0.717 | 323.15 | 0.396 | |
| | 283.15 | 0.690 | | | |
| The | The mole fraction values were calculated by the compiler. | | | | |
| | | AUXILIARY | INFORMATION | | |
| METHOD APPARATUS/PROCEDURE: The solvent was weighed in a bubbler tube. The amount of gas absorbed at temperatures above 273 K was deter- mined by reweighing to constant weight. The total pressure was barometric, very nearly 1 atm (101.325 kPa). | | Hydrogen from a co dried. Silicic a Carefully | TY OF MATERIALS: Chloride. Goo mmercial cylin cid tetraethyl purified, and y attested. | der was ester. | |
| For determinations below 273 K, a chemical titration was carried out. After the maximum absorption at the stated temperature, the bubbler tube was attached to a flask containing 1 dm ³ of water, and allowed to warm slowly (12 hours) to room temperature. The contents of the bubbler tube were then added to the water, and the total chloride ion was determined by the Volhard method. | | | $\delta T/K = 2 belo X_1/X_1 = 0.025$ | w 273 K | |
| A low temperature, Teddington type YM thermostat was used for tempera- tures below 273 K, the control being within ± 2 K. | | | | | |
| Other solvent names Tetraethyl orthosilicate Tetraethoxysilane | | | | | |

| COMPONENTS: | ORIGINAL MEASUREMENTS: | | |
|---|---|--|--|
| <pre>1. Hydrogen Chloride; HCl; [7647-01-0]</pre> | Gerrard, W.; Mincer, A. M. A.; Wyvill, P. L. | | |
| 2. Silicic acid tetrapropyl ester; C ₁₂ H ₂₈ O ₄ S; [682-01-9] | J. Appl. Chem. <u>1959</u> , 9, 89 - 93. | | |
| | | | |
| VARIABLES: T/K: 273.15 - 331.15 Total P/kPa: 101.325 (1 atm) | PREPARED BY: W. Gerrard (smoothed data calculated by H.L. Clever) | | |
| EXPERIMENTAL VALUES: | | | |
| $\frac{T/K}{mHCl/nC_{12}}$ | | | |
| 273.15 2.64 | | | |
| 283.15 2.21 298.15 1.60 | | | |
| 311.15 1.15 | | | |
| | | | |
| | $.006/(T/100) - 22.925 \ln (T/100)$ Regression Line = 2.61 x 10^{-3} | | |
| | | | |
| T/K I | Mol Fraction | | |
| | хнсі | | |
| 273.15 | 0.726 | | |
| 283.15 | 0.692 | | |
| 293.15 | 0.643 | | |
| 303.15 313.15 | 0.586 0.524 | | |
| The mole fraction values were calculated by the compiler. | | | |
| AUXILIARY | INFORMATION | | |
| METHOD / APPARATUS / PROCEDURE : | SOURCE AND PURITY OF MATERIALS: | | |
| The solvent was weighed in a bubbler tube. The amount of gas absorbed was determined by reweighing to constant weight. The total pressure was barometric, very nearly 1 atm | Hydrogen Chloride. Good specimen from a commercial cylinder was dried. Silicic acid tetrapropyl ester. | | |
| (101.325 kPa). | Carefully purified, and purity rigorously attested. | | |
| | ESTIMATED ERROR: | | |
| | $\delta x_{1}/x_{1} = 0.005$ | | |
| | | | |
| Other solvent names tetrapropyl orthosilicate tetrapropoxysilane | REFERENCES : | | |
| | | | |

| COMPONENTS : | ORIGINAL MEASUREMENTS: | |
|--|---|--|
| <pre>(1) Hydrogen chloride; HCl; [7647-01-0]</pre> | Gerrard, W.; Mincer, A. M. A.; Wyvill, P. L. | |
| <pre>(2) Silicic acid tetra(4-methyl-2- pentyl) ester or tetra-(4-methyl- pent-2-yloxy)silane; C₂₄H₅₂O₄Si; [18765-36-1]</pre> | J. Appl. Chem. <u>1959</u> , 9, 89 - 93. | |
| VARIABLES: | PREPARED BY: | |
| T/K: 211.15 - 321.55 Total P/kPa: 101.325 (1 atm) | W. Gerrard (smoothed data calculated by H.L. Clever) | |
| EXPERIMENTAL VALUES: | | |
| | Ratio Mol Fraction | |
| ⁿ HC1 ^{/n} C ₂ | 4 ^H 52 ^O 4 ^{Si} ^x 1 | |
| 211.15 8.2 | | |
| 222.15 6.7 | | |
| 229.85 5.9 248.15 4.8 | | |
| 259.15 3.7 | | |
| 275.15 2.8 | | |
| 280.65 2.5 289.15 2.1 | | |
| 289.15 2.1 291.65 1.9 | | |
| 299.65 1.6 | 91 0.628 | |
| 314.05 1.0 | | |
| 320.55 0.8 321.55 0.8 | | |
| The compiler calculated the mole frac | | |
| — | | |
| | $52/(T/100K) - 11.990 \ln (T/100K)$ | |
| Standard error about | the regression line is 2.55 x 10^{-2} | |
| • | Mol Fraction | |
| The smoothed data equation is for use | x_1 | |
| botween the temper- | 0.795 | |
| atures of 263.15 and 283.15 | 0.745 0.690 | |
| 323.15 К. 293.15 | 0.634 | |
| 303.15 | 0.577 | |
| 313.15 323.15 | 0.523 0.470 | |
| | | |
| METHOD/APPARATUS/PROCEDURE: | SOURCE AND PURITY OF MATERIALS: | |
| The liquid component was weighed in | (1) Hydrogen chloride. Good specimen | |
| a bubbler tube. The amount of gas | from a commercial cylinder was | |
| absorbed was determined by re- | dried. | |
| weighing to constant weight. The total pressure was barometric, very | (2) Silicic acid tetra(4-methyl-2- | |
| nearly 1 atm (101.325 kPa). | pentyl)ester. Carefully | |
| - | purified, and purity rigorously | |
| For determination at temperatures | attested. | |
| below 273 K, a chemical titration was carried out. After the maximum | | |
| absorption at the stated temperature, | | |
| the bubbler tube was attached to a | | |
| flask containing one dm ³ of water, and allowed to warm slowly (12 hours) | ESTIMATED ERROR: | |
| to room temperature. The contents of | | |
| the bubbler tube were then added to | $\delta x_1 / x_1 = 0.03$ | |
| the water, and the total chloride ion | | |
| was determined by the Volhard method. A low temperature, Teddington-type YM | REFERENCES: | |
| thermostat was used for temperatures | | |
| below 273 K, the control being to | | |
| ± 2 K. | | |
| | | |
| | | |
| | | |
| | | |

| COMPONENTS : | | | ORIGINAL MEASUREMENTS: | | |
|---|---|---------------------------------|--|--|---|
| | <pre>(1) Hydrogen chloride; HCl; [7647-01-0]</pre> | | | W.; Mincer | |
| <pre>(2) Silicic acid tetra(4-methyl-2- pentyl)ester or tetra-(4-methyl- pent-2-yloxy)silane; C₂₄H₅₂O₄Si; [18765-36-1]</pre> | | | 1 - | | , 10, 115 - 121. |
| EXPERIMENT | | | | | |
| | | ature and pres- le fraction. | | | re and mole t temperature. |
| т/к | Pressure P1 ^{/mmHg} | Mol Fraction $\frac{x_1}{2}$ | т/к | Pressure p _l /mmHg | Mol Fraction |
| 225.15 238.15 249.65 255.85 264.85 | 65 103 159 208 287 | 0.671 | 253.15 | 141 187 338 425 760 | 0.640 0.671 0.735 0.764 0.804 |
| 273.15 282.15 286.35 291.55 296.15 300.55 | 393 557 648 764 879 966 | | 263.15 | 206 272 470 628 760 | 0.640 0.671 0.735 0.764 0.777 |
| 304.15 305.75 308.15 | 1046 1095 1141 | 0.764 | 273.15 | 290 390 695 760 | 0.640 0.671 0.735 0.742 |
| 229.65 231.15 241.95 252.15 255.15 256.15 259.65 263.55 266.65 | 165 177 265 420 441 492 560 636 722 | 0.764 | | | 0.764 0.640 0.671 0.725 0.735 0.764 ube through which |
| 273.15 277.15 225.15 227.15 238.15 247.15 247.15 247.75 258.65 273.15 273.15 278.75 283.35 286.35 287.95 291.35 | 955 1117 105 124 197 273 279 408 539 702 854 984 1080 1125 1231 | 0.735 | room temp flask was of a U-tu the other the oress nearest m equilibri ature. Fr the value read; and x_1 for th the x_1 va 4 series the set of | perature (c s attached ube manomet c limb bein sure, p_1 , w mmHg for th ium at each com a plot e of T/K fo d the separ hat T/K (l) alue for th were repor of p_1 vs. T | into the liquid at controlled). The to the tapped end er containing Hg, g open to the atm; as measured to the e condition of recorded temper- of p_1 /mmHg vs. T/K or $p_1 = 1$ atm was ately determined was taken to be e series. Data for ted as above. From /K curves data table above were |
| 224.65 230.65 243.15 248.65 256.15 261.75 269.75 272.65 278.15 283.65 290.95 296.55 300.75 | 57 64 101 121 158 200 255 285 353 458 600 746 856 | 0.640 | Obtained SOURCE AN (1) Hydro was o dried (2) Silar purif and i REFERENCE 1. Gerra | ND PURITY O ogen chlori obtained fr 1. ne. It was fied by a s its purity | F MATERIALS: de. A good specimer om a cylinder and prepared and tandard technique, was attested. ncer, A. M. A.; |
| METHOD/APPARATUS/PROCEDURE: To measure the total pressure, taken to be p_1 , a weighed amount of silane was put into a flask fitted with a | | | | | <u>1959</u> , 9, 89. |

| | Non-Aqueous Solvents |
|--|---|
| COMPONENTS: | ORIGINAL MEASUREMENTS: |
| <pre>(1) Hydrogen chloride; HCl; [7647-01-0]</pre> | Gerrard, W.; Mincer, A. M. A.; Wyvill, P. L. |
| <pre>(2) Silicic acid tetrakis(2-chloro ethyl) ester or tetra-(2-chloro- ethoxy)silane; CgH₁₆Cl₄O₄Si; [18290-84-1]</pre> | J. Appl. Chem. <u>1960</u> , 10, 115-121. |
| VARIABLES: | PREPARED BY: |
| T/K: 273.15 - 316.05 Total P/kPa: 101.325 (1 atm) | W. Gerrard (smoothed data calculated by H.L. Clever) |
| EXPERIMENTAL VALUES: | (smoothed data calculated by n.b. clever) |
| T/K Mol R | atio Mol Fraction |
| ⁿ HCl ^{/n} C ₈ H | 16 ^{C1} 4 ⁰ 4 ^{Si} |
| 273.15 0.7 | |
| 280.95 0.5 292.25 0.4 | |
| 299.85 0.3 | 33 0.250 |
| 309.75 0.2 | |
| 316.05 0.2 | |
| The compiler calculated the mole frac | ction values. |
| 1 | 4/(T/100) - 7.764 ln (T/100) |
| Standard error about | the regression line is 7.06×10^{-3} |
| T/K | Mol Fraction ^x 1 |
| 273.15 | 0.426 |
| 283.15 | |
| 293.15 303.15 | 0.289 0.239 |
| 313.15 | 0.199 |
| 323.15 | 0.166 |
| | |
| AUXILIAR | / INFORMATION |
| METHOD APPARATUS/PROCEDURE: | COUDCE AND DUDITY OF MATERIALS. |
| The liquid component was weighed in a bubbler tube. The amount of gas absorbed was determined by re- weighing to constant weight. The total pressure was barometric, very nearly 1 atm (101.325 kPa). | SOURCE AND PURITY OF MATERIALS: (1) Hydrogen chloride. Good specimen from a commercial cylinder was dried. (2) Silicic acid tetrakis (2-chloro- ethyl) ester. Carefully purified, and purity rigorously attested. |
| | |
| | ESTIMATED ERROR: |
| | $\delta x_{1}/x_{1} = 0.025$ |
| | REFERENCES: |
| | |
| | |
| | |
| | |

| COMPONENTS : | ORIGINAL MEASUREMENTS: | | |
|--|--|--|--|
| <pre>(1) Hydrogen chloride; HCl;</pre> | Gorshkov, A. S.; Reibakh, M. S.; | | |
| [7647-01-0] | Tsirlin, A. M. | | |
| (2) Triethoxysilane; C ₆ H ₁₆ O ₃ Si or | Zh. Prikl. Khim. (Leningrad) <u>1967</u> , | | |
| (C ₂ H ₅ O) ₃ SiH; [998-30-1] | 40, 151 - 155. | | |
| <pre>(3) Silicic acid, tetraethyl ester;</pre> | J. Appl. Chem. USSR (Engl. Transl.) | | |
| C ₈ H ₂₀ O ₄ Si; [78-10-4] | <u>1967</u> , 40, 131 - 135. | | |

EXPERIMENTAL VALUES:

The objective of this work was to determine the solubility of HCl in component 2, Triethoxysilane. A kinetic method was used. The hydrogen chloride reacted with the solvent, which was initially 95.9 % triethoxysilane and 4.1 % silicic acid, tetraethyl ester or tetraethoxysilane, to form an intermediate chlorosilane. (chlorodiethoxysilane, C $_4^{H}$ 11 2

[6485-91-2]), ethanol [64-17-5], and hydrogen [1333-74-0].

| Tempe | rature | Mol Ratio | Mol Fraction ¹ | Ratio of Mol Ratios ² |
|-------|--------|--------------------------------|---------------------------|-------------------------------------|
| t∕°C | T/K | n ₁ /n ₂ | <i>x</i> ₁ | $(n_1/n_2)/(n_1/n_3)$ |
| 20 | 293.15 | 1.365 | 0.577 | 0.975 |
| 35 | 308.15 | 0.6785 | 0.404 | 0.715 |
| 60 | 333.15 | 0.1399 | 0.123 | 0.680 |

 $^1\,$ Mol fraction values calculated by the compiler. The hydrogen chloride partial pressure, $p_{\,1}\,$, was stated to be 760 mmHg.

² The values are based on the solubility of HCl in silicic acid, tetraethyl ester at one atm HCl reported by V. E. Ditsent and co-workers.

The conventional method of determination is frustrated by the occurrence of an irreversible conversion of the triethoxysilane into tetraethoxysilane and hydrogen, via an intermediate chlorosilane formulated as $(C_2H_5O)_2$ SiHCl. It was stated that the solubility was determined from kinetic curves, and the known solubility of HCl in ethanol (1) and in tetraethoxysilane (the

citation being given merely as V. E. Ditsent and co-workers).

The solubility of HCl in monochloridiethoxysilane, $(C_{2}H_{5}O)_{2}$ SiHCl [6485-91-2], could not be determined from the kinetic curves; it was assumed to be half its solubility in triethoxysilane. It was stated that the data on the solubility of HCl in tetraethoxysilane for pressures below 760 mmHg (not recorded, but presumably those attributed to Ditsent, *et al.*) were used to convert the mole ratio values for 1 atm (Table above) to those for pressures below 1 atm by assuming that the solubility ratio, $(n_1/n_2)/(n_1/n_3)$, for 1 atm, at the chosen T/K remains constant at all partial pressures, p_1 , below 1 atm. These calculated data were presented as mole fractions, x_1 , for triethoxysilane, as shown on the next page.

Hydrogen Chloride in Non-Aqueous Solvents

| | gen chlo -01-0] | oride; HCl; [76 | 647-01- | ORIGINAL MEASUREME Gorshkov, A. S. Tsirlin, A. | ; Reibak | th, M. S.; |
|-----------------------|--------------------|---|------------|--|------------------|---|
| | | ane; C ₆ H ₁₆ O ₃ Si [998-30-1] | or | 2h. Prikl. Khim 40, 151 - 155. | . (Lenin | grad) <u>1967</u> , |
| 2.5 | | | | J. Appl. Chem. 1967, 40, 131 - | USSR (En 135. | gl. Transl.) |
| VARIABLES: | | | | PREPARED BY: | | |
| р | | 293.15 - 333.1 101.325 (1 atm | | W. Gerrard | | |
| EXPERIMENTA | L VALUES: | | | | | |
| p ₁ /mmHg | T/K | Mol Fraction x_1 | T/K | Mol Fraction x_{j} | T/K | Mol Fraction x_1 |
| 25 | 293.15 | 0.077 | 308.15 | | 333.15 | |
| 50 | | 0.143 | | 0.0611 | 555.15 | 0.01525 |
| 100 | | 0.247 0.371 | | 0.1155 0.209 | | 0.0301 |
| 300 | | 0.448 | | 0.275 | | 0.0549 0.0720 |
| 400 500 | | 0.498 | | | | 0.0883 |
| 600 | | 0.533 0.555 | | 0.333 | | 0.1005 0.1135 |
| 700 | | 0.573 | | 0.398 | | 0.1225 |
| | | | | | | |
| | | A | UXILIARY | INFORMATION | | |
| METHOD/APPA | | | _ | SOURCE AND PURITY | | |
| mined by | titrati | l absorbed was on by the Mohr unt of HCl abs | 's | | us hydro | Obtained chloric acid (concentrated). |
| was found | l by the | difference be | tween | | | |
| | | d through the that emerging | | | | contained e (95.9%) and |
| the absor | ption v | essel as an ef | fluent | tetraethox | ysilane | (4.1%). |
| | | he former bein r, and the lat | | | | |
| being col | lected | over water in . | a | | | |
| | | me of hydrogen 0 seconds. | was | | | |
| | - | | | ESTIMATED ERROR: | | |
| | | wed the variat nt in the solu | | | | |
| with time | e, for e | ach T/K. Thei: | r | | | |
| | | e volume of hydre reaction mixt | | | | |
| with time | | reaction mixt | ar G | REFERENCES: | | |
| The liqui | d phase | contained mono | o - | Technical E of Chemical | Incyclope | edia. Handbook |
| chlorodie | thoxysi | lane, ethanol, | tetra- | Technologic | al Data | (in Russian), |
| ethoxysil hydrogen | | iethoxysilane, | and | <u>1930</u> , 5, 42 | 22. | |
| "yurogen | CHILOTIC | - • | | | | |
| 1 | | _ | | | | |

| | Non-Aqueous Solvents 3/7 |
|---|--|
| COMPONENTS: | ORIGINAL MEASUREMENTS: |
| <pre>1. Hydrogen chloride; HCl; [7647-01-0]</pre> | Ahmed, W.; Gerrard, W.; Maladkar, V. K. |
| 2. Tetrachlorosilane; SiCl _{4;} [10026-04-7] | J. Appl. Chem. <u>1970</u> , 20, 109 - 115. |
| | |
| VARIABLES: T/K: 243.15 - 293.15 | PREPARED BY: |
| Total P/kPa: 101.325 (1 atm) | W. Gerrard (smoothed data calculated by H.L. Clever) |
| EXPERIMENTAL VALUES: T/K MOL Ra | tio Mol Fraction |
| ⁿ HC1/ ⁿ S | icl ₄ X _{HCl} |
| 243.15 0.08 | |
| 253.15 0.06 263.15 0.05 | |
| 273.15 0.04 | 0 0.0385 |
| 283.15 0.03 293.15 0.02 | |
| | ······································ |
| The mole fraction solubilities were compiler. | alculated from the mole ratio by the |
| - | 722/(T/100) - 3.170 ln (T/100) |
| | - |
| Standard error about : | regression line = 1.27×10^{-3} |
| T/K I | Mol Fraction |
| | X _{HC1} |
| 243.15 | 0.0804 |
| 253.15 263.15 | 0.0624 0.0491 |
| 273.15 | 0.0392 |
| 283.15 293.15 | 0.0317 0.0258 |
| | 0.0250 |
| | |
| | |
| | INFORMATION |
| | |
| METHOD /APPARATUS / PROCEDURE : | SOURCE AND PURITY OF MATERIALS: |
| Hydrogen chloride was passed into a known weight of liquid in a bubbler | 1. Hydrogen chloride. Obtained from a cylinder containing a good com- |
| tube at a total pressure measured by | mercial specimen. Was dried by |
| a manometer assembly. The absorbed | passage through concentrated sulfuric acid. |
| gas was weighed by re-weighing the bubbler tube. The temperature was | |
| manually controlled to within 0.2 K. | 2. Tetrachlorosilane. Best obtain- able specimen was suitably |
| The procedure and apparatus are described by Gerrard (1,2). | purified, dried, and fractionally |
| For the first three temperatures a | distilled, and attested. |
| chemical titration was conducted. | |
| | ESTIMATED ERROR: |
| | $\delta T/K = 0.2$ |
| | $\delta x/x = 0.005$ |
| | |
| | REFERENCES: |
| | 1. Gerrard, W. |
| | J. Appl. Chem. Biotechnol. <u>1972</u> , 22, 623 - 650. |
| | 2. Gerrard, W. "Solubility of Gases and Liquids" |
| | Plenum Press, New York, 1976 |
| | 1 |

Hydrogen Chloride in Non-Aqueous Solvents

| COMPONENTS: | | | ORIGINAL MEASUREMENTS: | | |
|---|------------------------------------|--------------------------------|------------------------|---------------------|---------------------------------|
| <pre>(1) Hydrogen chloride; HCl; [7647-01-0]</pre> | | | Rau, H. | | |
| (2) Tetrachlo tetrachlo [10026-04 | oride; SiCl | | J. Chem. Ther | rmodyn. <u>19</u> | <u>82</u> , <i>14</i> , 77 - 82 |
| VARIABLES: | | | PREPARED BY: | | |
| T/K | = 290.0 - = 3.1 - (0.031 - | | | H. L. Clev | ver |
| EXPERIMENTAL VAL | UES: | | | | |
| Temperature | Pressure | Mol Fraction | Temperature | Pressure | Mol Fraction |
| T/K | p ₁ /kPa | 10 ² x ₁ | T/K | p ₁ /kPa | 10 ² x ₁ |
| 290.0 | 46.4 | 0.869 | 364.0 | 3.1 | 0.066 |
| 290.5 | 84.8 | 1.380 | 364.0 | 97.6 | 0.866 |
| 293.0 | 124.4 | 2.054 | 364.0 | 165.8 | 1.367 |
| 295.5 | 30.8 | 0.456 | 364.0 | 243.3 | 2.162 |
| 295.5 | 5.3 | 0.456 | 204.0 | 640.0 | 2.102 |
| 296.0 | 5.3 | 0.057 | 276 5 | 56.0 | 0 470 |
| 23.5.5 | 150 7 | 2 255 | 376.5 | 56.0 | 0.473 |
| 315.5 | 159.7 | 2.055 | 377.0 | 11.3 | 0.055 |
| 318.5 | 42.3 | 0.453 | 377.5 | 111.2 | 0.872 |
| 320.0 | 7.2 | 0.055 | 378.0 | 183.7 | 1.378 |
| 320.5 | 69.4 | 0.857 | 378.0 | 271.0 | 2.128 |
| 320.5 | 116.0 ' | 1.365 | | | |
| 1 | | | 389.5 | 74.4 | 0.475 |
| 333.0 | 47.1 | 0.455 | 390.0 | 298.0 | 2.154 |
| 333.5 | 134.9 | 1.351 | 392.0 | 13.0 | 0.055 |
| 334.0 | 10.0 | 0.051 | 392.0 | 123.3 | 0.883 |
| | | | | | |
| 334.0 | 193.1 | 2.062 | 392.0 | 208.3 | 1.389 |
| 348.0 | 49.1 | 0.463 | 404.0 | 81.7 | 0.487 |
| 349.0 | 148.1 | 1.360 | 406.5 | 152.7 | 0.896 |
| 349.0 | 219.6 | 2.078 | 406.5 | 233.3 | 1.407 |
| 349.5 | 9.1 | 0.055 | 408.0 | 94.2 | 0.490 |
| 349.5 | 87.4 | 0.860 | 408.5 | 4.0 | 0.067 |
| 545.5 | 0/.4 | 0.000 | 410.5 | 94.1 | 0.491 |
| 362.0 | 54.1 | 0.466 | 410.5 | 24.1 | 0.491 |
| AUXILIARY INFORMATION | | | | | |
| METHOD / APPARATUS | /PROCEDURE · | | SOURCE AND PURIT | V OF MATERI | AT C . |
| | | all ailiga | | | |
| | | all-silica | (1) Hydrogen | chloride | Commercial |
| Bourdon gage. | - | | | | d in a glass |
| known pressur | | | | | zed to a pre- |
| Ithe silca spi | ral. The S: | iCl ₄ was added | 1 | - | e in a calibra- |
| | | ule containing | ted volum | - | , in a cartora- |
| a known weigh | t of the ma | aterial. | | | |
| | . - | | | | Merck/Darmstadt |
| | | paratus was | | | in high vac- |
| mounted in an | | | | | glass) and |
| windows so th | | | | glass amp | |
| to the end of | | |] | 2t | 1 |
| | | as brought to | | · / | |
| | | known pressure | ESTIMATED ERROR | | |
| of argon gas. | - | | m 1 | $V/K = \pm 0.5$ | |
| 1 . | | | | | |
| The total pressure was measured | | | op t/ | $p_t = \pm 0.0$ | 10 T |
| | | ature. The gas | ox1/ | $x_1 = \pm 0.1$ | LU |
| volume, the v | | | L | · | ** |
| the HCl partial pressure are determined assuming that liquid HCl has a | | | | | |
| density of 0.8 g cm ⁻³ , the liquid SiCl ₄ has the density of the pure liqu | | | | | ne pure liquid. |
| the gas compr | tors can be cal | loulated from | correspond | ling-state | |
| | | do not intera | | | |
| | | thor calculated | | | |
| C/pa=1 // | r_{1} The automatic n_{1} (Pa) | linor calculated | a nenry's cons | cant in th | le torm |
| $= \frac{x_1}{1}$ | $(\pi/ra) \cdot A$ | linear regress: | ton gave the e | quation 1 | $\log (C/Pa^{-1}) =$ |
| $-8.279 + 437/(\bar{T}/K)$. The author states that Henry's law is obeyed within experimental error | | | | | eyea within |
| experimental | error. | | | | |
| | | | | | |

| COMPONENTS: | | EVALUATOR: |
|-------------|--|--|
| 1. | Hydrogen Chloride; HCl; [7647-01-0] | Peter G. T. Fogg Department of Applied Chemistry and Life Sciences, |
| 2. | Tetrachlorostannane; SnCl ₄ ; [7646-78-8] Titanium Chlorıde; TiCl ₄ : [7550-45-0] | Polytechnic of North London, Holloway, London, N7 8DB, U.K. January 1989 |

CRITICAL EVALUATION:

The Solubility of Hydrogen Chloride in Tetrachlorostannane and in Titanium Chloride.

Ahmed *et al.*(1) have reported the solubility in tetrachlorostannane at a total pressure of 101.3 kPa over the temperature range 243.15 K to 293.15 K. The data are self-consistent and likely to be more reliable than the measurements at 273 K and 300 K reported by Howald & Willard (2) which correspond to lower solubilities. The mole fraction solubility at 273 K from Ahmed's data is 0.061 compared with 0.050 from Howald & Willard's data. The values for 300 K are 0.048 and 0.040 respectively.

Ahmed *et al.* also reported solubility in titanium chloride at the same pressure over a temperature range of 243.15 K to 293.15 K. Measurements are self consistent and indicate mole fraction solubilities lower than for dissolution in tetrachlorostannane. The value of the mole fraction solubility at 273.15 K is 0.051.

REFERENCES

- Ahmed, W.; Gerrard, W.; Maladkar, V. K. J. Appl. Chem. 1970, 20, 109-115.
- 2. Howald, R. A.; Willard, J. E. J. Am. Chem. Soc. 1955, 77, 2046-2049.

| COMPONENTS: | | | ORIGINAL MEASUREN | ÆNTS: |
|---|--|--|---|--|
| (1) Hydrogen chl [7647-01-0] | oride; HC | 1; | 1 | .; Willard, J. E. |
| <pre>(2) Tetrachlorostannane; SnCl₄; [7646-78-8]</pre> | | | J. Am. Chem. 2046 - 2049. | <i>Soc</i> . <u>1955</u> , 77, |
| VARIABLES: | | | PREPARED BY: | |
| T/K: P/kPa: | 273, 300 not giv | | | W. Gerrard |
| EXPERIMENTAL VALUES: | | <u> </u> | • <u>• • • • • • • • • • • • • • • • • • </u> | |
| | T/ K | Henry's Constant ¹ K x 10 ⁵ | Mol Fraction ² | _ |
| | 273 300 | 6.6 ± 0.5 5.2 ± 1. | 0.050 0.040 | _ |
| | ¹ K/(mmHg | $x_{1}^{-1} = x_{1}^{-1} (y_{1}^{-1})$ | p1/mmHg) | |
| | for a p 101.325 assumed | artial press kPa (760mm a linear fu | ility calculate sure of HCl of Hg). The compi unction of mole ure up to 760 m | ler |
| | The pressures of the not stated. They coul as 40 mmHg. | | | vere : low |
| | | | | |
| | | AUXILIARY | INFORMATION | |
| METHOD/APPARATUS/PRO | CEDURE: | | SOURCE AND PURIT | |
| The solubility s small part of th | e paper. | The complete | (1) Hydrogen Gas taker | chloride. Matheson Co. from cylinder. |
| statement about measurement is a solubility of HC determined by me exerted by a kno metered into a volume containin SnCl ₄ ." | the solub is follows il in SnCl asuring t own amount flask of | ility : "the 4 was he pressure of HCl known | (2) Tetrachlo given. Ch | prostannane. Source not memically pure, and anhydrous. |
| | | | ESTIMATED ERROR: | |
| | | | | |
| | | | REFERENCES : | |
| | | | | |
| | | | | |

| COMPONENTS: | ORIGINAL MEASUREMENTS: |
|---|---|
| 1 Wednesses ablenides UCL [7647-0]-01 | Abmod M & Command M |
| 1. Hydrogen chloride; HCl; [7647-01-0] | Ahmed, W.; Gerrard, W.; Maladkar, V. K. |
| <pre>2. Tetrachlorostannane; SnCl₄; [7646-78-8]</pre> | J. Appl. Chem. <u>1970</u> , 20, 109 - 115. |
| VARIABLES : | |
| T/K: 243.15 - 293.15 | PREPARED BY: W. Gerrard |
| P/kPa: 101.325 (1 atm) | (smoothed data calculated by H.L. Clever) |
| EXPERIMENTAL VALUES: | |
| T/K Mol Ratio | Mol Fraction |
| n _{HCl} /n _{SnCl4} | XHCl |
| 243.15 0.115 | 0.103 |
| 253.15 0.092 263.15 0.076 | 0.0842 0.0706 |
| 273.15 0.065 | 0.0610 |
| 283.15 0.058 293.15 0.053 | 0.0548 0.0503 |
| | |
| Smoothed Data: $\ln \chi_{HCl} = -34.460 + 4$ | |
| Standard error about | regression line 3.49 x 10^{-4} |
| T/K Mol F | raction |
| X | HCl |
| 243.15 0.1 | 03 |
| 253.15 0.0 | |
| 263.15 0.0 273.15 0.0 | 705 |
| 283.15 0.0 | 548 |
| 293.15 0.0 | 502 |
| 298.15 0.0 | 485 |
| The mole fraction solubilities were ca | lculated from the mole ratio by the |
| compiler. AUXILIARY | INFORMATION |
| METHOD/APPARATUS/PROCEDURE: | SOURCE AND PURITY OF MATERIALS: |
| Hydrogen chloride was passed into a | 1. Hydrogen chloride. Obtained from |
| known weight of pure liquid in a bubbler tube at a total pressure | a cylinder containing a good commercial specimen. The HCl was |
| measured by a manometer assembly. The | dried by passage through concen- |
| absorbed gas was weighed by re-weighin the bubbler tube. The temperature was | trated sulfuric acid. |
| manually controlled to within 0.2 K. | 2. Tetrachlorostannane. Best obtain- |
| For the two lowest temperatures the ga | able specimen was suitably purified, dried, fractionally |
| absorbed was determined by a chemical titration. | distilled, and attested. |
| The apparatus and procedure are | ESTIMATED ERROR: |
| described by Gerrard (1,2). | $\delta T/K = 0.2$ |
| | $\delta X/X = 0.005$ |
| | REFERENCES : |
| | 1. Gerrard, W. |
| | J. Appl. Chem. Biotechnol. <u>1972</u> , 22, 623 - 650. |
| | 2. Gerrard, W. |
| | "Solubility of Gases and Liquids" Plenum Press, New York, 1976 |
| L | |

| ORIGINAL MEASUREMENTS: |
|---|
| Ahmed, W.; Gerrard, W.; Maladkar, V. K. |
| J. Appl. Chem. <u>1970</u> , 20, 109 - 115. |
| PREPARED BY: |
| |
| W. Gerrard (smoothed data calculated by H.L. Clever) |
| atio Mol Fraction |
| ricl ₄ ^X HCl |
| |
| 05 0.0950 30 0.0741 |
| 54 0.0602 |
| 54 0.0512 |
| 47 0.0449 40 0.0385 |
| |
| alculated from the mole ratio by the |
| $1.417/(T/100) + 10.794 \ln (T/100)$ |
| regression line 7.31 x 10^{-4} |
| x _{HCl} |
| 0.0945 |
| 0.0745 |
| 0.0608 |
| 0.0511 0.0441 |
| 0.0389 |
| 0.0368 |
| |
| INFORMATION |
| SOURCE AND PURITY OF MATERIALS: |
| 1. Hydrogen chloride. Obtained from |
| a cylinder containing a good com- |
| mercial specimen. Was dried by passage through concentrated |
| sulfuric acid. |
| 2. Titanium chloride. Best obtain- |
| able specimen was suitably puri- |
| fied, dried, and fractionally distilled, and attested. |
| arberreu, and arbeoteu. |
| |
| ESTIMATED ERROR: |
| $\delta T/K = 0.2$ |
| $\delta X/X = 0.01$ |
| |
| REFERENCES : |
| <pre>1. Gerrard, W. J. Appl. Chem. Biotechnol. 1972, 22, 623 - 650.</pre> |
| 2. Gerrard, W. "Solubility of Gases and Liquids" Plenum Press, New York, 1976 |
| |

| COMPONENTS : | EVALUATOR: | |
|---|--|--|
| <pre>1. Hydrogen Bromide; HBr; [10035-10-6]</pre> | Peter G. T. Fogg Department of Applied Chemistry and Life Sciences, | |
| 2. Organic Solvents | Polytechnic of North London, Holloway, London, N7 8DB, U.K. January 1989 | |

The Solubility of Hydrogen Bromide in Organic Solvents

Alkanes

Solubility in hexane was measured by Fontana & Herold (1) at 278.15 K and 293.15 K over the pressure range 41.4 kPa to 213.7 kPa and by Boedeker & Lynch (2) at 298.15 K, 308.15 K and 318.15 K over the pressure range 6.7 kPa to 93.3 kPa. Results were expressed as Henry's constants. Mole fraction solubilities at a partial pressure of 101.3 kPa from the sets of data may be fitted to the equation :

 $\ln x_{\text{HBr}} = -44.591 + 2912.4/(T/K) + 5.5481 \ln(T/K)$

This equation is based upon data for the temperature range 278.15 K to 318.15 K. Extrapolation outside this range may lead to error. The standard deviation in values of $x_{\rm HBr}$ is 0.00089.

Solubility in decane at a total pressure of 101.3 kPa over the temperature range 243.15 K to 293.15 K has been measured by Ahmed *et al.*(3) and at 298.15 K to 319.15 K in the pressure range 6.7 kPa to 92.3 kPa by Boedeker & Lynch (2). The latter reported Henry's constants for three temperatures rather than measurements of solubility at individual pressures. Mole fraction solubilities at a partial pressure of 101.3 kPa from these Henry's constants show good consistency with values for lower temperature from Ahmed's data. The mole fraction solubility at 101.3 kPa by extrapolation of values based upon Ahmed's data is 0.0497 compared with the value of 0.0519 from the Henry's constant at this temperature published by Boedeker & Lynch. Mole fraction solubilities at 101.3 kPa from the two sources may be fitted to the equation :

 $\ln x_{\text{HBr}} = -73.774 + 4380.1/(T/K) + 9.8532 \ln(T/K)$

The standard deviation in values of x_{HBr} is 0.0020.

Solubility in butane at 278.15 K and 298.15 K over a pressure range from 41.4 kPa to 213.7 kPa was measured by Fontana & Herold (1). Solubility in octane at partial pressures from 0.067 to 93.3 kPa at 298.15 K, 308.15 K and 318.15 K was measured by Boedeker & Lynch (2). In each case data were reported as Henry's constants from which mole fraction solubilities at a partial pressure of 101.3 kPa may be calculated.

Solubility in heptane at a total pressure of 101.3 kPa over a temperature range from 233.15 K to 293.15 K was measured by Ahmed *et al.*(3).

Mole fraction solubilities at 298.15 K for a partial pressure of hydrogen bromide of 101.3 kPa, on the basis of the available data, are as follows :

| butane | 0.0332 | | |
|-----------|----------|--|--|
| hexane | 0.0402 | | |
| heptane | 0.0446 | (extrapolated and corrected to P _{HBr} = 101.3 kPa) | |
| octane | 0.0448 | HBr | |
| decane | 0.0527 | | |
| (referenc | ce value | from Raoult's law equation = 0.0410) | |

Mole fraction solubilities at this temperature are close to the reference value from the Raoult's law equation and show an increase in mole fraction solubility with increase in carbon number of the solvent. The solubilities of hydrogen chloride in alkanes are also close to reference line values but, in this case, the data do not clearly indicate an increase with carbon number of the alkane.

| COMPONENTS. | EVALUATOR: |
|---|---|
| <pre>1. Hydrogen Bromide; HBr; [10035-10-6]</pre> | Peter G. T. Fogg Department of Applied Chemistry and Life Sciences, |
| 2. Organic Solvents | Polytechnic of North London, Holloway, London, N7 8DB, U.K. |
| | January 1989 |

The available data for solubilities of hydrogen bromide in butane, heptane and octane are consistent with measurements of the solubilities of this gas in hexane and in decane which have been studied by more than one group. Solubilities in these three solvents may be accepted on a tentative basis.

Fontana & Herold (1) also showed that the mole fraction solubility in butane and in hexane are reduced in the presence of aluminium bromide under the conditions of their measurements. The accuracy of these additional measurements cannot be evaluated.

Aromatic hydrocarbons

Mole fraction solubilities in aromatic hydrocarbons at a partial pressure of gas of 101.3 kPa over the temperature range in which measurements are available lie above the reference line based upon the Raoult's law equation and increase in the order:

benzene < methylbenzene < 1,3-dimethylbenzene < 1,3,5-trimethylbenzene</pre>

Solubility in benzene in the range 263.15 K to 293.15 K at a total pressure of 101.3 kPa was measured by Ahmed *et al.*(3). O'Brien & Bobalek (4) reported solubility at 298.15 K over the partial pressure range 0.111 kPa to 57.2 kPa, Kapustinskii & Mal'tsev (5) at 303.15 K & 323.15 K over the range 1.02 kPa to 84.35 kPa and Brown & Wallace (6) at 278.85 K at pressures to 20 kPa. Ahmed's data have been corrected to give values of the mole fraction solubility at a partial pressure. The smoothing equation for mole fraction solubility at a partial pressure of 101.3 kPa. Other data available for the temperature range 263.15 K to 323.15 K is :

 $\ln x_{HRr} = 115.68 - 3357.2/(T/K) - 18.780 \ln(T/K)$

Values of x_{HBr} fit this equation with a standard deviation of 0.0054.

Ahmed et al.(3) have also reported the solubility in methylbenzene at a total pressure of 101.3 kPa in the temperature range 233.15 K to 293.15 K. O'Brien & Bobalek (4) measured the solubility at 298.15 K over a partial pressure range of 19.47 kPa to 47.73 kPa and Brown & Wallace (6) at 273.15 K and pressures to 18.7 kPa. Mole fraction solubilities by extrapolation or by correction to a partial pressure of 101.3 kPa may be fitted to the equation :

 $\ln x_{\text{HBr}} = 71.850 - 1427.6/(T/K) - 12.212 \ln(T/K)$

Values of x_{HBr} fit this equation with a standard deviation of 0.0091.

Ahmed et a1.(3) measured the solubility in 1,3-dimethylbenzene at a total pressure of 101.3 kPa over the temperature range 233.15 K to 293.15 K. The difference between these measurements and the solubility at a partial pressure of gas of 101.3 kPa is likely to be less than experimental error. The mole fraction solubility for a partial pressure of 101.3 kPa at 273.15 K based upon these measurements is 0.134. This differs from the value of 0.204 corresponding to the Henry's constant from measurements to 15.3 kPa reported by Brown & Wallace (6) and based upon the assumption that the variation of mole fraction solubility with pressure is linear to 101.3 kPa. If the variation approximates to that expressed by the Margules equation then the mole fraction solubility at 101.325 kPa, corresponding to Brown & Wallace's measurement, would be about 0.16. This is closer to Ahmed's value.

Ahmed's data are likely to give a better measure of the solubility at a partial pressure of 101.3 kPa. They should be treated as tentative values until further measurements on the system are available.

| COMPONENTS. | | EVALUATOR: |
|---|--|---|
| Hydrogen Bromide; HBr; [10035-10-6] Organic Solvents | | Peter G. T. Fogg Department of Applied Chemistry and Life Sciences, Polytechnic of North London, Holloway, London, N7 8DB, U.K. |
| [| | January 1989 |

Brown & Wallace (6) also measured the solubility in 1,3,5-trimethylbenzene at 273.15 K to 14.67 kPa. Measurements indicate that, to this pressure at least, solubility is greater than in 1,3-dimethylbenzene. Linear extrapolation to a partial pressure of 101.3 kPa gives a value of the mole fraction solubility of 0.226. If, however, the variation of mole fraction solubility with change of partial pressure approximates to the Margules equation then the mole fraction solubility at a partial pressure of 101.3 kPa would be about 0.17. These extrapolated values should be considered to be of semi-guantitative significance only.

Alkanols

Mole fraction solubilities in alkanols at a partial pressure of 101.3 kPa are appreciably higher than values represented by a reference line based upon the Raoult's law equation applied to hydrogen bromide. Mole fraction solubilities of hydrogen chloride show similar high values relative to the corresponding reference line for hydrogen chloride.

The mole fraction solubility in ethanol from data reported by Dorofeeva (7) is 0.285 at 298.15 K. It is not clear whether this corresponds to a total or to a partial pressure of 101.325 kPa as no details of the measurements were given. No other measurements of the solubility of hydrogen bromide in this solvent are available for comparison. The value is low in comparison with solubilities in higher alkanols and in chlorinated ethanols discussed below. Further measurements are needed.

Solubility in 1-octanol at a total pressure of 101.3 kPa was measured by Ahmed *et al.*(3) for the temperature range 213.15 K to 293.15 K. The partial pressure of the solvent makes insignificant contribution to the total pressure in this temperature range. Solubility at a partial pressure of 101.3 kPa in the range 288.15 K to 333.15 was measured by Fernandes (8). There is good agreement between solubilities over the few degrees in which the measurements overlap. At 288.15 K the interpolated value of mole fraction solubility from Ahmed's data is 0.530. The value given by Fernandes is 0.519. However the slopes of the curves of mole fraction solubility against temperature differ in the two cases so that extrapolated data from one source are not compatible with data from the other source. (fig. 1)

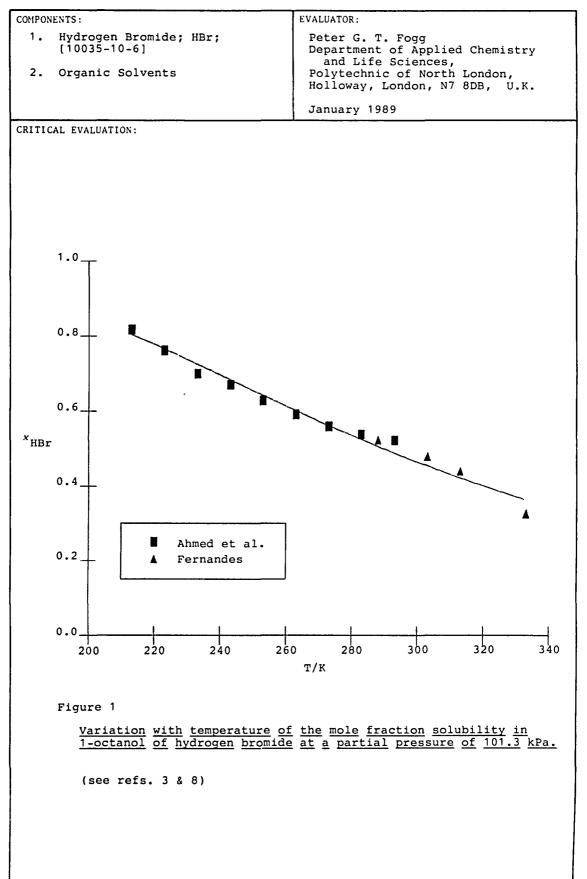
Mole fraction solubilities for a partial pressure of 101.3 kPa from the two sources may be represented by the equation :

 $\ln x_{\rm HBr} = 31.5861 - 892.58/(T/K) - 5.1505 \ln(T/K)$

The standard deviation in values of $x_{\rm HBr}$ is 0.021.

In view of the differences between the two sets of data this equation is considered to be tentative. It should not be used to estimate solubilities outside the temperature range of 213.15 K to 333.15 K.

Fernandes (7) also reported solubilities at a partial pressure of 101.3 kPa over temperature ranges of various extent in 1-pentanol, 1-hexanol, 1-heptanol, 1-nonanol, 1-decanol, 1-dodecanol. 1-tetradecanol and 1-hexadecanol. Variation of mole fraction solubility with chain length is rather irregular as may be seen below :



| COMPONENTS: | | EVALUATOR: | | | |
|---|-------------|---|--|--|--|
| <pre>1. Hydrogen Bromide; HBr; [10035-10-6]</pre> | | Peter G. T. Fogg Department of Applied Chemistry and Life Sciences, | | | |
| 2. Organi | ic Solvents | Polytechnic of North London, Holloway, London, N7 8DB, U.K. | | | |
| | | January 1989 | | | |
| CRITICAL EVALUATION: | | | | | |
| <u>Mole fraction solubilities of hydrogen bromide in alcohols at a</u> partial pressure of 101.3 kPa at 333.15 K measured by Fernandes | | | | | |
| | 1-pentanol | 0.334 | | | |

| 1-pentanol | 0.334 |
|----------------|-------|
| 1-hexanol | 0.318 |
| 1-heptanol | 0.305 |
| 1-octanol | 0.322 |
| 1-nonanol | 0.325 |
| 1-decanol | 0.351 |
| 1-dodecanol | 0.351 |
| 1-tetradecanol | 0.301 |
| 1-hexadecanol | 0.301 |
| | |

The solubility in 2,2-dimethyl-1-propanol at 268.15 K to 283.15 K was reported by Whitmore & Rothrock (9) as an incidental part of a study of chemical reaction. The pressure of hydrogen bromide was probably about 101.3 kPa. The mole fraction solubility at 283.15 K, calculated from these data, is 0.286. This may be compared with the value of 0.533 for the isomeric 1-pentanol, by extrapolation of Fernandes' data. Data for solubility of hydrogen chloride in 2,2-dimethyl-1-propanol are not available for comparison but the solubility of hydrogen chloride at a partial pressure of 101.3 kPa, at temperatures around 283.15 K, in the isomeric branched chain alcohol, 2-methyl-1-butanol, is close to that in 1-pentanol. Solubility of hydrogen chloride in 2-methyl-1-propanol is also close to that in 1-butanol. In the absence of any supporting evidence for low solubility of hydrogen halides in 2,2-dimethyl-1-propanol, compared with solubility in isomeric alcohols, the data reported by Whitmore and Rothrock should be rejected.

Substitution of chlorine into an alcohol lowers the solubility of hydrogen chloride in that alcohol. The solubility of hydrogen bromide in 2-chloroethanol, 2,2-dichloroethanol and in 2,2,2-trichloroethanol have been reported by Gerrard & co-workers for a pressure of 101.3 kPa within the temperature range of 253.15 K to 312.15 K. The work shows that mole fraction solubility decreases with increase in chlorine content. Data for solubility in 2,2,2-trichloroethanol are contained in two papers from the same laboratory with some disagreement between the two sets of data at the higher end of the temperature ranges. Mole fraction solubilities at 273.15 K, 283.15 K and 293.15 K from the earlier paper (10) are respectively 0.161, 0.130 and 0.0944. Values for these temperatures from the later paper (11) are, respectively, 0.149, 0.133 & 0.128.

The mole fraction solubility of hydrogen bromide in ethanol at 298.15 K and 101.325 kPa, from Dorofeeva's measurements discussed above, does not fit into the pattern. This value of 0.285 is less than the corresponding value of 0.377 for dissolution in 2-chloroethanol. The data for the chlorinated compound are likely to be the more reliable.

Ethers

The solubility in 1,1'-oxybisoctane was measured by Ahmed, Gerrard & Maladkar (11) at a total pressure of 101.3 kPa over the temperature range 223.15 K to 293.15 K. Data are self-consistent. Mole fraction solubility is very high, as is the solubility of hydrogen chloride in alkyl ethers under similar conditions. No other data for solubility of hydrogen bromide are available for comparison but these data may be accepted on a tentative basis.

| COMPO | NENTS. | EVALUATOR: |
|---------------------|--|---|
| 1. | Hydrogen Bromide; HBr; [10035-10-6] | Peter G. T. Fogg Department of Applied Chemistry and Life Sciences, |
| 2. Organic Solvents | | Polytechnic of North London, Holloway, London, N7 8DB, U.K. |
| | | January 1989 |

Alkanoic acids

Ahmed, Gerrard & Maladkar (11) repofted solubilities in acetic acid and in hexanoic acid at a total pressure of 101.3 kPa and over temperature ranges of 253.15 K to 293.15 K and 223.15 K to 293.15 K respectively. Mole fraction solubilities lie above the reference line corresponding to the Raoult's law equation. Values for hexanoic acid are greater than those for acetic acid. This is consistent with the observation that mole fraction solubilities of hydrogen chloride in alkanoic acids increase with chain length. At 293.15 K the value for acetic acid is 0.324 and that for hexanoic acid is 0.398. These data should be accepted on a tentative basis.

Halogenated alkanes

Howland *et al.*(12) measured solubilities in trichloromethane over the temperature range 273.15 K to 298.15 K at partial pressures from 20.7 kPa to 88.5 kPa. They also measured solubilities in tetrachloromethane over this temperature range at pressures from 39.7 kPa to 74.0 kPa. The values of Henry's constant which were reported may be used to estimate mole fraction solubility at a partial pressure of 101.3 kPa.

Ahmed *et al.*(11) measured solubilities in these two solvents at a total pressure equal to 101.3 kPa over the temperature range 233.15 K to 293.15 K. Values of mole fraction solubilities at a partial pressure of 101.3 kPa may be estimated from these data by allowing for the vapor pressure of the solvents.

Mole fraction solubilities at a partial pressure of 101.3 kPa from the two sources are in reasonably good agreement for trichloromethane over the temperature range in which measurements overlap. The value of the mole fraction solubility at 273.15 K under a partial pressure of hydrogen bromide of 101.3 kPa is 0.0734 from Howland's data and 0.077 from Ahmed's data. Mole fraction solubilities for the temperature range 233.15 K to 298.15 K may be represented by the equation :

 $\ln x_{\text{HBr}} = -58.395 + 3772.6/(T/K) + 7.4877 \ln(T/K)$

The standard deviation in values of $x_{\rm HBr}$ is 0.0015.

The agreement between mole fraction solubilities in tetrachloromethane at a partial pressure of 101.3 kPa and based upon data from the two sources is less satisfactory. Values from Howland's data are about 14% greater than values from Ahmed's data, extrapolated to 298.15 K. The two values for 273.15 K are 0.0628 and 0.054 respectively. The relative merits of the two sources of data cannot be judged. The available data may be represented by the equation :

 $\ln x_{\text{HBr}} = 17.294 + 684.90/(T/K) - 4.0365 \ln(T/K)$

Values of $x_{\rm HBr}$ fit this equation with a standard deviation of 0.0061.

Disparity between the data from the two sources should be borne in mind when this equation is used.

Ahmed et al.(11) also measured solubilities in dichloromethane at a total pressure of 101.3 kPa over the temperature range 233.15 K to 293.15 K. The pure solvent has a vapor pressure at 293.15 K of 46.8 kPa. Mole fraction solubilities at a partial pressure of 101.3 kPa lie close to values for trichloromethane at the same temperature but are higher than values for tetrachloromethane. Mole fraction solubilities at 273.15 K for

| Hydrogen Bromide in Non-Aqueous Solvents 389 | | |
|--|--|---------------------------|
| COMPONENTS : | EVALUATOR: | |
| <pre>1. Hydrogen Bromide; HBr; [10035-10-6]</pre> | Peter G. T. Fogg Department of Applied Chemistry and Life Sciences, | |
| 2. Organic Solvents | Polytechnic of North London, Holloway, London, N7 8DB, U.K. | |
| | January 1989 | |
| CRITICAL EVALUATION: | | |
| tetrachloromethane and for trichlorom and the value for dichloromethane bas | | |
| tetrachloromethane 0.058 trichloromethane 0.076 dichloromethane 0.069 (reference value from the Raoult's | law equation = 0.078) | |
| Solubility in iodomethane at a total temperature range 254.65 K to 293.15 solubility at 273.15 K and a partial correcting the measurements to allow solvent, 1s 0.12. No other data on t comparison. | K was measured by Maladkar (13). T pressure of 101.3 kPa, obtained by for the partial pressure of the | he |
| Solubility at a total pressure of 101 in 1-bromopropane at 273.15 K to 293. 1-bromohexane at 273.15 K. Ahmed <i>et</i> 1-bromooctane also at a total pressur to 293.15 K. Maladkar also measured total pressure for the temperature ra fraction solubilities at 273.15 K and bromide of 101.3 kPa, based upon meas | 15 K and in 1-bromobutane and al. (11) reported the solubility in e of 101.3 kPa over the range 233.1 solubility in 1-iodopropane at this nge 253.15 K to 293.15 K. Mole a partial pressure of hydrogen | і 5 К |
| follows : 1-bromopropane 0.139 1-bromobutane 0.153 1-bromohexane 0.170 1-bromooctane 0.141 1-10dopropane 0.141 | | |
| These values are greater than values a alkanes of the same carbon number at highly volatile at the highest temper. 14.6 kPa at 293.15 K). The other three volatile at the temperatures at which Measurements were made at three temper and at one temperature in the case of Measurements were made at seven temper and are self-consistent over this rand solvent may therefore be more reliable solvents and may be accepted on a tem 1-bromoalkanes should be considered to until the measurements are confirmed 1-icodopropane was measured at five tem self consistent and may be accepted on | this temperature. 1-Bromopropane i ature of measurement (vapor pressur- ee alkyl bromides are not appreciab solubilities were determined. ratures in the case of this solvent 1-bromobutane and of 1-bromohexane ratures in the case of 1-bromooctan- ge. Solubility data for this last e than data for the other three tative basis. The data for the other o be of semi-quantitative significa- by other workers. Solubility in mperatures. The measurements are a | e ly e er nce |
| Solubilities in 1-chlorooctane and in | 1-iodooctane were also reported by | |

Solubilities in 1-chlorooctane and in 1-iodooctane were also reported by Ahmed *et al.*(11) for a total pressure of 101.3 kPa and a temperature range of 213.15 K to 293.15 K. Mole fraction solubilities in these two solvents are greater than in 1-bromooctane in the overlapping temperature range. At 273.15 K mole fraction solubilities from these measurements are :

1-bromooctane 0.141; 1-chlorooctane 0.194; 1-iodooctane 0.200.

The data for the chloro and the iodo compound are also self consistent and may be accepted on a tentative basis.

Maladkar (13) measured solubilities in 1,2-dibromoethane, 1,3-dibromopropane, 1,4-dibromobutane, and 1,6-dibromohexane at 273.15 K and a total pressure of 101.3 kPa. The partial pressures of the solvents were insignificant at this temperature. Mole fraction solubilities increase with carbon number of the solvent and may be accepted on a

| COMPONENTS: | | EVALUATOR: |
|-------------|--|---|
| 1. | Hydrogen Bromide; HBr; [10035-10-6] | Peter G. T. Fogg Department of Applied Chemistry and Life Sciences, |
| 2. | Organic Solvents | Polytechnic of North London, Holloway, London, N7 8DB, U.K. |
| | | January 1989 |

tentative basis. Maladkar also measured the solubility in 1,2-dichloroethane at this pressure but over the temperature range 233.15 K to 273.15 K. These measurements may also be accepted on a tentative basis. The mole fraction solubility at 273.15 K in this solvent, corrected to give the value for a partial pressure of 101.3 kPa, is 0.114 compared with a value of 0.124 for solubility in 1,2-dibromoethane.

<u>Halobenzenes</u>

Ahmed *et al.* (11) reported solubilities at a total pressure of 101.3 kPa in chlorobenzene, bromobenzene and iodobenzene for the temperature range 233.15 K to 293.15 K. Mole fraction solubilities increase under these conditions in the order:

chlorobenzene < bromobenzene < iodobenzene. This is contrary to the trend indicated from data for solubility of hydrogen chloride in halobenzenes. However these data for hydrogen bromide solubilities are self consistent and may be accepted on a tentative basis.

Nitrogen compounds

Ahmed, Gerrard & Maladkar (11) measured the solubility of hydrogen bromide in nitrobenzene at a pressure of 101.3 kPa and at four temperatures from 263.15 K to 293.15 K. O'Brien & Bobalek (4) measured solubility in 1-methyl-2-nitrobenzene and 1-methyl-3-nitrobenzene at 298.15 K over pressure ranges below barometric pressure. The mole fraction solubility in nitrobenzene at 298.15 K by extrapolation of Gerrard's data is 0.0997 which is greater than the values for mole fraction solubility in 1-methyl-2-nitrobenzene and 1-methyl-3-nitrobenzene of 0.0941 and 0.0881 respectively. In the case of data for mole fraction solubilities of hydrogen chloride in these compounds the corresponding value for nitrobenzene is less than values for the methyl nitrobenzenes. Despite this apparent inconsistency these data for dissolution of hydrogen bromide may be accepted on a tentative basis.

Solvents containing sulfur

Frazer & Gerrard (14) reported solubilities at 273.15 K and a total pressure of 101.3 kPa in thiols and sulfides. Mole fraction solubilities were, in each case, above the reference values from the Raoult's law equation. The pattern of solubilities is similar to that for hydrogen chloride. Values for thiols are less than those for sulfides and values for aromatic compounds less than those for non-aromatic compound i.e.

Mole fraction solubilities at 273.15 K, corrected where necessary, at a partial pressure of 101.3 kPa

| thiophene | 0.126 | |
|-----------------------|---------------------------|--------|
| benzenethiol | 0.153 | |
| 1,1'-thiobisbenzene | 0.187 | |
| 2-propanethiol | 0.248 | |
| 1-butanethiol | 0.261 | |
| 2,2'-thiobispropane | 0.734 | |
| 1,1'-thiobisbutane | 0.717 | |
| (reference value from | the Raoult's law equation | 0.078) |

The overall pattern of these data is likely to be reliable but individual values for the different solvents must be considered to be tentative values.

Ahmed (15) measured the solubility of hydrogen bromide in liquid sulfur dioxide over the temperature range 228.15 K to 253.15 K in addition to measuring the solubility of hydrogen chloride in this solvent over a

| COMPONENTS: | EVALUATOR: | |
|---|---|--|
| <pre>1. Hydrogen Bromide; HBr; [10035-10-6]</pre> | Peter G. T. Fogg Department of Applied Chemistry and Life Sciences, | |
| 2. Organic Solvents | Polytechnic of North London, Holloway, London, N7 8DB, U.K. | |
| | January 1989 | |

similar temperature range. Despite liquid hydrogen bromide having a higher vapor pressure than hydrogen chloride at the same temperature the measurements indicate that hydrogen bromide has the lower mole fraction solubility. Further work on these two systems is desirable and these data should be considered to be of semi-quantitative significance until they can be verified by other workers.

Solvents containing boron

Gerrard et al.(10) measured the solubility of hydrogen bromide in tripentyl borate over a temperature range at a total pressure equal to barometric pressure in addition to measuring the solubility of hydrogen chloride in this solvent under similar conditions. Mole fractions solubilities are greater in the case of hydrogen bromide. This is to be expected because of the lower volatility of liquid hydrogen bromide at the same temperature. In each case experimental values are greater than those calculated from the Raoult's law equation. The variation of mole fraction solubility with variation of temperature shows a similar relationship to the reference line based upon the Raoult's law equation for hydrogen bromide as does the variation of mole fraction solubility of hydrogen chloride to the reference line for that gas. The measurements are likely to be reliable but no comparison with independent measurements on this system is possible.

REFERENCES

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- 2. Boedeker, E. R.; Lynch, C. C. J. Am. Chem. Soc. 1950, 72, 3234-3236.
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- Gerrard, W.; Mincer, A. M. A.; Wyvill, P. L. J. Appl. Chem. <u>1960</u>, 10, 115-121.
- Ahmed, W.; Gerrard, W.; Maladkar, V. K. J. Appl. Chem. <u>1970</u>, 20, 109-115.
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- 13. Maladkar, V. K. Thesis, <u>1970</u>, University of London.
- 14. Frazer, M. J.; Gerrard, W. Nature, <u>1964</u>, 204, 1299-1300.
- 15. Ahmed, W. Thesis, 1970, University of London.

| COMPONENTS : | | | | ORIGINAL MEASUREMENTS: | | |
|---|--------------|--|---|------------------------|---|--|
| <pre>(1) Hydrogen bromide; HBr; [10035-10-6]</pre> | | Fontana, C. M.; Herold, R. J. J. Am. Chem. Soc. 1948, 70, | | | | |
| (2) Butane; C ₄ H ₁₀ ; [106-97-8] | | | -97-8] | 2881 - | | |
| VARIA | BLES: | | | PREPARED B | Y: | |
| | | K: 278.15, a: 41.4 - (6 - 3 | | | W. Gerrard | |
| EXPER | IMENTAL VALU | ES: | | | | |
| | т/к | Henry's | Constants M | ol Ratio | Mol Fraction | |
| | | K/psia | K/atm | n1/n2 | <i>x</i> 1 | |
| | 278.15 | 326 | 22.18 | 0.0472 | 0.0451 | |
| | 298.15 | 443 | 30.14 | 0.0343 | 0.0332 | |
| | values we: | re calcula | ted by the com | piler. Th | o and mole fraction he mole ratio and essure of 101.325 kPa | |
| | Henry's co | onstants: | , | | | |
| | K/psia = | =(p ₁ /psia) | $/x_1$ where psi | a is poun | nds per square inch absolute. | |
| | | (p ₁ /atm)/ | | | | |
| | | | T | | | |
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| | | | AUXILIARY | INFORMATION | N | |
| METHOD / AP PARATUS / PROCEDURE : | | | | SOURCE AND | PURITY OF MATERIALS: | |
| The apparatus consisted of a stain- less steel solubility bomb, 217.5 cm ³ capacity, fitted with a charging | | co. | rogen bromide. Dow Chemical It was stored in a small inless steel cylinder. | | | |
| and pressure measuring apparatus. A weighed amount of butane was added to the bomb and its vapor pressure was measured. Hydrogen bromide was added from a weighed container, a second weighing giving the amount added, and the pressure was measured | | | tane was added por pressure bromide was ontainer, a the amount | was | ane. Purity 99 ⁺ percent. It dried and degassed. | |
| The solubility values at 298.15 K were shown on a graph. The Henry's constants were tabulated. The heat of solution was stated to be -2.51 kcal mol ⁻¹ (-10.5 kJ mol ⁻¹). | | ESTIMATED | ERROR: | | | |
| | | REFERENCES | ç. | | | |
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| COMPONENTS: | ORIGINAL MEASUREMENTS: |
|---|---|
| <pre>(1) Hydrogen bromide; HBr; [10035-10-6]</pre> | Fontana, C. M.; Herold, R. J. |
| (2) Hexane; C ₆ H ₁₄ ; [110-54-3] | J. Am. Chem. Soc. <u>1948</u> , 70, 2881 - 2883. |
| | |
| VARIABLES: | PREPARED BY: |
| T/K: 278.15, 293.15 P/kPa: 41.4 - 213.7 (6 - 31 psia) | W. Gerrard |
| EXPERIMENTAL VALUES: | |
| T/K Henry's Constant | s Mol Ratio Mol Fraction |
| K/psia K/at | n_1/n_2 x_1 |
| 278.15 265 18.0 | 3 0.0587 0.0555 |
| 293.15 348 23.6 | 7 0.0441 0.0422 |
| The Henry's constant, K/at fraction values were calcu mole ratio and mole fracti pressure of 101.325 kPa (1 | lated by the compiler. The on values are for a partial |
| Henry's constants: | |
| K/psia = $(p_1/psia)/x_1$ wher | e psia is pounds per square inch absolute. |
| $K/atm = (p_1/atm)/x_1$ | |
| | |
| | |
| AUXILIARY | INFORMATION |
| METHOD/APPARATUS/PROCEDURE: The apparatus consisted of a stain- less steel solubility bomb, 217.5 cm ³ capacity, fitted with a charging and pressure measuring apparatus. A weighed amount of solvent was added to the bomb and its vapor pressure was measured. Hydrogen bromide was added from a weighed container, a second weighing giving the amount added, and the pressure was measured. The heat of solution was stated to be | <pre>stainless steel cylinder. (2) Hexane. The commercial specimen was rigorously purified and distilled; n²⁵_D, 1.3721.</pre> |
| -3.05 kcal mol ⁻¹ (-12.8 kJ mol ⁻¹). | |
| | ESTIMATED ERROR: |
| | |
| | DEFENSIVE. |
| | REFERENCES: |
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| 1 | 1 |

| 394 Hydrogen bronn | nde in Non-Aqueous Solvents |
|---|---|
| COMPONENTS: | ORIGINAL MEASUREMENTS: |
| <pre>(1) Hydrogen bromide; HBr; [10035-10-6]</pre> | Boedeker, E. R.; Lynch, C. C. |
| (2) Hexane; C ₆ H ₁₄ ; [110-54-3] | J. Am. Chem. Soc. <u>1950</u> , 72, 3234 - 3236. |
| VARIABLES: T/K: 298.15 - 318.15 P/kPa: 6.67 - 93.33 (50 - 700 mmHg) | PREPARED BY: W. Gerrard |
| EXPERIMENTAL VALUES: | |
| T/K Henry's Constant 10 ⁻³ K | Mol Ratio Mol Fraction t ¹ n_1/n_2 x_1 |
| 298.15 1.64±0.0 | 02 0.0434 0.0416 |
| 308.15 1.97±0.0 | 08 0.0361 0.0349 |
| 318.15 2.20±0.0 | 08 0.0323 0.0313 |
| ¹ K/mmHg kg solut: concentration of kg of <i>solution</i> . | ion mol ⁻¹ . Note that the f HBr is given as mol HBr per |
| | |
| AUX | ILIARY INFORMATION |
| METHOD/APPARATUS/PROCEDURE: | SOURCE AND PURITY OF MATERIALS: |
| The apparatus was stated to be modified form of that used by Ho et al. (1). The solvent in the absorption flask was saturated hydrogen bromide at a known pre measured on a manometer. The hy rogen bromide in a known weight sample of the saturated solutio determined by a chemical titrat | wland, Co. Degassed by alternate freezing and thawing. with essure (2) Hexane. Phillips Petroleum Co. b.p. at 1 atm T/K 341.9; of a n_D^{25} 1.3730. |
| The heat of solution was stated be -2.62 kcal mol ⁻¹ (-10.96 kJ | $ \frac{1}{mol^{-1}} = \frac{\text{ESTIMATED ERROR:}}{\delta K/K} = 0.05 $ |
| | REFERENCES: 1. Howland, J. J.; Miller, D. R.; Willard, J. E. J. Am. Chem. Soc. <u>1941</u> , 63, 2807. |

| COMPONENTS: | ORIGINAL MEASUREMENTS: |
|---|---|
| <pre>1. Hydrogen bromide; HBr; [10035-10-6]</pre> | Ahmed, W.; Gerrard, W.; Maladkar, V. K. |
| 2. Heptane; C _{7^H16} ; [142-82-5] | J. Appl. Chem. <u>1970</u> , 20, 109-115. |
| | |
| VARIABLES : | PREPARED BY: |
| T/K: 233.15 - 293.15 | |
| Total P/kPa: 101.325 (1 atm) | W. Gerrard |
| | (smoothed data calculated by H.L. Clever) |
| EXPERIMENTAL VALUES: | |
| T/K Mol Rat | |
| ⁿ HBr/ ⁿ C ₇ | H ₁₆ X _{HBr} |
| | <u>16</u> |
| 233.15 0.22 | |
| 243.15 0.14 | |
| 253.15 0.10 263.15 0.08 | |
| 273.15 0.07 | |
| 283.15 0.05 | |
| 293.15 0.04 | 7 0.0449 |
| The mole fraction solubilities were c | alculated from the mole ratio by the |
| compiler. Smoothed Data: ln X _{HBr} = -22.304 + 3 | 4.013/(T/100) + 7.072 ln (T/100) |
| | Regression Line = 2.42×10^{-3} |
| <u> </u> | ol Fraction |
| | X _{HBr} |
| | |
| 233.15 243.15 | 0.177 0.131 |
| 243.13 | 0.100 |
| 263.15 | 0.0791 |
| 273.15 | 0.0642 |
| 283.15 | 0.0533 |
| 293.15 | 0.0452 |
| | |
| AUXILIARY | INFORMATION |
| METHOD / APPARATUS / PROCEDURE : | COURCE AND DUDITY OF MATERIALS. |
| | SOURCE AND PURITY OF MATERIALS: |
| Hydrogen bromide was passed into a known weight of pure liquid in a | 1. Hydrogen bromide. High quality HBr was obtained from a cylinder |
| bubbler tube at a total pressure | and passed through a tube at 223 K. |
| measured by a manometer assembly. | For repeat runs it was prepared |
| The absorbed gas was weighed by re- | from phosphorus tribromide, |
| weighing the bubbler tube. The | dried by phosphorus pentoxide, |
| temperature was manually controlled | and stored at 193 K. |
| to within 0.2 K. | 2. Heptane. Best obtainable specimen |
| For the four lowest temperatures the gas absorbed was determined by a chemical titration. | was purified, fractionally dis- tilled, and attested. |
| The apparatus and procedure are | |
| described by Gerrard (1,2). | ESTIMATED ERROR: |
| | $\delta T/K = 0.2$ $\delta X/X = 0.02$ |
| | 0.02 |
| 1 | |
| | REFERENCES : |
| | 1. Gerrard, W. |
| | J. Appl. Chem. Biotechnol. <u>1972</u> , 22, 623-650. |
| | |
| | 2. Gerrard, W. "Solubility of Gases and Liquids" |
| 1 | Plenum Press, New York, 1976. |
| | |
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| COMPONENTS : | ORIGINAL MEASUREMENTS: |
|---|--|
| <pre>(1) Hydrogen bromide; HBr; [10035-10-6]</pre> | Boedeker, E. R.; Lynch, C. C. |
| (2) Octane; C ₈ H ₁₈ ; [111-65-9] | J. Am. Chem. Soc. <u>1950</u> , 72, 3234 - 3236. |
| | |
| VARIABLES: | PREPARED BY: |
| T/K: 298.15 - 318.15 P/kPa: 6.67 - 93.33 (50 - 700 mmHg) | W. Gerrard |
| EXPERIMENTAL VALUES: | |
| T/K Henry's Mo Constant ¹ 10 ⁻³ K | Dl Ratio Mol Fraction n_1/n_2 x_1 |
| 298.15 2.01 + 0.05 | 0.0469 0.0448 |
| 308.15 2.33 <u>+</u> 0.07 | 0.0404 0.0389 |
| | |
| at 101.325 (1 atm) HBr pa calculated by the compile | s given as mol HBr per atio and the mole fraction artial pressure were er. |
| AUXILIARY | INFORMATION |
| METHOD/APPARATUS/PROCEDURE: The apparatus was stated to be a modified form of that used by Howland, et al. (1). The solvent in the absorption flask was saturated with hydrogen bromide at a known pressure measured on a manometer. The hydrogen bromide in a known weight of a sample of the saturated solution was determined by a chemical titra- tion. | freezing and thawing. (2) Octane. Connecticut Hard Rubber Co. Purified and distilled. B.p. at 1 atm T/K 398.15; |
| The heat of solution was stated to be -2.49 kcal mol ⁻¹ (-10.42 kJ mol ⁻¹). | ESTIMATED ERROR: δK/K = 0.05 |
| | REFERENCES : |
| | <pre>1. Howland, J. J.; Miller, D. R.; Willard, J. E. J. Am. Chem. Soc. <u>1941</u>, 63, 2807.</pre> |
| | |

| COMPONENTS: (1) Hydrogen bromide; HBr; [10035-10-6] | ORIGINAL MEASUREMENTS: Boedeker, E. R.; Lynch, C. C. |
|--|--|
| (2) Decane; C ₁₀ H ₂₂ ; [124-18-5] | J. Am. Chem. Soc. <u>1950</u> , 72, 3234 - 3236. |
| | |
| VARIABLES: | PREPARED BY: |
| T/K: 298.15 - 318.15 P/kPa: 6.67 - 93.33 (50 - 700 mmHg) | W. Gerrard |
| EXPERIMENTAL VALUES: | |
| | 1 Ratio Mol Fraction n_1/n_2 x_1 |
| 298.15 2.15 ± 0.07 0 | .0548 0.0519 |
| 308.15 2.49 <u>+</u> 0.07 0 | .0473 0.0452 |
| 318.15 2.75 <u>+</u> 0.07 0 | .0428 0.0411 |
| ¹ K/mmHg kg solution mol concentration of HBr is kg of <i>solution</i> . | |
| The values of the mole ra at 101.325 (1 atm) HBr pa calculated by the compile | rtial pressure were |
| | |
| AUXILIARY | INFORMATION |
| METHOD/APPARATUS/PROCEDURE: | SOURCE AND PURITY OF MATERIALS: |
| The apparatus was stated to be a modified form of that used by Howland, <i>et al.</i> (1). The solvent in the absorption flask was saturated with hydrogen bromide at a known pressure measured on a manometer. The hydrogen bromide in a known weight of a sample of the saturated solution was determined by a chemical titration. | Hydrogen bromide. Dow Chemical Co. Degassed by alternate freezing and thawing. Decane. Connecticut Hard Rubber Co. Purified and distilled. B.p. at 1 atm T/K 447.15; n²⁵ 1.4118. |
| The heat of solution was stated to be $-2.34 \text{ kcal mol}^{-1}$ (-9.79 kJ mol ⁻¹). | ESTIMATED ERROR: |
| | δK/K = 0.05 |
| | REFERENCES : |
| | <pre>kipekences: I. Howland, J. J.; Miller, D. R.; Willard, J. E. J. Am. Chem. Soc. <u>1941</u>, 63, 2807.</pre> |
| | |

| COMPONENTS: | ORIGINAL MEASUREMENTS: |
|--|--|
| <pre>1. Hydrogen bromide; HBr; [10035-10-6]</pre> | Ahmed, W.; Gerrard, W.; Maladkar, V. K. |
| 2. Decane; C ₁₀ H ₂₂ ; [124-18-5] | J. Appl. Chem. <u>1970</u> , 20, 109-115. |
| | |
| VARIABLES: | PREPARED BY: |
| T/K: 243.15 - 293.15 Total P/kPa: 101.325 (l atm) | W. Gerrard |
| 10tal F/KFa. 101.325 (1 atm) | (smoothed data calculated by H.L. Clever) |
| EXPERIMENTAL VALUES: | tio Mol Fraction |
| ⁿ HBr/ ⁿ C ₁ | 0 ^H 22 ^X HBr |
| 243.15 0.24 | |
| 253.15 0.17 | 3 0.147 |
| 263.15 0.12 273.15 0.09 | |
| 283.15 0.07 | 5 0.0698 |
| 293.15 0.05 | 9 0.0557 |
| The mole fraction solubilities were c compiler. | alculated from the mole ratio by the |
| Smoothed Data: $\ln x_{HBr} = -9.021 + 17$ | .947/(T/100) |
| Standard Error about | Regression Line = 2.31×10^{-3} |
| · <u>T/K M</u> | ol Fraction |
| | X _{HBr} |
| 243.15 | 0.194 |
| 253.15 263.15 | 0.145 |
| 273.15 | 0.0863 |
| 283.15 293.15 | 0.0684 0.0551 |
| | |
| | |
| | |
| AUXILIARY | INFORMATION |
| METHOD / APPARATUS / PROCEDURE : | SOURCE AND PURITY OF MATERIALS: |
| Hydrogen bromide was passed into a | 1. Hydrogen bromide. High quality HBr was obtained from a cylinder |
| known weight of pure liquid in a bubbler tube at a total pressure | and passed through a tube at 223 K. |
| measured by a manometer assembly. | For repeat runs it was prepared |
| The absorbed gas was weighed by re- weighing the bubbler tube. The | from phosphorus tribromide, dried by phosphorus pentoxide, |
| temperature was manually controlled | and stored at 193 K. |
| to within 0.2 K. | 2. Decane. Best obtainable specimen |
| For the 3 lowest temperatures the gas absorbed was determined by a chemical titration. | was purified, fractionally dis- tilled, and attested. |
| The apparatus and procedure are | ESTIMATED ERROR: |
| described by Gerrard (1,2). | $\delta T/K = 0.2$ |
| | $\delta X/X = 0.02$ |
| | REFERENCES : |
| | 1. Gerrard, W. J. Appl. Chem. Biotechnol. <u>1972</u> , 22, 623-650. |
| | 2. Gerrard, W. |
| | "Solubility of Gases and Liquids" Plenum Press, New York, 1976. |
| | |

| Hydrogen Bromide in | Non-Aqueous Solvents 3 | |
|--|---|--|
| COMPONENTS : | ORIGINAL MEASUREMENTS: | |
| <pre>(1) Hydrogen bromide; HBr; [10035-10-6]</pre> | Fontana, C. M.; Herold, R. J. | |
| <pre>(2) Aluminum bromide; AlBr₃; [7727-15-3]</pre> | J. Am. Chem. Soc. <u>1948</u> , 70, 2881 - 2883. | |
| (3) Butane; C ₄ H ₁₀ ; [106-97-8] | | |
| VARIABLES: | PREPARED BY: | |
| T/K: 278.15, 298.15 P/kPa: up to 241.3 (up to 35 psia) | W. Gerrard | |
| EXPERIMENTAL VALUES: | | |
| T/K Aluminum | Henry's Constants | |
| Bromide | | |
| Al ₂ Br ₆ mol per cent | K/psia K/atm | |
| 278.15 0 | 326 22.18 | |
| 1.30 | 346 25.54 | |
| 298.15 0 | 443 30.14 | |
| 2.80 | 479 32.59 | |
| K/psia = (p _l /psia)/x _l where psia i K/atm = (p _l /atm)/x _l | | |
| 1 1 | | |
| $K/atm = (p_1/atm)/x_1$ | INFORMATION | |
| $K/atm = (p_1/atm)/x_1$ | | |
| K/atm = (p ₁ /atm)/x ₁ AUXILIARY METHOD/APPARATUS/PROCEDURE: The apparatus consisted of a stain- less steel solubility bomb, 217.5 cm ³ capacity, fitted with a charging and | SOURCE AND PURITY OF MATERIALS: (1) Hydrogen bromide. Dow Chemical | |
| K/atm = (p ₁ /atm)/x ₁ K/atm = (p ₁ /atm)/x ₁ AUXILIARY METHOD/APPARATUS/PROCEDURE: The apparatus consisted of a stain- less steel solubility bomb, 217.5 cm ³ capacity, fitted with a charging and pressure measuring apparatus. A weighed amount of solvent was added to the bomb and its vapor pressure | SOURCE AND PURITY OF MATERIALS: (1) Hydrogen bromide. Dow Chemical Co. It was stored in a small stainless steel cylinder. (2) Aluminum bromide. Doubly dis- tilled from aluminum chips, sealed into ampoules under | |
| K/atm = (p ₁ /atm)/x ₁ K/atm = (p ₁ /atm)/x ₁ AUXILIARY METHOD/APPARATUS/PROCEDURE: The apparatus consisted of a stain- less steel solubility bomb, 217.5 cm ³ capacity, fitted with a charging and pressure measuring apparatus. A weighed amount of solvent was added to the bomb and its vapor pressure was measured. Hydrogen bromide was added from a weighed container, a second weighing giving the amount | SOURCE AND PURITY OF MATERIALS: (1) Hydrogen bromide. Dow Chemical Co. It was stored in a small stainless steel cylinder. (2) Aluminum bromide. Doubly dis- tilled from aluminum chips, sealed into ampoules under vacuum for storage until used. (3) Butane. Purity 99+ percent. | |
| K/atm = (p ₁ /atm)/x ₁ K/atm = (p ₁ /atm)/x ₁ AUXILIARY METHOD/APPARATUS/PROCEDURE: The apparatus consisted of a stain- less steel solubility bomb, 217.5 cm ³ capacity, fitted with a charging and pressure measuring apparatus. A weighed amount of solvent was added to the bomb and its vapor pressure was measured. Hydrogen bromide was added from a weighed container, a second weighing giving the amount | SOURCE AND PURITY OF MATERIALS: (1) Hydrogen bromide. Dow Chemical Co. It was stored in a small stainless steel cylinder. (2) Aluminum bromide. Doubly dis- tilled from aluminum chips, sealed into ampoules under vacuum for storage until used. (3) Butane. Purity 99+ percent. | |
| K/atm = (p ₁ /atm)/x ₁ K/atm = (p ₁ /atm)/x ₁ AUXILIARY METHOD/APPARATUS/PROCEDURE: The apparatus consisted of a stain- less steel solubility bomb, 217.5 cm ³ capacity, fitted with a charging and pressure measuring apparatus. A weighed amount of solvent was added to the bomb and its vapor pressure | SOURCE AND PURITY OF MATERIALS: (1) Hydrogen bromide. Dow Chemical Co. It was stored in a small stainless steel cylinder. (2) Aluminum bromide. Doubly dis- tilled from aluminum chips, sealed into ampoules under vacuum for storage until used. (3) Butane. Purity 99+ percent. It was dried and degassed. | |
| K/atm = (p ₁ /atm)/x ₁ K/atm = (p ₁ /atm)/x ₁ AUXILIARY METHOD/APPARATUS/PROCEDURE: The apparatus consisted of a stain- less steel solubility bomb, 217.5 cm ³ capacity, fitted with a charging and pressure measuring apparatus. A weighed amount of solvent was added to the bomb and its vapor pressure was measured. Hydrogen bromide was added from a weighed container, a second weighing giving the amount | SOURCE AND PURITY OF MATERIALS: (1) Hydrogen bromide. Dow Chemical Co. It was stored in a small stainless steel cylinder. (2) Aluminum bromide. Doubly dis- tilled from aluminum chips, sealed into ampoules under vacuum for storage until used. (3) Butane. Purity 99+ percent. It was dried and degassed. | |
| K/atm = (p ₁ /atm)/x ₁ K/atm = (p ₁ /atm)/x ₁ AUXILIARY METHOD/APPARATUS/PROCEDURE: The apparatus consisted of a stain- less steel solubility bomb, 217.5 cm ³ capacity, fitted with a charging and pressure measuring apparatus. A weighed amount of solvent was added to the bomb and its vapor pressure was measured. Hydrogen bromide was added from a weighed container, a second weighing giving the amount | SOURCE AND PURITY OF MATERIALS: (1) Hydrogen bromide. Dow Chemical Co. It was stored in a small stainless steel cylinder. (2) Aluminum bromide. Doubly dis- tilled from aluminum chips, sealed into ampoules under vacuum for storage until used. (3) Butane. Purity 99+ percent. It was dried and degassed. | |
| K/atm = (p ₁ /atm)/x ₁ K/atm = (p ₁ /atm)/x ₁ AUXILIARY METHOD/APPARATUS/PROCEDURE: The apparatus consisted of a stain- less steel solubility bomb, 217.5 cm ³ capacity, fitted with a charging and pressure measuring apparatus. A weighed amount of solvent was added to the bomb and its vapor pressure was measured. Hydrogen bromide was added from a weighed container, a second weighing giving the amount | SOURCE AND PURITY OF MATERIALS: (1) Hydrogen bromide. Dow Chemical Co. It was stored in a small stainless steel cylinder. (2) Aluminum bromide. Doubly dis- tilled from aluminum chips, sealed into ampoules under vacuum for storage until used. (3) Butane. Purity 99+ percent. It was dried and degassed. | |

| CMFORENTS: (1) Hydrogen bromide; HBr; (1) Aluminum bromide; AlBr ₃ ; (2) Aluminum bromide; AlBr ₃ ; (3) Hexane; C _g H ₁₄ ; [110-54-3] VARIABLES: T/K: 278.15, 293.15 P/KPa: up to 241.3 (up to 35 psia) EXPERIMENTAL VALUES: T/K Aluminum Bromide Al ₃ Dr ₆ (up to 35 psia) EXPERIMENTAL VALUES: T/K Aluminum Bromide Al ₃ Dr ₆ (1, 05 293.15 C, 65 385 26.20 Henry's constants: K/psia = (p ₁ /psia)/z ₁ where psia is pounds per square inch absolute. K/atm = (p ₁ /atm)/z ₁ MIXILIARY INFORMATION HETHOD/APPARATUS/FROCEDURE: The apparatus consisted of a stain- cass steel solubility bomb, 217.5 cm ³ capacity, fitted with a charging and pressure measuring apparatus. A weighed amount of solvent was added to the bond nit supor pressure was measured. Hydrogen bromide was added from a weighed conclairer, a second weighing giving the amount added, and the pressure was measured. Herror state of the pressure was measured. Herror state of the pressure was measured. (3) Hexane. A commercial sample was rigorously purified and distilled, ng, 1.3721. ESTIMATED ERMOR: |
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| <pre>(2) Aluminum bromide; AlBr₃; [7727-15-3] (3) Hexane; C₆H₁₄; [110-54-3] VARIABLES: T/K: 278.15, 293.15 P/KPa: up to 241.3 (up to 35 psia)</pre> PREPARED BY: T/K Aluminum Bromide Al_2Dr ₆ (b) 203 19.94 293.15 0 265 18.03 1.05 293 19.94 293.15 0 348 23.68 2.65 385 26.20 Henry's constants: K/psia = (p ₁ /psia)/z ₁ where psia is pounds per square inch absolute. K/atm = (p ₁ /atm)/z ₁ MUXILLARY INFORMATION METHOD/APPARATUS/PROCEDURE: The apparatus consisted of a stain- less steel solubility bomb, 217.5 cm appacity, fitted with a charging and pressure measuring apparatus. A weighed amount of solvent was added to the bom and its vapor pressure was measured. Hydrogen bromide was second weighing giving the amount added, and the pressure was measured. (3) Hexane. A commercial sample was rigorously purified and distilled, n _D , 1.3721. |
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| $\frac{Al_2Br_6}{mol \ per \ cent} = \frac{M_1 \ per \ cent}{278.15} \frac{mol \ per \ cent}{1.05} = \frac{265}{18.03} \frac{19.94}{19.94} \frac{293.15}{293.15} \frac{0}{2.65} \frac{348}{385} \frac{23.68}{26.20}$ Henry's constants: K/psia = $(p_1/psia)/x_1$ where psia is pounds per square inch absolute. K/atm = $(p_1/atm)/x_1$ MUXILIARY INFORMATION METHOD/APPARATUS/PROCEDURE: The apparatus consisted of a stain- less steel solubility bomb, 217.5 cm ³ capacity, fitted with a charging and pressure measured. Hydrogen bromide was added from a weighed container, a second weighing giving the amount added, and the pressure was measured. (1) Hexane. A commercial sample was rigorously purified and distilled, $\frac{\pi_D^{5}}{1.3721}$. |
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| added from a weighed container, a second weighing giving the amount added, and the pressure was measured. (3) Hexane. A commercial sample was rigorously purified and distilled, n_D^{25} , 1.3721. |
| second weighing giving the amount added, and the pressure was measured. (3) Hexane. A commercial sample was rigorously purified and distilled, $n_D^{2^\circ}$, 1.3721. |
| added, and the pressure was measured. (3) Hexane. A commercial sample was rigorously purified and distilled, $n_D^{2^\circ}$, 1.3721. |
| rigorously purified and distilled, $n_{\rm D}^{25}$, 1.3721. |
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| ESTIMATED ERROR: |
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| REFERENCES : |
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| COMPONENTS: | ORIGINAL MEASUREMENTS: |
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| (1) Hydrogen bromide; HBr; | O'Brien, S. J.; Bobalek, E. G. |
| [10035-10-6] | J. Am. Chem. Soc. 1940, 62, |
| (2) Benzene; C ₆ H ₆ ; [71-43-2] | 3227 - 3230. |
| (2) Benzene, C6 ⁶ 6, [12 35 2] | 5227 52501 |
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| | |
| VARIABLES: | PREPARED BY: |
| T/K: 298.15 P/kPa: 11.11 - 57.20 | W. Gerrard |
| (83.3 - 429 mmHg) | |
| | <u> </u> |
| EXPERIMENTAL VALUES: | |
| | Henry's Mol Ratio Mol Fraction |
| p _l /mmHg m _l /mol kg ⁻¹ | $\frac{\text{Constant}}{k^1} n_1 n_2 x_1$ |
| | |
| 298.15 83.3 0.097 | 1.13 0.00757 0.00751 |
| 125 0.162 | 1.01 0.0126 0.0125 |
| 128 0.167 | 1.01 0.0130 0.0129 0.99 0.0176 0.0173 |
| 170 0.226 233 0.302 | 0.99 0.0176 0.0173 1.02 0.0236 0.0230 |
| 233 0.302 429 0.477 | 1.18 0.0372 0.0359 |
| 427 U.4// | |
| (760 0.971 | 1.03 av. 0.0757 $0.0704)^2$ |
| | |
| ¹ k/atm mol ⁻¹ kg | |
| Kyatin mor Ky | |
| ² Value calculated by the compile: | r from the average value of Henry's |
| constant. Use of the high and | tow values of Henry's constant |
| | 30 for the mole fraction solubility |
| at one atm (101.325 kPa). | |
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| AUXILIARY | INFORMATION |
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| METHOD /APPARATUS / PROCEDURE : | SOURCE AND PURITY OF MATERIALS: |
| METHOD/APPARATUS/PROCEDURE: The method and apparatus are those of | SOURCE AND PURITY OF MATERIALS: (1) Hydrogen bromide. Prepared from bromine and tetralin, and passed |
| METHOD/APPARATUS/PROCEDURE: The method and apparatus are those of Saylor (1) as modified by O'Brien <i>et</i> | SOURCE AND PURITY OF MATERIALS: (1) Hydrogen bromide. Prepared from bromine and tetralin, and passed |
| METHOD/APPARATUS/PROCEDURE: The method and apparatus are those of Saylor (1) as modified by O'Brien et al. (2). The main difference is the | SOURCE AND PURITY OF MATERIALS: (1) Hydrogen bromide. Prepared from bromine and tetralin, and passed successively over red phosphorus |
| METHOD/APPARATUS/PROCEDURE: The method and apparatus are those of Saylor (1) as modified by O'Brien <i>et</i> al. (2). The main difference is the use of a 1 to 2 day instead of a 5 to | SOURCE AND PURITY OF MATERIALS: (1) Hydrogen bromide. Prepared from bromine and tetralin, and passed successively over red phosphorus |
| METHOD/APPARATUS/PROCEDURE: The method and apparatus are those of Saylor (1) as modified by O'Brien et al. (2). The main difference is the use of a 1 to 2 day instead of a 5 to 7 day equilibration time. | SOURCE AND PURITY OF MATERIALS: (1) Hydrogen bromide. Prepared from bromine and tetralin, and passed successively over red phosphorus and phosphorus pentoxide. (2) Benzene. Stored over sodium |
| METHOD/APPARATUS/PROCEDURE: The method and apparatus are those of Saylor (1) as modified by O'Brien <i>et</i> al. (2). The main difference is the use of a 1 to 2 day instead of a 5 to 7 day equilibration time. The apparatus consists of two bulbs | SOURCE AND PURITY OF MATERIALS: (1) Hydrogen bromide. Prepared from bromine and tetralin, and passed successively over red phosphorus and phosphorus pentoxide. (2) Benzene. Stored over sodium and distilled, m.p. 278.63 K. |
| METHOD/APPARATUS/PROCEDURE: The method and apparatus are those of Saylor (1) as modified by O'Brien <i>et</i> al. (2). The main difference is the use of a 1 to 2 day instead of a 5 to 7 day equilibration time. The apparatus consists of two bulbs which are separated by a tap. The | SOURCE AND PURITY OF MATERIALS: (1) Hydrogen bromide. Prepared from bromine and tetralin, and passed successively over red phosphorus and phosphorus pentoxide. (2) Benzene. Stored over sodium |
| METHOD/APPARATUS/PROCEDURE: The method and apparatus are those of Saylor (1) as modified by O'Brien et al. (2). The main difference is the use of a 1 to 2 day instead of a 5 to 7 day equilibration time. The apparatus consists of two bulbs which are separated by a tap. The solvent is partially saturated with | SOURCE AND PURITY OF MATERIALS: (1) Hydrogen bromide. Prepared from bromine and tetralin, and passed successively over red phosphorus and phosphorus pentoxide. (2) Benzene. Stored over sodium and distilled, m.p. 278.63 K. |
| METHOD/APPARATUS/PROCEDURE: The method and apparatus are those of Saylor (1) as modified by O'Brien <i>et</i> al. (2). The main difference is the use of a 1 to 2 day instead of a 5 to 7 day equilibration time. The apparatus consists of two bulbs which are separated by a tap. The solvent is partially saturated with the gas, and the solution added to | SOURCE AND PURITY OF MATERIALS: (1) Hydrogen bromide. Prepared from bromine and tetralin, and passed successively over red phosphorus and phosphorus pentoxide. (2) Benzene. Stored over sodium and distilled, m.p. 278.63 K. |
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| METHOD/APPARATUS/PROCEDURE: The method and apparatus are those of Saylor (1) as modified by O'Brien <i>et</i> al. (2). The main difference is the use of a 1 to 2 day instead of a 5 to 7 day equilibration time. The apparatus consists of two bulbs which are separated by a tap. The solvent is partially saturated with the gas, and the solution added to the lower bulb. The bulbs are partially evacuated, the tap opened, | SOURCE AND PURITY OF MATERIALS: (1) Hydrogen bromide. Prepared from bromine and tetralin, and passed successively over red phosphorus and phosphorus pentoxide. (2) Benzene. Stored over sodium and distilled, m.p. 278.63 K. |
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| METHOD/APPARATUS/PROCEDURE: The method and apparatus are those of Saylor (1) as modified by O'Brien <i>et</i> <i>al</i> . (2). The main difference is the use of a 1 to 2 day instead of a 5 to 7 day equilibration time. The apparatus consists of two bulbs which are separated by a tap. The solvent is partially saturated with the gas, and the solution added to the lower bulb. The bulbs are partially evacuated, the tap opened, and the whole apparatus put in a thermostat from 1 to 2 days. The tap is closed. The HBr in the upper bulb is quantitatively removed and titrated with NaOH. The HBr partial pressure is calculated from the bulb volume and the number of moles of HBr assuming ideal gas behavior. A weighed solution sample is removed from the lower bulb and | <pre>SOURCE AND PURITY OF MATERIALS: (1) Hydrogen bromide. Prepared from bromine and tetralin, and passed successively over red phosphorus and phosphorus pentoxide. (2) Benzene. Stored over sodium and distilled, m.p. 278.63 K. Good quality.</pre> ESTIMATED ERROR: |

| COMPONENTS : | | ORIGINAL M | EASUREMENTS: |
|---|---|---|---|
| (1) Hydrogen bromide; [10035-10-6] | HBr; | | nskii, A. F.; Mal'tsev, B. A. |
| (2) Benzene; C ₆ H ₆ ; [7] | -43-2] | J. Phys 105 - 1 | . Chem. (USSR) <u>1940</u> , 14, 09. |
| VARIABLES : | | PREPARED B | y · |
| T/K: 303.15, P/kPa: 1.016 - | 84.353 | | W. Gerrard |
| (0.01003 EXPERIMENTAL VALUES: | - 0.8325 atm) | <u> </u> | |
| | | | |
| т/к | Pressure Mol p1/atm | raction ^x 1 | Henry's Constant K/atm = p_1/x_1 |
| 303.15 | 0.01003 0.0 0.0835 0.0 0.2634 0.0 0.3953 0.0 0.4622 0.0 0.7455 0.0 [1.0 0.0 | 005459 01649 02535 02913 04713 | 16.3 15.3 16.0 15.6 15.9 15.8 Mean: 15.8 |
| 323.15 | 0.8325 0.0 |)2226)3418 | 24.3 25.0 24.0 24.4 Mean: 24.4 |
| The auth HBr in b | of x_1 and p_1 . Hors give the here as 4197 heat of mixing al mol ⁻¹ (732 J | at of sol cal mol-1 of liquid mol-1) | ution of gaseous (17.56 kJ mol ⁻¹), HBr with benzene |
| | AUXILIARY | INFORMATIO | N |
| METHOD APPARATUS / PROCEDURE : | | SOURCE AND | PURITY OF MATERIALS: |
| An improved form of th described by Saylor (1 Constant weight mixtur hydrogen bromide and b obtained after not les days. The weight of hy was determined separat gaseous and the liquid chemical titration. |) was used. es of dry enzene were s than five drogen bromide sely in the | acti trib (2) Benz acid | ogen bromide. Prepared by the on of water on phosphorus romide. ene. Treated with sulfuric and water. Dried over sodium. illed, b.p./°C 80.1 - 80.3. |
| The ICT (2) gives the of HBr as 26.1 atm at 40.2 atm at 323.15 K. | vapor pressure 303.15 K, and | ESTIMATED | ERROR: |
| | | REFERENCE | S : |
| | | 1. Saylo | r, J. H. . Chem. Soc. <u>1937</u> , 59, 1712. |
| | | McGra | national Critical Tables, w-Hill Co., New York, <u>1928</u> , 3, p. 228. |

| (1) Hydrogen bromide; HBr; [10035-10-6] (2) Benzene; C ₆ H ₆ ; [71-43-2] VARIABLES: T/K: 278.85 P/kPa: up to 20 (150 mmHg) EXPERIMENTAL VALUES: T/K Highest Pressure Henry's Constant Mol Fraction Reported (graph) K = p_1/x_1 at 101.325 kI P1/mmHg Z78.85 150 The values of Henry's constant, K/atm, and the mole fraction solubility at one atm were calculated by the compiler. The data were given simply as Henry's constant, K/mmHg, and a straight line plot of x_1 and total pressure (4 points). Henry's constant for an "ideal solution" was taken as the vapor pressure of pure liquid HBr (11850 mmHg or 15.59 atm) estimated from data reported by Bates, Halford and Anderson The value from the International Critical Tables (2) is 14.3 atm. The mole fraction solubility was calculated assuming Henry's law is obeyed up to a pressure of one atm, thus $x_1 = 1/(K/atm)$ AUXILIARY INFORMATION METHOD APPARATUS/PROCEDURE: SOURCE AND PURITY OF MATERIALS: | 'a |
|--|-----------------|
| (2) Benzene; $C_{6}H_{6}$; $[71-43-2]$ VARIABLES: T/K: 278.85 P/kPa: up to 20 (150 mmHg) EXPERIMENTAL VALUES: T/K Highest Pressure Henry's Constant Mol Fraction Reported (graph) P1/mmHg Z78.85 150 The values of Henry's constant, K/atm, and the mole fraction solubility at one atm were calculated by the compiler. The data were given simply as Henry's constant, K/mmHg, and a straight line plot of x_1 and total pressure (4 points). Henry's constant for an "ideal solution" was taken as the vapor pressure of pure liquid HBr (11850 mmHg or 15.9 atm) estimated from data reported by Bates, Halford and Anderson The value from the International Critical Tables (2) is 14.3 atm. The mole fraction solubility was calculated assuming Henry's law is obeyed up to a pressure of one atm, thus $x_1 \approx 1/(K/at)$ METHOD APPARATUS/PROCEDURE: SOURCE AND PURITY OF MATERIALS: | a |
| T/K:278.85 P/kPa:W. GerrardEXPERIMENTAL VALUES:T/KHighest Pressure Reported (graph) $P_1/mmHg$ Henry's Constant $K = p_1/x_1$ at 101.325 kf $p_1/mmHg$ 278.8515059207.790.128The values of Henry's constant, K/atm, and the mole fraction solubility at one atm were calculated by the compiler.The data were given simply as Henry's constant, K/mmHg, and a straight line plot of x_1 and total pressure (4 points).Henry's constant for an "ideal solution" was taken as the vapor pressure of pure liquid HBr (l1850 mmHg or 15.59 atm) estimated from data reported by Bates, Halford and Anderson The value from the International Critical Tables (2) is 14.3 atm.The mole fraction solubility was calculated assuming Henry's law is obeyed up to a pressure of one atm, thus $x_1 = 1/(K/at)$ AUXILIARY INFORMATIONMUXILIARY INFORMATIONMUXILIARY INFORMATION | 'a |
| T/K:278.85 P/kPa:W. GerrardEXPERIMENTAL VALUES:T/KHighest Pressure Reported (graph) $P_1/mmHg$ Henry's Constant $K = p_1/x_1$ at 101.325 kf $p_1/mmHg$ 278.8515059207.790.128The values of Henry's constant, K/atm, and the mole fraction solubility at one atm were calculated by the compiler.The data were given simply as Henry's constant, K/mmHg, and a straight line plot of x_1 and total pressure (4 points).Henry's constant for an "ideal solution" was taken as the vapor pressure of pure liquid HBr (l1850 mmHg or 15.59 atm) estimated from data reported by Bates, Halford and Anderson The value from the International Critical Tables (2) is 14.3 atm.The mole fraction solubility was calculated assuming Henry's law is obeyed up to a pressure of one atm, thus $x_1 = 1/(K/at)$ AUXILIARY INFORMATIONMUXILIARY INFORMATIONMUXILIARY INFORMATION | 'a |
| P/kPa: up to 20 (150 mmHg)W. GerrardEXPERIMENTAL VALUES:T/K Highest Pressure Henry's Constant Mol Fraction Reported (graph) $p_1/mmHg$ K/mmHg K/atm x_1 278.85 150 5920 7.79 0.128The values of Henry's constant, K/atm, and the mole fraction solubility at one atm were calculated by the compiler.The data were given simply as Henry's constant, K/mmHg, and a straight line plot of x_1 and total pressure (4 points).Henry's constant for an "ideal solution" was taken as the vapor pressure of pure liquid HBr (11850 mmHg or 15.5 atm) estimated from data reported by Bates, Halford and Anderson The value from the International Critical Tables (2) is 14.3 atm.The mole fraction solubility was calculated assuming Henry's law is obeyed up to a pressure of one atm, thus $x_1 = 1/(K/at)$ AUXILIARY INFORMATIONMUXILIARY INFORMATIONMUXILIARY INFORMATION | |
| T/KHighest Pressure Reported (graph) $p_1/mmHg$ Henry's Constant p_1/x_1 Mol Fraction at 101.325 kg x_1 278.8515059207.790.128The values of Henry's constant, K/atm, and the mole fraction solubility at one atm were calculated by the compiler.The data were given simply as Henry's constant, K/mmHg, and a straight line plot of x_1 and total pressure (4 points).Henry's constant for an "ideal solution" was taken as the vapor pressure of pure liquid HBr (11850 mmHg or 15.59 atm) estimated from data reported by Bates, Halford and Anderson The value from the International Critical Tables (2) is 14.1 atm.The mole fraction solubility was calculated assuming Henry's law is obeyed up to a pressure of one atm, thus $x_1 = 1/(K/at)$ AUXILIARY INFORMATIONMUXILIARY INFORMATIONMUXILIARY INFORMATION | 'a |
| Reported (graph) $p_1/mmHg$ $K = p_1/x_1$ at 101.325 kF $p_1/mmHg$ $K/mmHg$ K/atm x_1 278.8515059207.790.128The values of Henry's constant, K/atm, and the mole fraction solubility at one atm were calculated by the compiler.The data were given simply as Henry's constant, K/mmHg, and a straight line plot of x_1 and total pressure (4 points).Henry's constant for an "ideal solution" was taken as the vapor pressure of pure liquid HBr (ll850 mmHg or 15.59 atm) estimated from the International Critical Tables (2) is 14.3 atm.The mole fraction solubility was calculated assuming Henry's law is obeyed up to a pressure of one atm, thus $x_1 = 1/(K/at)$ AUXILIARY INFORMATIONMUXILIARY INFORMATIONMUXILIARY INFORMATION | a |
| 278.8515059207.790.128The values of Henry's constant, K/atm, and the mole fraction solubility at one atm were calculated by the compiler.The data were given simply as Henry's constant, K/mmHg, and a straight line plot of x_1 and total pressure (4 points).Henry's constant for an "ideal solution" was taken as the vapor pressure of pure liquid HBr (11850 mmHg or 15.59 atm) estimated from data reported by Bates, Halford and Anderson The value from the International Critical Tables (2) is 14.1 atm.The mole fraction solubility was calculated assuming Henry's law is obeyed up to a pressure of one atm, thus $x_1 = 1/(K/at)$ AUXILIARY INFORMATIONMETHOD 'APPARATUS/PROCEDURE:SOURCE AND PURITY OF MATERIALS: | |
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| a straight line plot of x_1 and total pressure (4 points).Henry's constant for an "ideal solution" was taken as the vapor pressure of pure liquid HBr (11850 mmHg or 15.59 atm) estimated from data reported by Bates, Halford and Anderson The value from the International Critical Tables (2) is 14.3 atm.The mole fraction solubility was calculated assuming Henry's law is obeyed up to a pressure of one atm, thus $x_1 = 1/(K/at)$ AUXILIARY INFORMATIONMETHOD 'APPARATUS/PROCEDURE:SOURCE AND PURITY OF MATERIALS: | L |
| vapor pressure of pure liquid HBr (l1850 mmHg or 15.59 atm) estimated from data reported by Bates, Halford and Anderson The value from the International Critical Tables (2) is 14.3 atm.The mole fraction solubility was calculated assuming Henry's law is obeyed up to a pressure of one atm, thus $x_1 = 1/(K/at)$ AUXILIARY INFORMATIONMETHOD 'APPARATUS/PROCEDURE:SOURCE AND PURITY OF MATERIALS: | as |
| law is obeyed up to a pressure of one atm, thus $x_1 = 1/(k/at)$ AUXILIARY INFORMATION METHOD APPARATUS/PROCEDURE: Source AND PURITY OF MATERIALS: | |
| METHOD APPARATUS/PROCEDURE: SOURCE AND PURITY OF MATERIALS: | :m). |
| METHOD APPARATUS/PROCEDURE: SOURCE AND PURITY OF MATERIALS: | |
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| The amount of HBr absorbed at the observed total pressure was measured by the change in pressure in a calibrated bulb containing the gas. A high precision high vacuum appara- tus was used. (1) Hydrogen bromide. Pure alumin bromide was allowed to hydrat approximately AlBr ₃ 'H ₂ O, which was then heated in an evacuat tube. HBr was distilled from bath at 193 K. | e to h ed |
| The amount of solvent was probably about 0.03 mole. (2) Benzene. The liquid may be ta as of high quality. | ken |
| ESTIMATED ERROR: | <u></u> |
| | |
| REFERENCES : | <u>-</u> |
| <pre>1. Bates, J. R.; Halford, J. 0.; Anderson, L. C. J. Chem. Phys. <u>1935</u>, 3, 531.</pre> | |
| 2. International Critical Tables, McGraw-Hill Co., New York, <u>192</u> Vol. 3, p. 228. | |

| COMPONENTS : | ORIGINAL MEASUREMENTS: |
|--|--|
| <pre>1. Hydrogen bromide; HBr; [10035-10-6]</pre> | Ahmed, W.; Gerrard, W.; Maladkar, V. K. |
| 2. Benzene; C ₆ H ₆ ; [71-43-2] | J. Appl. Chem. <u>1970</u> , 20, 109-115. |
| | |
| VARIABLES: | PREPARED BY: |
| T/K: 243.15 - 293.15 | W. Gerrard |
| Total P/kPa: 101.325 (1 atm) | |
| | (smoothed data calculated by H.L. Clever) |
| EXPERIMENTAL VALUES: | |
| T/K Mol Rat | |
| ⁿ HBr/ ⁿ C | 6 ^H 6 X _{HBr} |
| 263.15 0.21 | .0 0.174 |
| 273.15 0.15 | |
| 283.15 0.11 293.15 0.09 | |
| | |
| The mole fraction solubilities were o | alculated from the mole ratio by the |
| compiler. | |
| Smoothed Data: $\ln X_{HBr} = -55.228 + 8$ | 1.862/(T/100) + 23.118 ln (T/100) |
| Standard error about | regression line = 2.06×10^{-3} |
| | |
| T/K N | lol Fraction |
| | X _{HBr} |
| 263.15 | |
| 273.15 283.15 | 0.131 |
| 293.15 | 0.0872 |
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| | |
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| | |
| AUXILIARY | INFORMATION |
| METHOD /APPARATUS / PROCEDURE : | SOURCE AND PURITY OF MATERIALS: |
| Hydrogen bromide was passed into a | 1. Hydrogen bromide. High quality |
| known weight of pure liquid in a bubbler tube at a total pressure | HBr was obtained from a cylinder and passed through a tube at 223 K. |
| measured by a manometer assembly. | For repeat runs it was prepared |
| The absorbed gas was weighed by re- | from phosphorus tribromide |
| weighing the bubbler tube. The temperature was manually controlled | dried by phosphorus pentoxide, and stored at 193 K. |
| to within 0.2 K. | 2. Benzene. Best obtainable speci- |
| | men was purified, fractionally |
| | distilled, and attested. |
| | |
| The apparatus and procedure are | ESTIMATED ERROR: |
| described by Gerrard (1,2). | $\delta T/K = 0.2$ |
| | $\delta X/X = 0.01$ |
| | |
| | REFERENCES : |
| | |
| | 1. Gerrard W. |
| | J. Appl. Chem. Biotechnol. 1972, |
| | J. Appl. Chem. Biotechnol. <u>1972</u> , 22, 623-650. |
| | J. Appl. Chem. Biotechnol. <u>1972</u> , 22, 623-650. 2. Gerrard, W. |
| | J. Appl. Chem. Biotechnol. <u>1972</u> , 22, 623-650. |

| COMPONENTS : | ORIGINAL MEASUREMENTS: | | | | | |
|---|---|--|---|--|--|--|
| (1) Hydrogen bromide; HBr; | | O'Brien, S. J.; Bobalek, E. G. | | | | |
| [10035-10-6] | | J Am CI | hem. Soc. 1 | 940. 62. | | |
| (2) Methylbenzene or toluene; C ₇ H ₈ ; [108-88-3] | | 3227 - 32 | | , | | |
| | | 5227 52 | 200. | | | |
| (100 00 0 | | | | | | |
| | | | | | | |
| | | - | | | | |
| VARIABLES: T/K: | 298.15 | PREPARED B | PREPARED BY: | | | |
| P/kPa: | 19.47 - 47.73 | 1 | W. Gerra | ırd | | |
| -, | (146 - 358 mmHg) | 1 | | | | |
| | | | _ | | | |
| EXPERIMENTAL VAL | JES: | | | | | |
| T/K | | Henry's | Mol Ratio | Mol Fraction | | |
| | p ₁ /mmHg m ₁ /mol kg ⁻¹ | Constant | n_1/n_2 | <i>x</i> ₁ | | |
| | | <u>k</u> 1 | | | | |
| 298.15 | 146 0.185 | 1.03 | 0.0170 | 0.0167 | | |
| 250.25 | 171 0.194 | 1.15 | 0.0178 | 0.0175 | | |
| | 210 0.286 | 0.97 | 0.0263 | 0.0256 | | |
| | 299 0.407 | 0.97 | 0.0374 | 0.0361 | | |
| | 335 0.446 | 0.97 | 0.0410 | 0.0394 | | |
| | 358 0.477 | 0.99 | 0.0439 | 0.0420 | | |
| | | | | 0.00501 | | |
| | (760 1.010 | 0.99 av. | 0.0929 | 0.0850) ² | | |
| | | | | | | |
| ¹ k/atm m | ol ⁻¹ kg | | | | | |
| 2 - | | | | | | |
| | alculated by the compile | er from the | e average v | Value of Henry's | | |
| constan | t. Use of the high and | low values | s of Henry | s constant | | |
| gives a | range of 0.0741 to 0.08 | 366 for the | e mole frac | ction solubility | | |
| | atm (101.325 kPa). | | | | | |
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| | AUXILIARY | INFORMATION | N | | | |
| METHOD /APPARATIIS | | | | ATERIALS : | | |
| METHOD/APPARATUS | /PROCEDURE: | SOURCE AND | PURITY OF M | | | |
| The method an | /PROCEDURE: d apparatus are those of | SOURCE AND | PURITY OF M | le. Prepared fro | | |
| The method an Savlor (1) as | /PROCEDURE: d apparatus are those of modified by O'Brien <i>et</i> | SOURCE AND (1) Hydro brom | PURITY OF M ogen bromic ine and tet | le. Prepared fro tralin, and passe | | |
| The method an Saylor (1) as al . (2). The | /PROCEDURE: d apparatus are those of modified by O'Brien <i>et</i> main difference is the | SOURCE AND (1) Hydro brom: succe | PURITY OF M ogen bromid ine and ten essively ov | le. Prepared fro tralin, and passe ver red phosphoru | | |
| The method an Saylor (1) as al . (2). The use of a 1 to | /PROCEDURE: d apparatus are those of modified by O'Brien <i>et</i> main difference is the 2 day instead of a 5 to | SOURCE AND (1) Hydro brom: succe | PURITY OF M ogen bromid ine and ten essively ov | le. Prepared fro tralin, and passe | | |
| The method an Saylor (1) as al . (2). The | /PROCEDURE: d apparatus are those of modified by O'Brien <i>et</i> main difference is the 2 day instead of a 5 to | SOURCE AND (1) Hydro brom succo and | PURITY OF M ogen bromid ine and tet essively ov phosphorus | de. Prepared fro tralin, and passe ver red phosphoru pentoxide. | | |
| The method an Saylor (1) as al. (2). The use of a 1 to 7 day equilib | /PROCEDURE: d apparatus are those of modified by O'Brien <i>et</i> main difference is the 2 day instead of a 5 to ration time. | SOURCE AND (1) Hydro brom succo and p (2) Tolu | PURITY OF M ogen bromid ine and tet essively ov phosphorus ene. Good | de. Prepared fro tralin, and passe ver red phosphoru pentoxide. quality. Stored | | |
| The method an Saylor (1) as al. (2). The use of a 1 to 7 day equilib The apparatus | /PROCEDURE: d apparatus are those of modified by O'Brien <i>et</i> main difference is the 2 day instead of a 5 to ration time. consists of two bulbs | SOURCE AND (1) Hydro brom succo and y (2) Tolucover | PURITY OF M ogen bromid ine and tet essively ov phosphorus ene. Good sodium and | de. Prepared fro tralin, and passe ver red phosphoru pentoxide. | | |
| The method an Saylor (1) as al. (2). The use of a 1 to 7 day equilib The apparatus which are sep | /PROCEDURE: d apparatus are those of modified by O'Brien <i>et</i> main difference is the 2 day instead of a 5 to ration time. consists of two bulbs arated by a tap. The | SOURCE AND (1) Hydro brom succo and y (2) Tolucover | PURITY OF M ogen bromid ine and tet essively ov phosphorus ene. Good | de. Prepared fro tralin, and passe ver red phosphoru pentoxide. quality. Stored | | |
| The method an Saylor (1) as al. (2). The use of a 1 to 7 day equilib The apparatus which are sep solvent is pa | /PROCEDURE: d apparatus are those of modified by O'Brien <i>et</i> main difference is the 2 day instead of a 5 to ration time. consists of two bulbs arated by a tap. The rtially saturated with | SOURCE AND (1) Hydro brom succo and y (2) Tolucover | PURITY OF M ogen bromid ine and tet essively ov phosphorus ene. Good sodium and | de. Prepared fro tralin, and passe ver red phosphoru pentoxide. quality. Stored | | |
| The method an Saylor (1) as al. (2). The use of a 1 to 7 day equilib The apparatus which are sep solvent is pa the gas, and | /PROCEDURE: d apparatus are those of modified by O'Brien <i>et</i> main difference is the 2 day instead of a 5 to ration time. consists of two bulbs arated by a tap. The rtially saturated with the solution added to | SOURCE AND (1) Hydro brom succo and y (2) Tolucover | PURITY OF M ogen bromid ine and tet essively ov phosphorus ene. Good sodium and | de. Prepared fro tralin, and passe ver red phosphoru pentoxide. quality. Stored | | |
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| The method an Saylor (1) as al. (2). The use of a 1 to 7 day equilib The apparatus which are sep solvent is pa the gas, and the lower bul partially eva | /PROCEDURE: d apparatus are those of modified by O'Brien <i>et</i> main difference is the 2 day instead of a 5 to ration time. consists of two bulbs arated by a tap. The rtially saturated with the solution added to b. The bulbs are cuated, the tap opened, | SOURCE AND (1) Hydro brom succe and p (2) Tolue over n ²⁰ , | PURITY OF M ogen bromid ine and tet essively ov phosphorus ene. Good sodium and 1.4959. | de. Prepared fro tralin, and passe ver red phosphoru pentoxide. quality. Stored | | |
| The method an Saylor (1) as al. (2). The use of a 1 to 7 day equilib The apparatus which are sep solvent is pa the gas, and the lower bul partially eva and the whole | /PROCEDURE: d apparatus are those of modified by O'Brien <i>et</i> main difference is the 2 day instead of a 5 to ration time. consists of two bulbs arated by a tap. The rtially saturated with the solution added to b. The bulbs are cuated, the tap opened, apparatus put in a | SOURCE AND (1) Hydro brom succo and y (2) Tolucover | PURITY OF M ogen bromid ine and tet essively ov phosphorus ene. Good sodium and 1.4959. | de. Prepared fro tralin, and passe ver red phosphoru pentoxide. quality. Stored | | |
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| The method an Saylor (1) as al. (2). The use of a 1 to 7 day equilib The apparatus which are sep solvent is pa the gas, and the lower bul partially eva and the whole thermostat fr The tap is cl upper bulb is and titrated partial press the bulb volu | /PROCEDURE: d apparatus are those of modified by O'Brien <i>et</i> main difference is the 2 day instead of a 5 to ration time. consists of two bulbs arated by a tap. The rtially saturated with the solution added to b. The bulbs are cuated, the tap opened, apparatus put in a om 1 to 2 days. osed. The HBr in the quantitatively removed with NaOH. The HBr ure is calculated from me and the number of | SOURCE AND (1) Hydro brom succe and (2) Tolue over n ² ⁰ , ESTIMATED REFERENCES 1. Sayle | PURITY OF M ogen bromid ine and tet essively or phosphorus ene. Good sodium and 1.4959. ERROR: $\delta T/K = 0$ S: or, J. H. | de. Prepared fro tralin, and passe ver red phosphoru pentoxide. quality. Stored distilled; | | |
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| The method an Saylor (1) as al. (2). The use of a 1 to 7 day equilib The apparatus which are sep solvent is pa the gas, and the lower bul partially eva and the whole thermostat fr The tap is cl upper bulb is and titrated partial press the bulb volu moles of HBr behavior. A | /PROCEDURE: d apparatus are those of modified by O'Brien <i>et</i> main difference is the 2 day instead of a 5 to ration time. consists of two bulbs arated by a tap. The rtially saturated with the solution added to b. The bulbs are cuated, the tap opened, apparatus put in a om 1 to 2 days. osed. The HBr in the quantitatively removed with NaOH. The HBr ure is calculated from me and the number of assuming ideal gas weighed solution sample | SOURCE AND (1) Hydro brom succe and (2) Tolue over n ² _D , ESTIMATED REFERENCES 1. Sayle J. An | PURITY OF M ogen bromid ine and tet essively or phosphorus ene. Good sodium and 1.4959. ERROR: $\delta T/K = 0$ S: or, J. H. m. Chem. So | <pre>de. Prepared fro tralin, and passe yer red phosphoru pentoxide. quality. Stored d distilled; 0.02 pc. <u>1937</u>, <i>\$9</i>, 171</pre> | | |
| The method an Saylor (1) as al. (2). The use of a 1 to 7 day equilib The apparatus which are sep solvent is pa the gas, and the lower bul partially eva and the whole thermostat fr The tap is cl upper bulb is and titrated partial press the bulb volu moles of HBr behavior. A is removed fr | /PROCEDURE: d apparatus are those of modified by O'Brien <i>et</i> main difference is the 2 day instead of a 5 to ration time. consists of two bulbs arated by a tap. The rtially saturated with the solution added to b. The bulbs are cuated, the tap opened, apparatus put in a om 1 to 2 days. osed. The HBr in the quantitatively removed with NaOH. The HBr ure is calculated from me and the number of assuming ideal gas weighed solution sample om the lower bulb and | SOURCE AND (1) Hydro brom succe and (2) Tolue over n ² 0, ESTIMATED REFERENCES 1. Sayle J. An 2. O'Br | PURITY OF M ogen bromid ine and ten essively of phosphorus ene. Good sodium and 1.4959. ERROR: $\delta T/K = 0$ S: or, J. H. m. Chem. So ien, S. J. | de. Prepared fro tralin, and passe yer red phosphoru pentoxide. quality. Stored distilled; 0.02 bc. <u>1937</u>, 59, 171 ; Kenny, C. L. | | |
| The method an Saylor (1) as al. (2). The use of a 1 to 7 day equilib The apparatus which are sep solvent is pa the gas, and the lower bul partially eva and the whole thermostat fr The tap is cl upper bulb is and titrated partial press the bulb volu moles of HBr behavior. A | /PROCEDURE: d apparatus are those of modified by O'Brien <i>et</i> main difference is the 2 day instead of a 5 to ration time. consists of two bulbs arated by a tap. The rtially saturated with the solution added to b. The bulbs are cuated, the tap opened, apparatus put in a om 1 to 2 days. osed. The HBr in the quantitatively removed with NaOH. The HBr ure is calculated from me and the number of assuming ideal gas weighed solution sample om the lower bulb and | SOURCE AND (1) Hydro brom succo and f (2) Toluc over n ²⁰ , ESTIMATED REFERENCES 1. Saylo J. An 2. O'Br Zeur | PURITY OF M. ogen bromid ine and tet essively or phosphorus ene. Good sodium and 1.4959. ERROR: $\delta T/K = 0$ S: or, J. H. m. Chem. So ien, S. J. cher, R. A | de. Prepared fro tralin, and passe yer red phosphoru pentoxide. quality. Stored distilled; 0.02 bc. <u>1937</u>, <i>59</i>, 171 ; Kenny, C. L. | | |
| The method an Saylor (1) as al. (2). The use of a 1 to 7 day equilib The apparatus which are sep solvent is pa the gas, and the lower bul partially eva and the whole thermostat fr The tap is cl upper bulb is and titrated partial press the bulb volu moles of HBr behavior. A is removed fr | /PROCEDURE: d apparatus are those of modified by O'Brien <i>et</i> main difference is the 2 day instead of a 5 to ration time. consists of two bulbs arated by a tap. The rtially saturated with the solution added to b. The bulbs are cuated, the tap opened, apparatus put in a om 1 to 2 days. osed. The HBr in the quantitatively removed with NaOH. The HBr ure is calculated from me and the number of assuming ideal gas weighed solution sample om the lower bulb and | SOURCE AND (1) Hydro brom succo and f (2) Toluc over n ²⁰ , ESTIMATED REFERENCES 1. Saylo J. An 2. O'Br Zeur | PURITY OF M. ogen bromid ine and tet essively or phosphorus ene. Good sodium and 1.4959. ERROR: $\delta T/K = 0$ S: or, J. H. m. Chem. So ien, S. J. cher, R. A | de. Prepared fro tralin, and passe yer red phosphoru pentoxide. quality. Stored distilled; 0.02 bc. <u>1937</u>, 59, 171 ; Kenny, C. L. | | |

| COMPONENTS : | ORIGINAL MEASUREMENTS: |
|---|---|
| <pre>(1) Hydrogen bromide; HBr; [10035-10-6]</pre> | Brown, H. C.; Wallace, W. J. |
| <pre>(2) Methylbenzene or toluene; C₇H₈; [108-88-3]</pre> | J. Am. Chem. Soc. <u>1953</u> , 75, 6268 - 6274. |
| [109-09-2] | |
| VARIABLES: | PREPARED BY: |
| T/K: 273.15 P/kPa: up to 18.67 (140 mmHg) | W. Gerrard |
| EXPERIMENTAL VALUES: | ······································ |
| T/K Highest Pressure He Reported (graph) | mry's Constant Mol Fraction $K = p_1/x_1$ at 101.325 kPa mmHg K/atm x_1 |
| | 440 5.84 0.171 |
| The values of Henry's constant solubility at one atm were cal | , K/atm, and the mole fraction culated by the compiler. |
| The data were given simply as a straight line plot of x_1 and | Henry's constant, K/mmHg, and as total pressure (4 points). |
| Henry's constant for an "ideal vapor pressure of pure liquid estimated from data reported b (1). The value from the <i>Inter</i> is 12.3 atm. | HBr (10070 mmHg or 13.25 atm) y Bates, Halford and Anderson |
| Note that the mole fraction so is calculated with the assumpt up to a pressure of one atm, t | lubility at 101.325 kPa (1 atm) ion that Henry's law is obeyed hus $x_1 = 1/(K/atm)$. |
| but they gave no information a | K/mmHg = 100 (0.132 atm, compiler), bout the pressure range studied. onstant was given as 404 mmHg. |
| AUXILIARY | INFORMATION |
| | COURCE AND BUDITY OF MATERIALC. |
| METHOD/APPARATUS/PROCEDURE: The amount of HBr absorbed at the observed total pressure was measured by the change in pressure in a calibrated bulb containing the gas. | SOURCE AND PURITY OF MATERIALS: (1) Hydrogen bromide. Pure aluminum bromide was allowed to hydrate to approximately AlBr₃·H₂O, which |
| A high precision high vacuum appara- tus was used. | was then heated in an evacuated tube. HBr was distilled from a bath at 193 K. |
| The amount of solvent was probably about 0.03 mole. | (2) Methylbenzene. The liquid may be taken as of high quality. |
| | ESTIMATED ERROR: |
| | REFERENCES: 1. Bates, J. R.; Halford, J. O.; Anderson, L. C. J. Chem. Phys. <u>1935</u> , 3, 531. |
| | 2. International Critical Tables, McGraw-Hill Co., New York, <u>1928</u> , Vol. 3, p. 228. |

| COMPONENTS : | ORIGINAL MEASUREMENTS: |
|---|--|
| <pre>1. Hydrogen bromide; HBr; [10035-10-6]</pre> | Ahmed, W.; Gerrard, W.; Maladkar, V. K. |
| 2. Methylbenzene (toluene);C ₇ H ₈ ; | J. Appl. Chem. <u>1</u> 970, 20, 109–115. |
| [108-88-3] | |
| [100 00 3] | |
| | |
| VARIABLES: | PREPARED BY: |
| T/K: 233.15 - 293.15 | W. Gerrard |
| Total P/kPa: 101.325 (1 atm) | (smoothed data calculated by H.L. Clever) |
| | |
| EXPERIMENTAL VALUES: | |
| T/K Mol Ra | |
| ⁿ HBr/ ⁿ C | 7 ^H 8 ^X HBr |
| 222.15 0.7 | |
| | 55 0.430 65 0.317 |
| 253.15 0.3 | |
| 263.15 0.2 | |
| 273.15 0.1 283.15 0.1 | |
| | |
| | |
| The mole fraction solubilities were c compiler. | alculated from the mole ratio by the |
| Smoothed Data: $\ln X_{upr} = 22.521 - 22$ | 2.991/(T/100) - 15.959 ln (T/100) |
| Standard Error about | Regression Line = 5.45×10^{-3} |
| Standila Erfor anout | Regression Line 5.45 a re |
| T/K M | ol Fraction |
| | × _{HBr} |
| 233.15 | 0.428 |
| | 0.328 |
| | 0.251 |
| | 0.191 0.145 |
| | 0.110 |
| 293.15 | 0.0833 |
| | |
| | |
| | INFORMATION |
| METHOD /APPARATUS / PROCEDURE : | SOURCE AND PURITY OF MATERIALS: |
| Hydrogen bromide was passed into a | 1. Hydrogen bromide. High quality |
| known weight of pure liquid in a | HBr was obtained from a cylinder |
| bubbler tube at a total pressure measured by a manometer assembly. | and passed through a tube at 223 K. For repeat runs it was prepared |
| The absorbed gas was weighed by re- | from phosphorus tribromide, |
| weighing the bubbler tube. The | dried by phosphorus pentoxide, |
| temperature was manually controlled | and stored at 193 K. |
| to within 0.2 K. | 2. Methylbenzene. Best obtainable |
| For the 4 lowest temperatures the | specimen was purified, fraction- ally distilled, and attested. |
| gas absorbed was determined by a chemical titration. | arty utsettieu, and accested. |
| The apparatus and procedure are | |
| described by Gerrard (1,2). | ESTIMATED ERROR: |
| | $\delta T/K = 0.2$ $\delta X/X = 0.03$ |
| | |
| | |
| | REFERENCES : |
| | 1. Gerrard, W. |
| | J. Appl. Chem. Biotechnol. <u>1972</u> , 22, 623-650. |
| | |
| | 2. Gerrard, W. "Solubility of Gases and Liquids" |
| | Plenum Press, New York, 1976. |
| | |
| | |

| 408 Hydrogen Bromide in | | | | |
|---|---|--|--|--|
| COMPONENTS: (1) Hydrogen bromide; HBr; [10035-10-6] | ORIGINAL MEASUREMENTS: Brown, H. C.; Wallace, W. J. | | | |
| <pre>(2) 1,3-Dimethylbenzene or m-xylene; C₈H₁₀; [108-38-3]</pre> | J. Am. Chem. Soc. <u>1953</u> , 75, 6268 - 6274. | | | |
| VARIABLES: | PREPARED BY: | | | |
| T/K: 273.15 P/kPa: up to 15.33 (115 mmHg) | W. Gerrard | | | |
| EXPERIMENTAL VALUES: | | | | |
| Reported (graph) | mry's Constant Mol Fraction $K = p_1/x_1$ at 101.325 kPa mmHg K/atm x_1 | | | |
| 273.15 115 3 | 4.908 0.204 | | | |
| solubility at one atm were cal The data were given simply as | Henry's constant, K/mmHg, and | | | |
| as a straight line plot of x_1 and total pressure (4 points). Henry's constant for an "ideal solution" was taken as the vapor pressure of pure liquid HBr (10070 mmHg or 13.25 atm) estimated from data reported by Bates, Halford and Anderson (1). The value from the <i>International Critical</i> <i>Tables</i> (2) is 12.3 atm. Note that the mole fraction solubility at 101.325 kPa (1 atm) is calculated with the assumption that Henry's law is obeyed up to a pressure of one atm, thus $x_1 = 1/(K/atm)$. | | | | |
| | | | | |
| AUXILIARY | INFORMATION | | | |
| METHOD/APPARATUS/PROCEDURE: The amount of HBr absorbed at the observed total pressure was measured by the change in pressure in a calibrated bulb containing the gas. A high precision high vacuum apparatus was used. | SOURCE AND PURITY OF MATERIALS: (1) Hydrogen bromide. Pure aluminum bromide was allowed to hydrate to approximately AlBr₃·H₂O, which was then heated in an evacuated tube. HBr was distilled from a bath at 193 K. | | | |
| The amount of solvent was probably about 0.03 mole. | (2) 1,3-Dimethylbenzene. The liquid may be taken as of high quality. | | | |
| | ESTIMATED ERROR: | | | |
| | <pre>REFERENCES: 1. Bates, J. R.; Halford, J. O.; Anderson, L. C. J. Chem. Phys. <u>1935</u>, 3, 531. 2. International Critical Tables, McGraw-Hill Co., New York, <u>1928</u>, Vol. 3, p. 228.</pre> | | | |
| | | | | |

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| , | von-Aqueous Solvents 409 | | | |
|---|--|--|--|--|
| COMPONENTS: | ORIGINAL MEASUREMENTS: | | | |
| <pre>1. Hydrogen bromide; HBr; [10035-40-6]</pre> | Ahmed, W.; Gerrard, W.; Maladkar, V. K. | | | |
| <pre>2. 1,3-Dimethylbenzene (m-xylene); C₈H₁₀; [108-38-3]</pre> | J. Appl. Chem. 1970, 20, 109-115. | | | |
| VARIABLES: | PREPARED BY: | | | |
| T/K: 233.15 - 293.15 Total P/kPa: 101.325 (l atm) | W. Gerrard | | | |
| | (smoothed data calculated by H.L. Clever) | | | |
| EXPERIMENTAL VALUES: T/K MOL Rat | | | | |
| ⁿ HBr/ ⁿ C ₈ | H ₁₀ X _{HBr} | | | |
| 233.15 0.85 243.15 0.45 253.15 0.34 263.15 0.21 273.15 0.15 283.15 0.12 293.15 0.10 The mole fraction solubilities were c compiler. | 0.310 0.254 0.174 5 0.134 5 0.111 5 0.0950 alculated from the mole ratio by the | | | |
| Smoothed Data: $\ln x_{HBr} = -27.542 + 4$ Standard error about | $3.370/(T/100) + 9.644 \ln (T/100)$ regression line = 1.18×10^{-2} | | | |
| | | | | |
| т/к м | ol Fraction X _{HBr} | | | |
| 233.15 243.15 253.15 263.15 273.15 283.15 293.15 | 0.460 0.321 0.234 0.177 0.139 0.112 0.0930 | | | |
| AUXILIARY | INFORMATION | | | |
| METHOD /APPARATUS / PROCEDURE : | SOURCE AND PURITY OF MATERIALS: | | | |
| Hydrogen bromide was passed into a known weight of pure liquid in a bubbler tube at a total pressure measured by a manometer assembly. The absorbed gas was weighed by reweighing the bubbler tube. The temperature was manually controlled to within 0.2 K. For the 4 lowest temperatures the gas absorbed was determined by a chemical titration. | Hydrogen bromide. High quality HBr was obtained from a cylinder and passed through a tube at 223 K. For repeat runs it was prepared from phosphorus tribromide, dried by phosphorus pentoxide, and stored at 193 K. 1,3-Dimethylbenzene. Best obtainable specimen was purified, fractionally distilled, and attested. | | | |
| The apparatus and procedure are described by Gerrard (1,2). | ESTIMATED ERROR: | | | |
| | $\begin{array}{l} \delta T/K = 0.2\\ \delta X/X = 0.03 \end{array}$ | | | |
| | <pre>REFERENCES: 1. Gerrard, W. J. Appl. Chem. Biotechnol. 1972, 22, 623-650. 2. Gerrard, W. "Solubility of Gases and Liquids" Plenum Press, New York, 1976.</pre> | | | |

| <pre>COMPONENTS: (1) Hydrogen bromide; HBr; [10035-10-6] (2) 1,3,5-Trimethylbenzene or mesitylene; C₉H₁₂; [108-67-8]</pre> | ORIGINAL MEASUREMENTS: Brown, H. C.; Wallace, W. J. J. Am. Chem. Soc. <u>1953</u> , 75, 6268 - 6274. | | | |
|--|--|--|--|--|
| VARIABLES: T/K: 273.15 P/kPa: up to 14.67 (110 mmHg) | PREPARED BY: W. Gerrard | | | |
| EXPERIMENTAL VALUES: | | | | |
| Reported (graph) p1 ^{/mmHg} K/m | ry's Constant Mol Fraction $K = p_1/x_1$ at 101.325 kPa mHg K/atm x_1 | | | |
| 273.15 110 33 | 70 4.434 0.226 | | | |
| The values of Henry's constant, solubility at one atm were calc The data were given simply as H | ulated by the compiler. enry's constant, K/mmHg, and as | | | |
| a straight line plot of x_1 and total pressure (4 points). Henry's constant for an "ideal solution" was taken as the vapor pressure of pure liquid HBr (10070 mmHg or 13.25 atm) estimated from data reported by Bates, Halford and Anderson (1). The value from the International Critical Tables (2) is 12.3 atm. | | | | |
| to a pressure of 1 atm, thus x_I | on that Henry's law is obeyed up = l/(K/atm). | | | |
| | THEODINETION | | | |
| AUXILIARY | INFORMATION | | | |
| METHOD/APPARATUS/PROCEDURE: The amount of HBr absorbed at the observed total pressure was measured by the change in pressure in a calibrated bulb containing the gas. A high precision high vacuum apparatus was used. The amount of solvent was probably about 0.03 mole. | SOURCE AND PURITY OF MATERIALS: (1) Hydrogen bromide. Pure aluminum bromide was allowed to hydrate to approximately AlBr₃·H₂O, which was then heated in an evacuated tube. HBr was distilled from a bath at 193 K. (2) 1,3,5-Trimethylbenzene. The liquid may be taken as of high quality. | | | |
| | ESTIMATED ERROR: | | | |
| | <pre>REFERENCES: 1. Bates, J. R.; Halford, J. O.; Anderson, L. C. J. Chem. Phys. <u>1935</u>, 3, 531. 2. International Critical Tables, McGraw-Hill Co., New York, <u>1928</u>, Vol. 3, p. 228.</pre> | | | |

| COMPONENTS : | ORIGINAL MEASUREMENTS: | | | |
|---|--|--|--|--|
| <pre>(1) Hydrogen bromide; HBr; [10035-10-6]</pre> | Dorofeeva, N. G. Izv. Vyssh. Uchebn. Zaved., Khim. | | | |
| (2) Ethanol; C ₂ H ₆ O; [64-17-5] | 12v. Vyssn. Uchebn. Zavea., Khim. Khim. Tekhnol. <u>1962</u> , 5, 188-93. | | | |
| VARIABLES: $T/K = 298.15$ $p_1/kPa = 101.325$ | PREPARED BY: H. L. Clever | | | |
| EXPERIMENTAL VALUES: | | | | |
| Temperature Hydrogen Bromide t/°C T/K /wt % | _ | | | |
| | <u>n₁/n₂</u> <u>x₁</u> | | | |
| 25 298.15 41.2 | 0.399 0.285 | | | |
| values. | | | | |
| AUXILIARY | INFORMATION | | | |
| METHOD/APPARATUS/PROCEDURE: No information on the solubility measurement. | SOURCE AND PURITY OF MATERIALS: | | | |
| | ESTIMATED ERROR: REFERENCES: | | | |
| | | | | |

| COMPONENTS : | | | ORIGINAL MEASUREMENTS: | | | |
|---|--|---|---|---------------------------------|---|------------------------------|
| <pre>(1) Hydrogen bromide; HBr; [10035-10-6]</pre> | | | Whitmore, F. C.; Rothrock, H. S. J. Am. Chem. Soc. 1932, 54, 3431-5. | | | |
| <pre>(2) 2,2,-Dimethyl-1-propanol or neo- pentyl alcohol or t-butyl carbi- ol; C₅H₁₂O; [75-84-3]</pre> | | | J. An | n. Chem. | Soc. <u>1932</u> | , 54, 3431-5. |
| VARIABLES: | | | PREPAR | ED BY: | | |
| | T/K = 268 - 283 $p_1/kPa = 101.3$ | | | Н | . L. Clever | |
| EXPERIMENTAL VALUES: | | | | | | |
| Temperature | 2,2-Dime propano | ethyl-l- l | Hy | drogen | | |
| t∕°C T∕K | wt/g | mol | wt/g | | Mole Ratio n_1/n_2 | Mole Fraction x_1 |
| -5 268 | 188 | 2.13 | 140 | 1.73 | 0.812 | 0.448 |
| 4 277 | 188 | 2.13 | 106 | 1.31 | 0.615 | 0.381 |
| 10 283 | 188 | 2.13 | 69 | 0.854 | 0.400 | 0.286 |
| The saturated erature for 2 compounds. | The saturated solution was heated erature for 20 days. Reactions too compounds. | | | °C and ewhich | maintained yielded sev | at that temp- eral bromo- |
| | | AUXILIARY | INFORMATION | | | |
| METHOD/APPARATUS/PRO | CEDURE: | | SOURCE AND PURITY OF MATERIALS: | | | |
| This is not a measurement. Th interested in s obtaining the 1 in the alcohol the rearrangeme place at higher The alcohol m HBr is passed o liquid forms wh | e authors olubility, argest amo as possibl nt reaction temperature elts at 52 ver the al | were not , but in bunt of HBr le to study on that take ures. 2 °C. As Loohol a | (2) | 2,2,-Di Prepare magnesi | methyl-l-pr d by reacti um chloride e. Melting | on of t-butyl |
| ⁰ C, and saturat ing HBr through the sample was resaturated, th saturated again ments were carr | liquid forms which was cooled to 10 $^{\circ}$ C, and saturated with HBr by pass- ing HBr through the liquid. Later the sample was cooled to 4 $^{\circ}$ C and resaturated, then to -5 $^{\circ}$ C, and saturated again. Thus all measure- ments were carried out on the same | | | TED ERROR | :: | |
| alcohol sample as presented in The compiler pressure of the from the soluti | the table assumed at HBr as it | above. mospheric | 1. E | eattie, Intermed Public H | iate Labora | tute, Chicago, |

Hydrogen Bromide in Non-Aqueous Solvents

COMPONENTS: ORIGINAL MEASUREMENTS: (1) Hydrogen bromide; HBr; Fernandes, J. B. [10035-10-6] J. Chem. Eng. Data 1972, 17, (2) Alkanols 377-379. PREPARED BY: VARIABLES: T/K: See below H. L. Clever p₁/kPa : 101.325 (1 atm) EXPERIMENTAL VALUES: t/°C T/K Mole ratio Mole* Smoothed* fraction mole fraction ⁿHBr^{/n}alcohol ^xHBr ^xHBr 1-Pentanol, (amy1 15 288.15 1.062 0.515 0.518 alcohol); C₅H₁₂O; 0.953 0.482 25 298.15 0.488 [71-41-0] 40 313.15 0.710 0.415 0.419 0.376 50 323.15 0.501 60 333.15 0.334 0.333 343.15 70 0.291 80 353.15 0.338 0.253 0.253 Smoothing equation for use between 288.15 K and 353.15 K : $\ln x_{\text{HBr}} = 38.4282 - 52.0537/(T/100) - 19.8635 \ln(T/100)$ $HBr \text{Standard error in } x_{\text{HBr}} \text{ about the regression line} = 5.77 \times 10^{-3}$ 1-Hexanol; $C_6H_{14}O$; 15 288.15 1.078 0.519 0.521 [111-27-3] 25 298.15 0.475 0.7041 40 313.15 0.413 0.407 50 323.15 0.364 0.46551 60 333.15 0.318 0.324 70 343.15 0.286 0.341 80 353.15 0.254 0.252 Smoothing equation for use between 288.15 K and 353.15 K : $\ln x_{\text{HBr}} = 24.5414 - 31.5332/(T/100) - 13.4652 \ln(T/100)$ Standard error in x_{HBr} about the regression line = 8.62 × 10⁻³ * calculated by the compiler. 1 The vapor pressure correction was applied to the acid-base titration method. AUXILIARY INFORMATION METHOD/APPARATUS/PROCEDURE: Two methods were used: Weight increase method. This method was used when the estimated vapor pressure of the alcohol was less than one mmHg. A 15-20 g sample of alcohol was placed in a clean, dry, weighed saturator and weiged. The saturator and contents were thermostatted. HBr gas was passed through the liquid for about one hour. The saturator and contents were weighed. The process was repeated until two successive readings agreed. Acid-base titration method. The alcohol was saturated with HBr as in the weight increase method. A 1-2 cm³ sample of the saturated solution was taken in a clean, dry and weighed sample tube; weighed and transferred to a flask containing a known amount of chilled standard NaOH solution. After reaction of the HBr and NaOH the excess base was titrated with a standard HCl solution. The methods agreed within 1% by weight. SOURCE AND PURITY OF MATERIALS: (1) Hydrogen bromide. Matheson Co., Inc. Stated to be 99.8% pure. Used as received (2) Alkanols. K and K Labs. Reagent grade. Minimum purity 99%. Used as received. ESTIMATED ERROR:

One percent by weight.

413

| COMPONENTS: | | | ORIGINAL ME | CASUREMENTS | : |
|--|---|--|--|---|--|
| <pre>(1) Hydrogen bromide; [10035-10-6]</pre> | HBr; | | Fernandes, | J. B. | |
| (2) Alkanols | | | J. Chem. Er 377-379. | ng. Data <u>19</u> | <u>72</u> , 17, |
| EXPERIMENTAL VALUES: | t/°C | | Mole ratio HBr ^{/n} alcohol | Mole* fraction [*] HBr | Smoothed* mole fraction [×] HBr |
| 1-Heptanol; C ₇ H ₁₆ O; [111-70-6] | 15 25 30 40 50 60 | 288.15 298.15 303.15 313.15 323.15 333.15 | 1.04 0.964 0.72 0.438 | 0.510 0.491 0.419 0.305 | 0.513 0.497 0.479 0.429 0.368 0.304 |
| Smoothing equation for ln x _{HBr} = 104.3866 - Standard error | use bet 146.933/ ^{in x} HBr | ween 288 (T/100) about t | 3.15 K and 33 - 51.0831 lr the regressio | 33.15 K : n(T/100) on line = 1 | $.61 \times 10^{-2}$ |
| 1-Octanol; C ₈ H ₁₈ O; [111-87-5] | 15 25 30 40 50 * 60 | 288.15 298.15 303.15 313.15 323.15 333.15 | 1.08 0.91 0.772 0.474 | 0.519 0.476 0.436 0.322 | 0.518 0.497 0.479 0.433 0.379 0.322 |
| Smoothing equation for ln ^x _{HBr} = 80.3287 - 1 Standard error | use bet 12.5332/ ^{1n x} HBr | ween 288 (T/100) about t | 8.15 K and 33 - 39.6221 lr the regressio | 33.15 K : n(T/100) on line = 4 | .23 × 10 ⁻³ |
| 1-Nonanol; C ₉ H ₂₀ O; [143-08-8] | 15 25 30 40 50 60 70 80 | 288.15 298.15 303.15 313.15 323.15 333.15 343.15 353.15 | 1.05 0.797 0.481 0.242 | 0.512 0.444 0.325 0.195 | 0.511 0.508 0.494 0.449 0.388 0.321 0.255 0.196 |
| Smoothing equation for ln x _{HBr} = 117.492 - 1 Standard error | 66.5975/ | (T/100) | - 57.023 ln(| т/100) | .80 × 10 ⁻³ |
| 1-Decanol; C ₁₀ H ₂₂ O; [112-30-1] | 15 25 30 40 50 60 70 80 90 100 110 120 130 140 | 288.15 298.15 303.15 313.15 333.15 343.15 353.15 363.15 363.15 383.15 393.15 403.15 413.15 | 1.06 0.94 0.89 0.771 0.54 0.39 0.303 0.124 0.063 | 0.515 0.485 0.471 0.435 0.351 0.281 0.233 0.110 0.059 | 0.468 0.434 0.398 0.359 0.317 0.273 0.229 0.186 0.147 0.112 0.082 0.059 |
| ^{nbr} Standard error | 28.034/(in x _{HBr} | T/100) + about t | 220.254 ln(the regression | $T/100) - 3^{\circ}$ on line = 6 | |
| The solubility values a smoothed data fit. | at 288.1 | 5 K and | 373.15 K wer | e omitted : | from the |
| * calculated by the co | mpiler. | | | | |

| COMPONENTS: | | ORIGINAL ME | ASUREMENTS | : |
|---|---|---|--|---|
| (1) Hydrogen bromide; HBr | ;; | Fernandes, | J. B. | |
| [10035-10-6] (2) Alkanols | | J. Chem. En 377-379. | g. Data <u>19</u> | <u>72</u> , 17, |
| EXPERIMENTAL VALUES: | :/°C T/K n ₁ | Mole ratio HBr ^{/n} alcohol | Mole* fraction ^x HBr | Smoothed* mole fraction ^x HBr |
| 1 1 1 1 1 1 | 25 298.15 40 313.15 50 323.15 60 333.15 70 343.15 80 353.15 90 363.15 90 363.15 10 383.15 20 393.15 30 403.15 40 413.15 50 423.15 60 433.15 | 0.79 0.54 0.391 0.312 0.132 0.052 0.031 | 0.471 0.441 0.351 0.281 0.238 0.117 0.050 0.030 3.15 K : | 0.441 0.423 0.386 0.285 0.2232 0.184 0.142 0.107 0.079 0.057 0.041 0.028 |
| <pre>Smoothing equation for use</pre> | 943/(T/100) * _{HBr} about 60 333.15 70 343.15 | - 55.062 ln(the regressi 0.43 | T/100) on line ≈ 0.301 | 3.64×10^{-2} 0.301 0.271 |
| | 80 353.15 90 363.15 00 373.15 10 383.15 20 393.15 30 403.15 40 413.15 50 423.15 60 433.15 | 0.306 0.057 0.029 | 0.234 0.054 0.028 | 0.234 0.196 0.159 0.125 0.097 0.073 0.054 0.039 0.028 |
| Smoothing equation for use ln x _{HBr} = 116.547 - 172. HBrStandard error in | between 33 97/(T/100) ^{A ×} HBr about | 3.15 K and 43 - 54.702 ln(T the regressi | 3.15 K : /100) on line = | 5.76 × 10 ⁻⁺ |
| 1 1 1 | 60 333.15 70 343.15 80 353.15 90 363.15 00 373.15 10 383.15 20 393.15 30 403.15 40 413.15 | 0.461 0.236 0.051 | 0.316 0.191 0.049 | 0.316 0.245 0.191 0.150 0.119 0.094 0.075 0.061 0.049 |
| Smoothing equation for use ln * _{HBr} = 9.991 - 1.1 * calculated by the compil | e between 33 53/(T/100) | 3.15 K and 41 | 3.15 к : | 0.045 |
| | | | | |

| COMPONENTS : | ORIGINAL MEASUREMENTS: | | |
|--|--|--|--|
| <pre>1. Hydrogen bromide; HBr; [10035-10-6]</pre> | Ahmed, W.; Gerrard, W.; Maladkar, V. K. | | |
| 2. 1-Octanol; C ₈ H ₁₈ O; [111-87-5] | J. Appl. Chem. 1970, 20, 109 - 115. | | |
| | <u> </u> | | |
| | | | |
| | | | |
| VARIABLES: m/r , 212 15 - 202 15 | PREPARED BY: | | |
| T/K: 213.15 - 293.15 Total P/kPa: 101.325 (1 atm) | W. Gerrard | | |
| | (smoothed data calculated by H.L. Clever) | | |
| EXPERIMENTAL VALUES: T/K MO1 R | atio Mol Fraction | | |
| ⁿ HBR/ ⁿ C | | | |
| | | | |
| $ \begin{array}{cccccccccccccccccccccccccccccccccccc$ | | | |
| 233.15 2.34 | | | |
| 243.15 2.04 | | | |
| 253.15 1.7 | | | |
| 263.15 1.4 273.15 1.2 | | | |
| | | | |
| 293.15 1.09 | | | |
| The mole fraction solubilities were ca compiler. | alculated from the mole ratio by the | | |
| - | 288/(T/100) + 0.2867 ln(T/100) | | |
| HBr Standard error about a | regression line = 5.12×10^{-3} | | |
| | | | |
| T/K M | Nol Fraction | | |
| | X _{HBr} | | |
| 213.15 223.15 | 0.820 0.759 | | |
| 233.15 | 0.708 | | |
| 243.15 | 0.664 | | |
| 253.15 | 0.627 | | |
| 263.15 273.15 | 0.594 0.566 | | |
| 283.15 | 0.541 | | |
| 293.15 | 0.519 | | |
| | | | |
| AUXILIARY | INFORMATION | | |
| METHOD /APPARATUS / PROCEDURE : | SOURCE AND PURITY OF MATERIALS: | | |
| Hydrogen bromide was passed into a | 1. Hydrogen bromide of high quality | | |
| known weight of liquid in a bubbler | was obtained from a cylinder and | | |
| tube at a total pressure measured by a manometer assembly. The gas ab- | passed through a tube at 223 K. For repeat runs it was prepared | | |
| a manometer assembly. The gas ab- sorbed was weighed by re-weighing the | | | |
| tube. The temperature was manually | dried by phosphorus pentoxide, | | |
| controlled to within 0.2 K. For full | and stored at 193 K. | | |
| description see Gerrard (2,3). | 2. 1-Octanol. Best obtainable speci- | | |
| For temperatures below about 268 K a | men was purified, fractionally | | |
| chemical titration was conducted. | distilled, and attested. | | |
| | | | |
| | ESTIMATED ERROR: | | |
| | $\delta T = 0.2$ | | |
| | $\delta X/X = 0.01$ | | |
| | | | |
| | REFERENCES: | | |
| | 1. Gerrard, W. Research, Lond. | | |
| | $\frac{1954}{2}$, 7, S20. | | |
| | 2. Gerrard, W. J. Appl. Chem. Biotechnol. 1972, 22, 623. | | |
| | 3. Gerrard, W. "Solubility of | | |
| | Gases and Liquids," Plenum Press, | | |
| | New York, 1976. | | |
| | | | |

| COMPONENTS: | ORIGINAL MEASUREMENTS: | | |
|--|--|--|--|
| <pre>1. Hydrogen bromide; HBr; [10035-10-6]</pre> | Ahmed, W.; Gerrard, W.; Maladkar, V. K. | | |
| 2. 2,2-Dichloroethanol; C ₂ H ₄ OCl ₂ ; [598-38-9] | J. Appl. Chem. <u>1970</u> , 20, 109 - 115. | | |
| VARIABLES: | PREPARED BY: | | |
| T/K: 253.15 - 293.15 Total P/kPa: 101.325 (1 atm) | W. Gerrard (smoothed data calculated by H.L. Clever) | | |
| EXPERIMENTAL VALUES: T/K Mol R | atio Mol Fraction | | |
| ⁿ HBr/ ⁿ C ₂ | | | |
| 253.15 0.88 | <u> </u> | | |
| 263.15 0.66 | 0 0.398 | | |
| 273.15 0.53 283.15 0.43 | | | |
| 293.15 0.35 | | | |
| The mole fraction solubilities were c compiler. | alculated from the mole ratio by the | | |
| Smoothed Data: ln X _{HBr} = 4.027 - 1.5 | 06/(T/100) - 4.515 ln (T/100) | | |
| Standard error about | regression line = 3.43×10^{-3} | | |
| | Mol Fraction | | |
| | X _{HBr} | | |
| 253.15 | 0.467 | | |
| 263.15 | 0.401 | | |
| 273.15 283.15 | 0.346 0.300 | | |
| 293.15 | 0.261 | | |
| | | | |
| | | | |
| | | | |
| | | | |
| AUXILIARY | INFORMATION | | |
| METHOD/APPARATUS/PROCEDURE: Hydrogen bromide was passed into a known weight of liquid in a bubbler tube at a total pressure measured by a manometer assembly. The gas ab- sorbed was weighed by re-weighing the tube. The temperature was man- ually controlled to within 0.2 K. For full description see Gerrard (2,3). For the first two temperatures a chemical titration was conducted. | SOURCE AND PURITY OF MATERIALS: 1. Hydrogen bromide of high quality was obtained from a cylinder and passed through a tube at 223 K. For repeat runs it was prepared from phosphorus tribromide (1), dried by phosphorus pentoxide, and stored at 193 K. 2. 2,2-Dichloroethanol.Best obtain- able specimen was purified, frac- tionally distilled, and attested. | | |
| | ESTIMATED ERROR: | | |
| | $\begin{array}{rcl} \delta T/K &= & 0.2 \\ \delta X/X &= & 0.01 \end{array}$ | | |
| | | | |
| | REFERENCES : | | |
| | Gerrard, W. Research, Lond. <u>1954</u>, 7, S20. Gerrard, W. J. Appl. Chem. Biotechnol. 1972, 22, 623. Gerrard, W. "Solubility of Gases and Liquids," Plenum Press, New York, 1976. | | |

| COMPONENTS: | ORIGINAL MEASUREMENTS: |
|---|--|
| <pre>(1) Hydrogen Bromide; HBr; [10035-10-6]</pre> | Gerrard, W.; Mincer, A. M. A.; Wyvill, P. L. |
| (2) 2-Chloroethanol; C ₂ H ₅ ClO; [107-07-3] | J. Appl. Chem. <u>1960</u> , 10, 115-121. |
| | |
| VARIABLES: | PREPARED BY: |
| T/K: 277.35 - 312.15 | W. Gerrard |
| Total P/kPa: 101.325 (1 atm) | (smoothed data calculated by H.L. Clever) |
| | (smoothed data carculated by http: crever) |
| EXPERIMENTAL VALUES: | |
| T/K Mol Rat | tio Mol Fraction |
| | |
| $\qquad \qquad $ | |
| 277.35 0.776 | 0.437 |
| 281.95 0.744 | 0.427 |
| 285.15 0.715 | |
| 289.35 0.682 | |
| 294.35 0.638 | |
| 297.65 0.599 | |
| 307.15 0.541 | |
| 312.15 0.509 | |
| The compiler calculated the mole fraction values. | |
| Smoothed Data: $\ln x_1 = 15.229 - 19.442/(T/100) - 8.864 \ln (T/100)$ | |
| Smoothed Data: In $x_1 = 15.229 = 19.4$ | 42/(1/100) - 8.864 IN (1/100) |
| Standard error about | the regression line is 2.20 x 10^{-3} |
| | |
| T/K | Mol Fraction |
| | <i>x</i> ₁ |
| 272.15 | |
| 273.15 | 0.451 0.422 |
| 293.15 | 0.392 |
| 303.15 | 0.362 |
| 313.15 | 0.334 |
| | |
| | |
| AUXILIARY INFORMATION | |
| | |
| METHOD /APPARATUS / PROCEDURE : | SOURCE AND PURITY OF MATERIALS: |
| The liquid component was weighed in a bubbler tube. The amount of gas | (1) Hydrogen bromide. Prepared by adding calculated amount of |
| absorbed was determined by re- | water to pure phosphorus tri- |
| weighing to constant weight. The | bromide (1). Dried over P ₂ O ₅ |
| total pressure was barometric, very | 2.3 |
| nearly 1 atm (101.325 kPa). | and cooled to 243 K to remove traces of bromine. |
| | traces of biomine. |
| | (2) 2-Chloroethanol. Carefully |
| | purified, and purity rigorously |
| | attested. |
| | |
| | |
| | ESTIMATED ERROR: |
| | $\delta m / m = 0.005$ |
| | $\delta x_1 / x_1 = 0.005$ |
| | |
| | REFERENCES: |
| | REFERENCES; |
| | 1. Gerrard, W. |
| | Research, London, <u>1954</u> , 7, S20. |
| | |
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| | |

| Hydrogen Bromide in | Non-Aqueous Solvents 419 |
|--|--|
| COMPONENTS : | ORIGINAL MEASUREMENTS: |
| <pre>(1) Hydrogen bromide; HBr; [10035-10-6]</pre> | Gerrard, W.; Mincer, A. M. A.; Wyvill, P. L. |
| (2) 2,2,2-Trichloroethanol; C ₂ H ₃ Cl ₃ O; [115-20-8] | J. Appl. Chem. <u>1960</u> , 10, 115-121. |
| VARIABLES : | PREPARED BY: |
| Т/К: 273.15 - 299.45 | W. Gerrard |
| Total P/kPa: 101.325 (1 atm) | (smoothed data calculated by H.L. Clever) |
| EXPERIMENTAL VALUES: | |
| T/K Mol Rat | |
| ⁿ HBr ^{/n} C ₂ H | 2 ^{c1} 20 ^x 1 |
| 273.15 0.192 | 0.161 |
| 275.15 0.186 | 0.157 |
| 279.35 0.163 285.95 0.140 | |
| 291.95 0.107 | |
| 299.45 0.080 | 0 0.0741 |
| The compiler calculated the mole frac | tion values. |
| - | |
| Smoothed Data: $\ln x_1 = 186.182 - 250$ | _ |
| Standard error about | the regression line is 2.74 x 10^{-3} |
| т/к | Mol Fraction |
| | <i>x</i> 1 |
| 273.15 | 0.161 |
| 283.15 | 0.130 |
| 293.15 303.15 | 0.0944 0.0630 |
| · | |
| | |
| | |
| | |
| AUXILIARY | INFORMATION |
| METHOD ADDADATHS (DDOCEDHDE - | POUNCE AND DUDITY OF MATERIALS. |
| METHOD/APPARATUS/PROCEDURE: The liquid component was weighed in | SOURCE AND PURITY OF MATERIALS: (1) Hydrogen bromide. Prepared by |
| a bubbler tube. The amount of gas | adding calculated amount of |
| absorbed was determined by re- weighing to constant weight. The | water to pure phosphorus tri- bromide (1). Dried over P ₂ O ₅ |
| total pressure was barometric, very | and cooled to 243 K to remove |
| nearly 1 atm (101.325 kPa). | traces of bromine. |
| | (2) 2,2,2-Trichloroethanol. |
| | Carefully purified, and purity |
| | rigorously attested. |
| | |
| | ESTIMATED ERROR: |
| | $\delta x_1 / x_1 = 0.02$ |
| | REFERENCES : |
| | 1. Gerrard, W. |
| | Research, London, <u>1954</u> , 7, 520. |
| | |
| | |
| | |
| | <u></u> |

| COMPONENTS: | ORIGINAL MEASUREMENTS: |
|--|---|
| <pre>1. Hydrogen bromide; HBr; [10035-10-6]</pre> | Ahmed, W.; Gerrard, W.; Maladkar, V. K. |
| <pre>2. 2,2,2-Trichloroethanol;C2H3Cl3O; [115-20-8]</pre> | J. Appl. Chem. <u>1970</u> , 20, 109 - 115. |
| VARIABLES: | PREPARED BY: |
| Т/К: 253.15 - 293.15 | W. Gerrard |
| Total P/kPa: 101.325 (1 atm) | (smoothed data calculated by H.L. Clever) |
| EXPERIMENTAL VALUES: T/K MO1 R | atio Mol Fraction |
| $\frac{n_{\rm HBr}/n_{\rm C_2}}{2}$ | H ₃ Cl ₃ O X _{HBr} |
| | |
| 263.15 0.21 273.15 0.17 | |
| 283.15 0.15 | |
| 293.15 0.14 | 6 0.127 |
| The mole fraction solubilities were c compiler. | - |
| Smoothed Data: $\ln X_{HBr} = -101.97 + 1$ | 41.75/(T/100) + 47.942 ln (T/100) |
| Standard error about | regression line = 1.53×10^{-3} |
| . T/K | Mol Fraction X _{HBr} |
| | |
| 253.15 263.15 | 0.234 0.179 |
| 273.15 | 0.149 0.133 |
| 283.15 293.15 | 0.128 |
| | |
| AUXILIARY | INFORMATION |
| METHOD / APPARATUS / PROCEDURE : | SOURCE AND PURITY OF MATERIALS: |
| Hydrogen bromide was passed into a known weight of liquid in a bubbler tube at a total pressure measured by a manometer assembly. The gas ab- sorbed was weighed by re-weighing the tube. The temperature was man- ually controlled to within 0.2 K. For full description see Gerrard | Hydrogen bromide of high quality was obtained from a cylinder and passed through a tube at 223 K. For repeat runs it was prepared from phosphorus tribromide (1), dried by phosphorus pentoxide, and stored at 193 K. |
| (2,3). For the first two temperatures a chemical titration was conducted. | 2. 2,2,2-Trichloroethanol. Best obtainable specimen was purified, fractionally distilled, and attested. |
| | ESTIMATED ERROR: $\delta T/K = 0.2$ $\delta X/X = 0.005$ |
| | <pre>REFERENCES: 1. Gerrard, W. Research, Lond. 1954, 7, S20. 2. Gerrard, W. J. Appl. Chem. Biotechnol. 1972, 22, 623. 3. Gerrard, W. "Solubility of Gases and Liquids," Plenum Press, New York, 1976.</pre> |

| ., | a in Non-Aqueous Solvents 421 |
|---|--|
| COMPONENTS: | ORIGINAL MEASUREMENTS: |
| <pre>1. Hydrogen bromide; HBr; [10035-10-6]</pre> | Ahmed, W.; Gerrard, V.; Maladkar, V. K. |
| 2. l,l'-Oxybisoctane or dioctyl ether; C ₁₆ H ₃₄ O; [629-82-3] | J. Appl. Chem. <u>1970</u> , 20, 109 - 115. |
| | |
| VARIABLES: | PREPARED BY: |
| T/K: 223.15 - 293.15 | W. Gerrard |
| Total P/kPa: 101.325 (1 atm) | (smoothed data calculated by H.L. Clever) |
| | |
| EXPERIMENTAL VALUES: | Ratio Mol Fraction |
| | |
| ⁿ HBr/ | ^{'ⁿC₁₆H₃₄O ^XHBr} |
| 223.15 5 | 5.64 0.849 |
| | 0.821 |
| | 0.791 |
| | 0.766 |
| | 2.84 0.740 2.32 0.699 |
| | 2.01 0.668 |
| | .53 0.605 |
| The mole fraction solubilities wer compiler. | re calculated from the mole ratio by the |
| Smoothed Data: $\ln X_{up} = 12.416$ - | - 15.294/(T/100) - 7.145 ln (T/100) |
| | 2 |
| Standard error abo | but regression line 9.83 x 10^{-3} |
| T/K | Mol Fraction |
| | x |
| | X _{HBr} |
| 223.1 | |
| 233.1 | |
| 243.1 253.1 | |
| 263.1 | |
| 273.1 | .5 0.696 |
| 283.1 | |
| 293.1 | .5 |
| AUXILI | IARY INFORMATION |
| METHOD/APPARATUS/PROCEDURE: | SOURCE AND PURITY OF MATERIALS: |
| Hydrogen bromide was passed into a | 1. Hydrogen bromide of high quality |
| known weight of liquid in a bubble | er was obtained from a cylinder and |
| tube at a total pressure measured | |
| a manometer assembly. The gas | For repeat runs it was prepared from phosphorus tribromide (1), |
| absorbed was weighed by re-weighin the tube. The temperature was | dried by phosphorus pentoxide, |
| manually controlled to within 0.2 | |
| For full description see Gerrard | |
| (2,3). | Best obtainable specimen was purified, fractionally distilled, |
| For temperatures below about 268 K | |
| chemical titration was conducted. | |
| | ESTIMATED ERROR: |
| | $\delta T/K = 0.2$ |
| | $\delta X/X = 0.015$ |
| | |
| | |
| | REFERENCES: |
| | 1. Gerrard, W. Research, Lond. |
| | <u>1954</u> , 7, S20. 2. Gerrard, W. J. Appl. Chem. |
| | Biotechnol. <u>1972</u> , 22, 623. |
| | 3. Gerrard, W. "Solubility of |
| | Gases and Liquids," Plenum Press, |
| | New York, 1976. |
| | |

| Hzz Hydrogen bronnae in i | ton-Aqueous oolvenis | |
|---|--|--|
| COMPONENTS : | ORIGINAL MEASUREMENTS: | |
| <pre>1. Hydrogen bromide; HBr; [10035-10-6]</pre> | Ahmed, W.; Gerrard, W.; Maladkar, V. K. | |
| 2. Acetic Acid; C ₂ H ₄ O ₂ ; | J. Appl. Chem. <u>1970</u> , 20, 109 - 115. | |
| [64-19-7] | <u> </u> | |
| | | |
| VARIABLES: | PREPARED BY: | |
| T/K: 253.15 - 293.15 Total P/kPa: 101.325 (1 atm) | W. Gerrard (smoothed data calculated by H.L. Clever) | |
| EXPERIMENTAL VALUES: | | |
| T/K Mol Rat | io Mol Fraction | |
| ⁿ HBR/ ⁿ C | 2 ^H ₄ O ₂ X _{HB} r | |
| 253.15 1.1 | | |
| | | |
| 273.15 0.7 283.15 0.6 | | |
| 293.15 0.4 | | |
| The mole fraction solubilities were ca compiler. | alculated from the mole ratio by the | |
| - | .505/(T/100) - 10.464 ln (T/100) | |
| | regression line = 7.17×10^{-3} | |
| ۰ | | |
| T/K I | Mol Fraction | |
| | X _{HBr} | |
| 253.15 | 0.529 | |
| 263.15 273.15 | 0.473 0.420 | |
| 283.15 | 0.371 | |
| 293.15 0.326 | | |
| | | |
| | | |
| AUXILIARY | INFORMATION | |
| METHOD / APPARATUS / PROCEDURE : | SOURCE AND PURITY OF MATERIALS: | |
| Hydrogen bromide was passed into a | 1. Hydrogen bromide of high quality | |
| known weight of liquid in a bubbler tube at a total pressure measured by | was obtained from a cylinder and passed through a tube at 223 K. | |
| a manometer assembly. The gas | For repeat runs it was prepared | |
| absorbed was weighed by re-weighing the tube. The temperature was man- | from phosphorus tribromide (1), dried by phosphorus pentoxide, | |
| ually controlled to within 0.2 K. | and stored at 193 K. | |
| For full description see Gerrard (2,3). | 2. Acetic Acid. Best obtainable specimen was purified, frac- | |
| For the first two temperatures a | tionally distilled, and attested. | |
| chemical titration was conducted. | | |
| | ESTIMATED ERROR: $\delta T/K = 0.2$ | |
| | $\delta X/X = 0.015$ | |
| | | |
| | REFERENCES : | |
| | 1. Gerrard, W. Research, Lond. | |
| | <u>1954</u> , 7, S20. 2. Gerrard, W. J. Appl. Chem. | |
| | Biotechnol. <u>1972</u> , 22, 623. 3. Gerrard, W. <u>"Solubility</u> of | |
| | Gases and Liquids," Plenum Press, | |
| | New York, 1976. | |
| | | |

Hydrogen Bromide in Non-Aqueous Solvents

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|--|---|
| COMPONENTS : | ORIGINAL MEASUREMENTS: |
| <pre>1. Hydrogen bromide; HBr; [10035-10-6]</pre> | Ahmed, W.; Gerrard, W.; Maladkar, V. K. |
| 2. Hexanoic acid; C ₆ H ₁₂ O ₂ ; [142-62-1] | J. Appl. Chem. <u>1970</u> , 20, 109 - 115. |
| | |
| | |
| VARIABLES: | PREPARED BY: |
| T/K: 223.15 - 293.15 | W. Gerrard |
| Total P/kPa: 101.325 (1 atm) | (smoothed data calculated by H.L. Clever) |
| | |
| EXPERIMENTAL VALUES: T/K Mol Rat | tio Mol Fraction |
| | |
| ⁿ HBr/ ⁿ C ₆ | H ₁₂ O ₂ X _{HBr} |
| 223.15 2.64 | |
| 233.15 1.97 | |
| 243.15 1.65 | |
| | - |
| 263.15 1.16 273.15 0.91 | |
| 283.15 0.80 | |
| 293.15 0.66 | 0.398 |
| The mole fraction solubilities were ca compiler. | alculated from the mole ratio by the |
| - | .476/(T/100) - 7.435 ln (T/100) |
| | |
| Standard error about : | regression line = 7.33×10^{-3} |
| T/K I | Mol Fraction |
| } | X _{HBr} |
| 223.15 | 0.719 |
| 233.15 | 0.672 |
| 243.15 | 0.624 |
| 253.15 263.15 | 0.576 0.528 |
| 273.15 | 0.483 |
| 283.15 | 0.440 |
| 293.15 | 0.400 |
| AUXILIARY | INFORMATION |
| METHOD/APPARATUS/PROCEDURE: | SOURCE AND PURITY OF MATERIALS: |
| Hydrogen bromide was passed into a | 1. Hydrogen bromide of high quality |
| known weight of liquid in a bubbler | was obtained from a cylinder and |
| tube at a total pressure measured by | passed through a tube at 223 K. |
| a manometer assembly. The gas ab- sorbed was weighed by re-weighing the | For repeat runs it was prepared from phosphorus tribromide (1), |
| tube. The temperature was manually | dried by phosphorus pentoxide, |
| controlled to within 0.2 K. For full | |
| description see Gerrard (2,3). | 2. Hexanoic acid. Best obtainable |
| For the first 5 temperatures a chem- | specimen was purified, frac- |
| ical titration was conducted. | tionally distilled, and attested. |
| | |
| | ESTIMATED ERROR: |
| | $\delta T/K = 0.2$ |
| | $\delta x/x = 0.015$ |
| | |
| | REFERENCES ; |
| | 1. Gerrard, W. Research, Lond. |
| | <u>1954, 7, 820.</u> |
| | 2. Gerrard, W. J. Appl. Chem. |
| | Biotechnol. 1972, 22, 623. |
| | 3. Gerrard, W. "Solubility of |
| } | Gases and Liquids," Plenum Press, New York, 1976. |
| | |
| | |

| COMPONENTS: | ORIGINAL MEASUREMENTS: | | |
|---|--|--|--|
| <pre>(1) Hydrogen bromide; HBr; [10035-10-6]</pre> | Ahmed, W.; Gerrard, W.; Maladkar, V. K. | | |
| (2) Haloalkanes | J. Appl. Chem. <u>1970</u> , 20, 109-115. | | |
| VARIABLES: | PREPARED BY: | | |
| T/K: 233.15 - 293.15 Total P/kPa : 101.325 (1 atm) | W. Gerrard | | |
| EXPERIMENTAL VALUES: T/K | Mole ratio Mole* Smoothed** ⁿ HBr ^{/n} haloalk. ^x HBr ^x HBr | | |
| 253. 263. 273. | 50.2180.1790.17450.1420.1240.11950.0930.08510.083450.0600.05660.059850.0430.04120.0438 | | |
| Smoothing equation: $\ln x_{\text{HBr}} = -7.132 + 17.892/(T/100) - 2.224 \ln(T/100)$ Standard error in x_{HBr}^{+} about the regression line = 6.19 × 10 ⁻³ | | | |
| 263.1 273.1 | 50.3280.2470.24850.2140.1760.17550.1450.1270.12750.1030.0930.093750.0780.0720.070850.0560.0530.054450.0450.0430.0425 | | |
| <pre>Smoothing equation: ln x_{HBr} = -7.140 + 16.283/(T/100) - 1.462 ln(T/100) Standard error in x_{HBr} about the regression line = 1.26 × 10⁻³ * calculated by the compiler ** smoothing equation and smoothed values were calculated by H.L. Clever</pre> | | | |
| | INFORMATION | | |
| METHOD/APPARATUS/PROCEDURE Hydrogen bromide was passed into a known weight of pure liquid in a bubbler tube at a total pressure measured by a manometer assembly. The absorbed gas was weighed by re- weighing the bubbler tube. The temperature was manually controlled to within 0.2 K. For full description see Gerrard (2,3). For temperatures below about 268 K a chemical titration was performed. | <pre>SOURCE AND PURITY OF MATERIALS: 1. Hydrogen bromide. High quality HBr was obtained from a cylinder and passed through a tube at 223 K. For repeat runs it was prepared from phosphorus tribromide (1), dried by phosphorus pentoxide, and stored at 193 K. 2. Haloalkanes. Best obtainable specimens were purified, fraction- ally distilled and attested. ESTIMATED ERROR:</pre> | | |
| REFERENCES: | · · · · · · · · · · · · · · · · · · · | | |
| 1. Gerrard, W. Research, Lond. <u>1954</u> , 7, S20. | | | |
| 2. Gerrard, W. J. Appl. Chem. Biotechnol. <u>1972</u> , 22, 623-650. | | | |
| Gerrard, W. "Solubility of Gases and Liquids" Plenum Press, New York, 1976. | | | |

| | 425 |
|--|---|
| COMPONENTS: (1) Hydrogen bromide; HBr; [10035-10-6] | ORIGINAL MEASUREMENTS: Ahmed, W.; Gerrard, W.; Maladkar, V. K. |
| (2) Haloalkanes | J. Appl. Chem. <u>1970</u> , 20, 109-115. |
| EXPERIMENTAL VALUES: | |
| Т, | /K Mole ratio Mole* Smoothed** ⁿ HBr ^{/n} haloalk. fraction mole fraction |
| | HBr naloalk. ^x HBr ^x HBr |
| | |
| · 4· | 3.15 0.19 0.160 0.165 3.15 0.155 0.134 0.129 |
| 253 | 3.15 0.112 0.101 0.0991 |
| 263 | 3.15 0.085 0.078 0.0749 3.15 0.055 0.052 0.0560 |
| 28 | 3.15 0.042 0.040 0.0415 |
| 29: | 3.15 0.033 0.032 0.0305 |
| Smoothing equation: ln x _{HBr} = 35.0 Standard error in x _{HBr} about | 021 - 40.580/(T/100) - 22.935 ln(T/100) the regression line = 4.65 × 10 ⁻³ |
| 1,2-Dichloroethane; C ₂ H ₄ Cl ₂ ; 23 | 3.15 0.60 0.375 0.374 |
| [107-06-2] 24 2 24 | 3.15 0.3/5 0.2/3 0.2/4 |
| 25. | 3.15 0.250 0.200 0.202 3.15 0.180 0.153 0.150 |
| 273 | 3.15 0.125 0.111 0.112 |
| Smoothing equation: ln x _{HBr} = 13.1 Standard error in x _{HBr} about | 110 - 10.003/(T/100) - 11.581 ln(T/100) the regression line = 2.96 × 10 ⁻³ |
| 1-Chlorooctane; C.HCl; 213 | 3.15 2.00 0.667 0.704 |
| [111-85-3] 017 223 | 3.15 1.45 0.592 0.558 |
| | 3.15 0.85 0.459 0.448 3.15 0.58 0.367 0.363 |
| | 3.15 0.43 0.301 0.297 |
| | 3.15 0.31 0.237 0.245 3.15 0.24 0.194 0.204 |
| | 3.15 0.20 0.167 0.171 3.15 0.18 0.153 0.144 |
| | |
| Smoothing equation: ln × _{HBr} = 2.17 Standard error in × _{HBr} about _{HBr} | 76 + 1.598/(T/100) - 4.329 ln(T/100) the regression line = 2.21 × 10 ⁻² |
| 1-Bromooctane; C ₈ H ₁₇ Br; 233 | 3.15 0.750 0.429 0.432 |
| [111-03-1] 243 | 3.15 0.488 0.328 0.324 3.15 0.330 0.248 0.246 |
| 263 | 3.15 0.231 0.188 0.190 |
| | 3.15 0.164 0.141 0.148 3.15 0.145 0.127 0.117 |
| | 3.15 0.100 0.0909 0.094 |
| Smoothing equation: ln x _{HBr} = 0.84 Standard error in x _{HBr} about | 425 + 5.261/(T/100) - 4.653 ln(T/100) the regression line = 6.91 × 10 ⁻³ |
| 1 Indonatane C H I. 213 | 3.15 2.4 0.706 0.725 |
| | 3.15 2.4 0.706 0.725 3.15 1.47 0.595 0.581 |
| 233 | 0.479 0.467 |
| | 3.15 0.43 0.301 0.304 |
| | 3.15 0.32 0.242 0.247 3.15 0.25 0.200 0.201 |
| 283 | 0.15 0.19 0.160 0.164 |
| 293 | 3.15 0.16 0.138 0.134 |
| Smoothing equation: ln × _{HBr} = 10.2 Standard error in × _{HBr} about | $252 - 8.491/(T/100) - 8.707 \ln(T/100)$ the regression line = 1.12×10^{-2} |
| <pre>* calculated by the compiler ** smoothing equation and smoothe</pre> | ed values were calculated by H.L. Clever |

| COMPONENTS: | | ORIGINAL MEASUREMENTS: | | |
|--|---|--|--|--|
| <pre>(1) Hydrogen bromide; HBr; [10035-10-6]</pre> | | Howland, J. J.; Miller, D. R. Willard, J. E. | | |
| (2) Trichloromethane or c CHCl ₃ ; [67-66-3] | hloroform; | J. Am. Chem. Soc. <u>1941</u> , 63, 2807 - 2811. | | |
| | | | | |
| VARIABLES: T/K: 273.15 - 298.15 P/kPa: 20.66 - 88.53 (155 - 664 mmHg) | | PREPARED BY: W. Gerrard | | |
| EXPERIMENTAL VALUES: | | | | |
| T/K Pressure Range Pl/mmHg | Number o: Determinatio | | | |
| 273.15 294 - 511 | 3 | 9.92 + 0.03 0.0734 | | |
| 288.15 155 - 407 | 5 | 7.17 + 0.03 0.0545 | | |
| 298.15 210 - 664 | 8 | 5.97 ± 0.03 0.0454 | | |
| Henry's constant, K/(mm | Hg) ⁻¹ = $x_1/(1)$ | P ₁ /mmHg). | | |
| ² Values of the mole frac calculated by the compi | | ity at 101.325 kPa (1 atm, 760 mmHg) | | |
| | | | | |
| | AUXILIARY | INFORMATION | | |
| METHOD/APPARATUS/PROCEDURE: A mercury manometer was a an absorption bulb. The added to the bulb, and th pressure was determined. sure, p_2° , was used to cal gas partial pressure, p_1 , total pressure, p_t , measur manometer: $p_1 = p_t - p_2^{\circ}(1 - x_1)$. | solvent was the vapor This pres- culate the from the tred by the | SOURCE AND PURITY OF MATERIALS: (1) Hydrogen bromide. Prepared by passing hydrogen and bromine over a hot spiral of platinum. Residual bromine was removed by mercury, and hydrogen by freezing the HBr in liquid air trap. (2) Trichloromethane. Merck and Co. Technical grade, purified and distilled. | | |
| The amount of gas absorbe measured weight of soluti | on with- | ESTIMATED ERROR: | | |
| drawn as a sample, was de by a chemical titration. | etermined | $\delta K/K = 0.01$ | | |
| The heat of solution was | | | | |
| to be (-3.26 <u>+</u> 0.30) kcal (-13.64 kJ mol ⁻¹). | . mol ⁻¹ | REFERENCES : | | |
| | | | | |

| COMFONENTS: (1) Hydrogen bromide; HBr; [10035-10-6] | ORIGINAL MEASUREMENTS: Howland, J. J.; Miller, D. R. Willard, J. E. |
|--|--|
| <pre>(2) Tetrachloromethane; CCl₄; [56-23-5]</pre> | J. Am. Chem. Soc. <u>1941</u> , 63, 2807 - 2811. |
| | |
| VARIABLES: | PREPARED BY: |
| T/K: 273.15 - 298.15 P/kPa: 39.73 - 73.99 (298 - 555 mmHg) | W. Gerrard |
| EXPERIMENTAL VALUES: | |
| T/K Pressure Range Number o P _l /mmHg Determinati | |
| 273.15 304 - 430 2 | 8.26 + 0.01 0.0628 |
| 288.15 298 - 555 3 | 5.95 ± 0.02 0.0452 |
| 298.15 345 - 517 2 | 5.03 + 0.02 0.0382 |
| | |
| ¹ Henry's constant, K/(mmHg) ⁻¹ = x ₁ /(² Values of the mole fraction solubil calculated by the compiler. | - |
| | |
| | |
| | INFORMATION |
| METHOD/APPARATUS/PROCEDURE: A mercury manometer was attached to an absorption bulb. The solvent was added to the bulb, and the vapor pressure was determined. This pres- sure, p_2^0 , was used to calculate the gas partial pressure, p_1 , from the total pressure, p_t , measured by the manometer: $p_1 = p_t - p_2^0(1 - x_1)$. | SOURCE AND PURITY OF MATERIALS: (1) Hydrogen bromide. Prepared by passing hydrogen and bromine over a hot spiral of platinum. Residual bromine was removed by mercury, and hydrogen by freezing the HBr in liquid air trap. (2) Tetrachloromethane. Merck and Co. Technical grade, purified and distilled. |
| The amount of gas absorbed in a measured weight of solution with- | ESTIMATED ERROR: |
| drawn as a sample, was determined by a chemical titration. | δK/K = 0.01 |
| The heat of solution was determined | |
| to be (-3.23 ± 0.30) kcal mol ⁻¹ (-13.51 kJ mol ⁻¹). | REFERENCES: |
| (-13.51 KD 1001). | |
| | |

| COMPONENTS: (1) Hydrogen Bromide, HBr; [10035-10-6] (2) Alkyl halides VARIABLES: T/K: 253.15 - 293.15 Total P/kPa : 101.325 (1 atm) EXPERIMENTAL VALUES: | | ORIGINAL ME. Maladkar, V Thesis, 197 University PREPARED BY W. Ger Mole ratio | . K. 0, of London. : rrard Mole* | Smoothed** |
|---|---|---|---|--|
| | ⁿ H | HBr ^{/n} alk.hal. | fraction ^X HBr | mole fraction ^X HBr |
| 1-Bromopropane; C ₃ H ₇ Br; 2 [106-94-5] 2 2 | 73.15 83.15 93.15 | 0.153 0.0725 0.045 | 0.133 0.068 0.043 | 0.129 0.0721 0.0418 |
| Smoothing equation: ln x _{HBr} = -1 Standard error in x _{HBr} about | 8.625 the r | + 45.289/(T/ regression lin | 100) ne = 5.57 × | 10 ⁻³ |
| | 73.15 | 0.180 | 0.153 | |
| [109-65-9] ^{4 9} 1-Bromohexane; C ₆ H ₁₃ Br; 2 [111-25-1] | 73.15 | 0.205 | 0.170 | |
| Iodomethane; CH ₃ I; [74-88-4] 2 2 2 2 2 2 2 2 3 3 | 53.15 54.65 63.15 73.15 83.15 93.15 03.15 | 0.0525 | | 0.227 0.148 0.099 0.069 0.049 0.036 |
| Smoothing equation: ln x _{HBr} = -1. Standard error in x _{HBr} about | 3.993 the r | + 30.165/(T/ regression lin | 100) + 0.63 ne = 5.21 × | 8 ln(T/100) 10 ⁻³ |
| [107-08-4] ³ / 2 2 2 2 | 53.15 63.15 73.15 83.15 93.15 03.15 | 0.242 0.161 | 0.245 0.195 0.139 0.097 0.076 | 0.250 0.187 0.139 0.102 0.074 0.054 |
| Smoothing equation: ln x _{HBr} = 36 Standard error in x _{HBr} about | .916 - the r | 41.575/(T/10 regression lin | 00) - 23.55 ne = 7.42 × | $7 \ln(T/100)$ 10 ⁻³ |
| <pre>* calculated by the compiler ** smoothing equation and smoot</pre> | hed va | lues were cal | lculated by | H.L. Clever |
| AUXIL | IARY I | NFORMATION | | |
| METHOD/APPARATUS/PROCEDURE The gas was passed into a weighed amount of liquid in a bubbler tube as described by Ahmed <i>et al.</i> (1). Temperature control was manual to within 0.5 K. Pressure control was within 1 mmHg. Because of the volatility of the alkyl halides, | | and passed before use 2. Alkyl hal: | promide was obtained fr d through a e. | of best om a cylinder, tube at 223 K specimens were |
| and especially for measurements a the low temperatures, the hydroge bromide content was determined by quantitative addition of water to the bubbler assembly, and titrat: | at en y o | chloride, The purit: | and freshl les were at procedures. | y distilled. tested by the |
| with silver nitrate. | _ | $\delta x_{\rm HBr} / x_{\rm HBr}$ | = 0.01 - | 0.02 |
| The data were cited in reference | (2) | REFERENCES: 1. Ahmed, W.; Maladkar, J. Appl. C | | |
| | | 2. Gerrard, W and Liquic New York <u>1</u> | is" Plenum 1 | lity of Gases Press, |

| COMPONENTS: | ORIGINAL MEASUREMENTS: |
|--|---|
| 1. Hydrogen Bromide; HBr; [10035-10-6] | Maladkar, V. K. |
| 2. Dibromoalkanes; C _n H _{2n} Br ₂ ; | Thesis, <u>1970</u> University of London |
| | |
| VARIABLES: | PREPARED BY: |
| T/K: 273.15 Total P/kPa: 101.325 (1 atm) | W. Gerrard |
| EXPERIMENTAL VALUES: | |
| T/K Mol R HBr/ ⁿ Cn | atio Mol Fraction H ₂₂ Br ₂ X _{HBr} |
| | $c_{2} C_{2} C_{4} B C_{2}; [106-93-4]$ |
| 273.15 0.1 | |
| | ne; C ₃ H ₆ Br ₂ ; [109-64-8] |
| | 70 	 0.145 |
| | |
| | e; C ₄ H ₈ Br ₂ ; [110-52-1] 99 0.166 |
| | |
| 273.15 0.2 | e; $C_6 H_{12} Br_2$; [629-03-8] |
| | 45 0.197 |
| | |
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| | |
| AUXILIARY | INFORMATION |
| METHOD/APPARATUS/PROCEDURE: The gas was passed into the weighed | SOURCE AND PURITY OF MATERIALS: 1. Hydrogen bromide. Sample was of |
| amount of liquid in a bubbler tube | best quality, obtained from a |
| as described by Ahmed et al. (1). Temperature control was manual to | cylinder, and passed through a tube at 233 K before use. |
| within 0.2 K, and pressure control to within 1 mmHg. | 2. Dibromoalkanes. The best speci- |
| The data were cited in reference 2. | mens were washed and dried, and fractionally distilled under |
| | reduced pressure. |
| | |
| | ESTIMATED ERROR: |
| | $\delta x_1 / x_1 = 0.005$ |
| | |
| | REFERENCES : |
| | <pre>1. Ahmed, W.; Gerrard, W.; Maladkar, V. K.</pre> |
| | J. Appl. Chem. <u>1970</u> , 20, 109. |
| | Gerrard, W. "Solubility of Gases and Liquids" Plenum Press, New York, 1976. |

Hydrogen Bromide in Non-Aqueous Solvents

| COMPONENTS: (1) Hydrogen bromide; HBr; [10035-10-6] | ORIGINAL MEASUREMENTS: Ahmed, W.; Gerrard, W.; Maladkar, V. K. | |
|---|--|--|
| (2) Halobenzenes | J. Appl. Chem. <u>1970</u> , 20, 109-115. | |
| VARIABLES: | PREPARED BY: | |
| T/K: 233.15 - 293.15 Total P/kPa : 101.325 (1 atm) | W. Gerrard | |
| EXPERIMENTAL VALUES: | Mole ratio Mole* Smoothed** | |
| | Mole ratio Mole* Smoothed** ⁿ HBr ^{/n} halobenz.fraction mole fraction | |
| | HBr KHBr | |
| Chlorobenzene; C_H_Cl; 233.1 | 5 0.48 0.324 0.333 | |
| Chlorobenzene; C ₆ H ₅ Cl; 233.1 [108-90-7] 243.1 | 5 0.32 0.242 0.233 | |
| 253.1 | | |
| 263.1 273.1 | | |
| 273.1 | | |
| 293.1 | | |
| Smoothing equation: ln x _{HBr} = -9.812 Standard error in x _{HBr} about th | + 20.312/(T/100) e regression line = 6.06 × 10 ⁻³ | |
| Bromobenzene; $C_6H_5Br;$ 233.1 | 5 0.610 0.379 0.386 | |
| [100-00-1] 243.1 | | |
| 253.1 | 5 0.230§ 0.187 0.183 | |
| | 5 0.155 0.134 0.136 5 0.115 0.102 0.106 | |
| 273.1 283.1 | 5 0.115 0.103 0.106 5 0.095 0.0868 0.0858 | |
| 293.1 | | |
| <pre>§ printed in error as 0.130 in origi Smoothing equation: ln x_{HBr} = -41.07 Standard error in x_{HBr} about th HBr</pre> | nal paper. 6 + 61.493/(T/100) + 16.240 ln(T/100) e regression line = 5.10 × 10 ⁻³ | |
| Iodobenzene; C ₆ H ₅ I; 233.1 | | |
| [591-50-4] 243.1 | | |
| 253.1 | | |
| 263.1 273.1 | | |
| | 5 0.110 0.0991 0.101 | |
| 293.1 | | |
| Smoothing equation: $\ln x_{\text{HBr}} = -8.366 + 17.189/(T/100)$ Standard error in $x_{\text{HBr}}^{\text{HBr}}$ about the regression line = 1.41 × 10 ⁻² | | |
| * calculated by the compiler ** smoothing equation and smoothed | values were calculated by H.L. Clever | |
| AUXILIARY | INFORMATION | |
| METHOD/APPARATUS/PROCEDURE | SOURCE AND PURITY OF MATERIALS: | |
| Hydrogen bromide was passed into a | 1. Hydrogen bromide. High quality | |
| known weight of pure liquid in a | HBr was obtained from a cylinder | |
| bubbler tube at a total pressure | and passed through a tube at 223 K. | |
| measured by a manometer assembly. | For repeat runs it was prepared | |
| The absorbed gas was weighed by re- | from phosphorus tribromide, | |
| weighing the bubbler tube. The | dried by phosphorus pentoxide, and stored at 193 K. | |
| temperature was manually controlled to within 0.2 K. For the four | and stored at 193 K. | |
| lowest temperatures the gas | 2. Halobenzenes. Best obtainable | |
| absorbed was determined by a | specimens were purified, fraction- | |
| chemical titration. | ally distilled and attested. | |
| The apparatus and procedure are | ESTIMATED ERROR: | |
| described by Gerrard (1,2). | $\delta T/K = 0.2 \delta x_{HBr}/x_{HBr} = 0.02-0.05$ | |
| REFERENCES: | | |
| Gerrard, W. J. Appl. Chem. Biot Gerrard, W. "Solubility of Gase New York, 1976. | echnol. <u>1972</u> , 22, 623–650. s and Liquids" Plenum Press, | |
| | ······································ | |

| COMPONENTS: | |
|---|--|
| | ORIGINAL MEASUREMENTS: |
| <pre>1. Hydrogen bromide; HBr; [10035-10-6]</pre> | Ahmed, W.; Gerrard, W. Maladkar, V. K. |
| <pre>2. Nitrobenzene; C₆H₅NO₂; [98-95-3]</pre> | J. Appl. Chem. <u>1970</u> , 20, 109-115. |
| | |
| VARIABLES: | PREPARED BY: |
| T/K: 263.15 - 293.15 Total P/kPa: 101.325 (1 atm) | W. Gerrard (smoothed data calculated by H.L. Clever) |
| EXPERIMENTAL VALUES: T/K Mol F | atio Mol Fraction |
| ⁿ HBr/ ⁿ C | |
| | |
| | 252 0.201 171 0.146 |
| | 130 0.115 |
| | 115 0.103 |
| The mole fraction solubilities were compiler. | calculated from the mole ratio by the |
| Smoothed Data: $\ln X_{mp} = -145.956$ | + 206.442/(T/100) + 68.114 ln (T/100) |
| | t Regression Line = 1.84×10^{-3} |
| Standard Error abou | |
| T/K | Mol Fraction |
| | X _{HBr} |
| 263.15 | 0.202 |
| 273.15 | 0.145 |
| 283.15 293.15 | 0.116 0.103 |
| | |
| | |
| AUXILIA | RY INFORMATION |
| | |
| AUXILIA METHOD/APPARATUS/PROCEDURE: Hydrogen bromide was passed into a known weight of pure liquid in a bubbler tube at a total pressure measured by a manometer assembly. The absorbed gas was weighed by re- weighing the bubbler tube. The temperature was manually controlled to within 0.2 K. | SOURCE AND PURITY OF MATERIALS: 1. Hydrogen bromide. High quality HBr was obtained from a cylinder and passed through a tube at 223 K. For repeat runs it was prepared from phosphorus tribromide, dried by phosphorus pentoxide, |
| METHOD/APPARATUS/PROCEDURE: Hydrogen bromide was passed into a known weight of pure liquid in a bubbler tube at a total pressure measured by a manometer assembly. The absorbed gas was weighed by re- weighing the bubbler tube. The temperature was manually controlled to within 0.2 K. | SOURCE AND PURITY OF MATERIALS: 1. Hydrogen bromide. High quality HBr was obtained from a cylinder and passed through a tube at 223 K. For repeat runs it was prepared from phosphorus tribromide, dried by phosphorus pentoxide, and stored at 193 K. 2. Nitrobenzene. Best obtainable specimen was purified, fraction- ally distilled, and attested. |
| METHOD/APPARATUS/PROCEDURE: Hydrogen bromide was passed into a known weight of pure liquid in a bubbler tube at a total pressure measured by a manometer assembly. The absorbed gas was weighed by re- weighing the bubbler tube. The temperature was manually controlled to within 0.2 K. | SOURCE AND PURITY OF MATERIALS: Hydrogen bromide. High quality HBr was obtained from a cylinder and passed through a tube at 223 K. For repeat runs it was prepared from phosphorus tribromide, dried by phosphorus pentoxide, and stored at 193 K. Nitrobenzene. Best obtainable specimen was purified, fraction- |
| METHOD/APPARATUS/PROCEDURE: Hydrogen bromide was passed into a known weight of pure liquid in a bubbler tube at a total pressure measured by a manometer assembly. The absorbed gas was weighed by re- weighing the bubbler tube. The temperature was manually controlled to within 0.2 K. | <pre>SOURCE AND PURITY OF MATERIALS: 1. Hydrogen bromide. High quality HBr was obtained from a cylinder and passed through a tube at 223 K. For repeat runs it was prepared from phosphorus tribromide, dried by phosphorus pentoxide, and stored at 193 K. 2. Nitrobenzene. Best obtainable specimen was purified, fraction- ally distilled, and attested. ESTIMATED ERROR:</pre> |
| METHOD/APPARATUS/PROCEDURE: Hydrogen bromide was passed into a known weight of pure liquid in a bubbler tube at a total pressure measured by a manometer assembly. The absorbed gas was weighed by re- weighing the bubbler tube. The temperature was manually controlled to within 0.2 K. | <pre>SOURCE AND PURITY OF MATERIALS: 1. Hydrogen bromide. High quality HBr was obtained from a cylinder and passed through a tube at 223 K. For repeat runs it was prepared from phosphorus tribromide, dried by phosphorus pentoxide, and stored at 193 K. 2. Nitrobenzene. Best obtainable specimen was purified, fraction- ally distilled, and attested. ESTIMATED ERROR:</pre> |

| COMPONENTS: | ORIGINAL MEASUREMENTS: | | | |
|---|---|--|--|--|
| (1) Hydrogen bromide; HBr; | O'Brien, S. J.; Bobalek, E. G. | | | |
| [10035-10-6] | t in them for 1940 62 | | | |
| (a) 1 Matheal 2 mituchengene en e- | J. Am. Chem. Soc. <u>1940</u> , 62, 3227 - 3230. | | | |
| (2) 1-Methyl-2-nitrobenzene or o- | 3227 - 3230. | | | |
| nitrotoluene; C ₇ H ₇ NO ₂ ; [88-72-2] | | | | |
| | | | | |
| | | | | |
| VARIABLES: | PREPARED BY: | | | |
| т/К: 298.15 | | | | |
| P/kPa: 2.93 - 44.40 | W. Gerrard | | | |
| (22.0 - 333 mmHg) | | | | |
| EXPERIMENTAL VALUES: | | | | |
| T/K Pressure Molality | Henry's Mol Ratio Mol Fraction | | | |
| | Constant $n_1/n_2 = x_1$ | | | |
| p1/mmHg m1/mol kg ⁻¹ | k^{1} 1^{\prime} 2 1 | | | |
| | 1.27 0.00310 0.00309 | | | |
| 298.15 22.0 0.0226 28.6 0.0300 | 1.25 0.00411 0.00410 | | | |
| 43.9 0.0450 | 1.28 0.00617 0.00613 | | | |
| 60.5 0.0632 | 1.26 0.00867 0.00859 | | | |
| 147 0.147 | 1.31 0.0202 0.0198 | | | |
| 333 0.323 | 1.35 0.0443 0.0424 | | | |
| | | | | |
| (760 0.758 | 1.32 av. 0.104 $0.0941)^2$ | | | |
| | | | | |
| $\frac{1}{1} \text{ k/atm mol}^{-1} \text{ kg} = (p_1/\text{atm})/(m_1/m_1)$ | nol kg ⁻¹) | | | |
| | | | | |
| ² Value calculated by the compile | er from the average value of Henry's | | | |
| constant. Use of the high and | low values of Henry's constant | | | |
| | 988 for the mole fraction solubility | | | |
| at one atm (101.325 kPa). | | | | |
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| AUXILIARY | INFORMATION | | | |
| | INFORMATION | | | |
| METHOD /APPARATUS / PROCEDURE : | SOURCE AND PURITY OF MATERIALS: | | | |
| METHOD /APPARATUS / PROCEDURE : | SOURCE AND PURITY OF MATERIALS: (1) Hydrogen bromide. Prepared from | | | |
| METHOD/APPARATUS/PROCEDURE: The method and apparatus are those of Saylor (1) as modified by O'Brien et | SOURCE AND PURITY OF MATERIALS: (1) Hydrogen bromide. Prepared from bromine and tetralin, and passed | | | |
| METHOD/APPARATUS/PROCEDURE: The method and apparatus are those of Saylor (1) as modified by O'Brien et al. (2). The main difference is the | SOURCE AND PURITY OF MATERIALS: (1) Hydrogen bromide. Prepared from bromine and tetralin, and passed over red phosphorus and then | | | |
| METHOD/APPARATUS/PROCEDURE: The method and apparatus are those of Saylor (1) as modified by O'Brien et al. (2). The main difference is the use of a 1 to 2 day instead of a 5 to | SOURCE AND PURITY OF MATERIALS: (1) Hydrogen bromide. Prepared from bromine and tetralin, and passed over red phosphorus and then | | | |
| METHOD/APPARATUS/PROCEDURE: The method and apparatus are those of Saylor (1) as modified by O'Brien et al. (2). The main difference is the | SOURCE AND PURITY OF MATERIALS: (1) Hydrogen bromide. Prepared from bromine and tetralin, and passed over red phosphorus and then phosphorus pentoxide. | | | |
| METHOD/APPARATUS/PROCEDURE: The method and apparatus are those of Saylor (1) as modified by O'Brien et al. (2). The main difference is the use of a 1 to 2 day instead of a 5 to 7 day equilibration time. | SOURCE AND PURITY OF MATERIALS: (1) Hydrogen bromide. Prepared from bromine and tetralin, and passed over red phosphorus and then phosphorus pentoxide. (2) e-Nitrotoluene. Stored over | | | |
| METHOD/APPARATUS/PROCEDURE: The method and apparatus are those of Saylor (1) as modified by O'Brien <i>et</i> <i>al.</i> (2). The main difference is the use of a 1 to 2 day instead of a 5 to 7 day equilibration time. The apparatus consists of two bulbs | SOURCE AND PURITY OF MATERIALS: (1) Hydrogen bromide. Prepared from bromine and tetralin, and passed over red phosphorus and then phosphorus pentoxide. (2) o-Nitrotoluenc. Stored over calcium oxide and distilled; | | | |
| METHOD/APPARATUS/PROCEDURE: The method and apparatus are those of Saylor (1) as modified by O'Brien <i>et</i> <i>al</i> . (2). The main difference is the use of a 1 to 2 day instead of a 5 to 7 day equilibration time. The apparatus consists of two bulbs which are separated by a tap. The | SOURCE AND PURITY OF MATERIALS: (1) Hydrogen bromide. Prepared from bromine and tetralin, and passed over red phosphorus and then phosphorus pentoxide. (2) e-Nitrotoluene. Stored over | | | |
| METHOD/APPARATUS/PROCEDURE: The method and apparatus are those of Saylor (1) as modified by O'Brien <i>et</i> <i>al</i> . (2). The main difference is the use of a 1 to 2 day instead of a 5 to 7 day equilibration time. The apparatus consists of two bulbs which are separated by a tap. The solvent is partially saturated with | SOURCE AND PURITY OF MATERIALS: (1) Hydrogen bromide. Prepared from bromine and tetralin, and passed over red phosphorus and then phosphorus pentoxide. (2) o-Nitrotoluenc. Stored over calcium oxide and distilled; | | | |
| METHOD/APPARATUS/PROCEDURE: The method and apparatus are those of Saylor (1) as modified by O'Brien et al. (2). The main difference is the use of a 1 to 2 day instead of a 5 to 7 day equilibration time. The apparatus consists of two bulbs which are separated by a tap. The solvent is partially saturated with the gas, and the solution added to | SOURCE AND PURITY OF MATERIALS: (1) Hydrogen bromide. Prepared from bromine and tetralin, and passed over red phosphorus and then phosphorus pentoxide. (2) o-Nitrotoluenc. Stored over calcium oxide and distilled; | | | |
| METHOD/APPARATUS/PROCEDURE: The method and apparatus are those of Saylor (1) as modified by O'Brien <i>et</i> <i>al</i> . (2). The main difference is the use of a 1 to 2 day instead of a 5 to 7 day equilibration time. The apparatus consists of two bulbs which are separated by a tap. The solvent is partially saturated with the gas, and the solution added to the lower bulb. The bulbs are | SOURCE AND PURITY OF MATERIALS: (1) Hydrogen bromide. Prepared from bromine and tetralin, and passed over red phosphorus and then phosphorus pentoxide. (2) o-Nitrotoluenc. Stored over calcium oxide and distilled; | | | |
| METHOD/APPARATUS/PROCEDURE: The method and apparatus are those of Saylor (1) as modified by O'Brien <i>et</i> <i>al</i> . (2). The main difference is the use of a 1 to 2 day instead of a 5 to 7 day equilibration time. The apparatus consists of two bulbs which are separated by a tap. The solvent is partially saturated with the gas, and the solution added to the lower bulb. The bulbs are partially evacuated, the tap opened, | SOURCE AND PURITY OF MATERIALS: (1) Hydrogen bromide. Prepared from bromine and tetralin, and passed over red phosphorus and then phosphorus pentoxide. (2) o-Nitrotoluenc. Stored over calcium oxide and distilled; n²⁰_D, 1.5453. | | | |
| METHOD/APPARATUS/PROCEDURE: The method and apparatus are those of Saylor (1) as modified by O'Brien <i>et</i> <i>al</i> . (2). The main difference is the use of a 1 to 2 day instead of a 5 to 7 day equilibration time. The apparatus consists of two bulbs which are separated by a tap. The solvent is partially saturated with the gas, and the solution added to the lower bulb. The bulbs are partially evacuated, the tap opened, and the whole apparatus put in a | SOURCE AND PURITY OF MATERIALS: (1) Hydrogen bromide. Prepared from bromine and tetralin, and passed over red phosphorus and then phosphorus pentoxide. (2) o-Nitrotoluenc. Stored over calcium oxide and distilled; | | | |
| METHOD/APPARATUS/PROCEDURE: The method and apparatus are those of Saylor (1) as modified by O'Brien <i>et</i> <i>al</i> . (2). The main difference is the use of a 1 to 2 day instead of a 5 to 7 day equilibration time. The apparatus consists of two bulbs which are separated by a tap. The solvent is partially saturated with the gas, and the solution added to the lower bulb. The bulbs are partially evacuated, the tap opened, | SOURCE AND PURITY OF MATERIALS: (1) Hydrogen bromide. Prepared from bromine and tetralin, and passed over red phosphorus and then phosphorus pentoxide. (2) o-Nitrotoluenc. Stored over calcium oxide and distilled; n²⁰_D, 1.5453. | | | |
| METHOD/APPARATUS/PROCEDURE: The method and apparatus are those of Saylor (1) as modified by O'Brien et al. (2). The main difference is the use of a 1 to 2 day instead of a 5 to 7 day equilibration time. The apparatus consists of two bulbs which are separated by a tap. The solvent is partially saturated with the gas, and the solution added to the lower bulb. The bulbs are partially evacuated, the tap opened, and the whole apparatus put in a thermostat from 1 to 2 days. The tap is closed. The HBr in the | SOURCE AND PURITY OF MATERIALS: (1) Hydrogen bromide. Prepared from bromine and tetralin, and passed over red phosphorus and then phosphorus pentoxide. (2) o-Nitrotoluenc. Stored over calcium oxide and distilled; n²_D, 1.5453. ESTIMATED ERROR: | | | |
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| METHOD/APPARATUS/PROCEDURE: The method and apparatus are those of Saylor (1) as modified by O'Brien et al. (2). The main difference is the use of a 1 to 2 day instead of a 5 to 7 day equilibration time. The apparatus consists of two bulbs which are separated by a tap. The solvent is partially saturated with the gas, and the solution added to the lower bulb. The bulbs are partially evacuated, the tap opened, and the whole apparatus put in a thermostat from 1 to 2 days. The tap is closed. The HBr in the upper bulb is quantitatively removed and titrated with NaOH. The HBr partial pressure is calculated from | <pre>SOURCE AND PURITY OF MATERIALS: (1) Hydrogen bromide. Prepared from bromine and tetralin, and passed over red phosphorus and then phosphorus pentoxide. (2) o-Nitrotoluene. Stored over calcium oxide and distilled; n²⁰, 1.5453. ESTIMATED ERROR:</pre> | | | |
| METHOD/APPARATUS/PROCEDURE: The method and apparatus are those of Saylor (1) as modified by O'Brien et al. (2). The main difference is the use of a 1 to 2 day instead of a 5 to 7 day equilibration time. The apparatus consists of two bulbs which are separated by a tap. The solvent is partially saturated with the gas, and the solution added to the lower bulb. The bulbs are partially evacuated, the tap opened, and the whole apparatus put in a thermostat from 1 to 2 days. The tap is closed. The HBr in the upper bulb is quantitatively removed and titrated with NaOH. The HBr partial pressure is calculated from the bulb volume and the number of | <pre>SOURCE AND PURITY OF MATERIALS: (1) Hydrogen bromide. Prepared from bromine and tetralin, and passed over red phosphorus and then phosphorus pentoxide. (2) o-Nitrotoluenc. Stored over calcium oxide and distilled; n²⁰, 1.5453. ESTIMATED ERROR:</pre> | | | |
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| METHOD/APPARATUS/PROCEDURE: The method and apparatus are those of Saylor (1) as modified by O'Brien et al. (2). The main difference is the use of a 1 to 2 day instead of a 5 to 7 day equilibration time. The apparatus consists of two bulbs which are separated by a tap. The solvent is partially saturated with the gas, and the solution added to the lower bulb. The bulbs are partially evacuated, the tap opened, and the whole apparatus put in a thermostat from 1 to 2 days. The tap is closed. The HBr in the upper bulb is quantitatively removed and titrated with NaOH. The HBr partial pressure is calculated from the bulb volume and the number of moles of HBr assuming ideal gas behavior. A weighed solution sample is removed from the lower bulb and | <pre>SOURCE AND PURITY OF MATERIALS: (1) Hydrogen bromide. Prepared from bromine and tetralin, and passed over red phosphorus and then phosphorus pentoxide. (2) o-Nitrotoluene. Stored over calcium oxide and distilled; n²⁰, 1.5453. ESTIMATED ERROR: δT/K = 0.02 REFERENCES: 1. Saylor, J. H. J. Am. Chem. Soc. <u>1937</u>, 59, 1712. 2. O'Brien, S. J.; Kenny, C. L.</pre> | | | |
| METHOD/APPARATUS/PROCEDURE: The method and apparatus are those of Saylor (1) as modified by O'Brien <i>et</i> <i>al.</i> (2). The main difference is the use of a 1 to 2 day instead of a 5 to 7 day equilibration time. The apparatus consists of two bulbs which are separated by a tap. The solvent is partially saturated with the gas, and the solution added to the lower bulb. The bulbs are partially evacuated, the tap opened, and the whole apparatus put in a thermostat from 1 to 2 days. The tap is closed. The HBr in the upper bulb is quantitatively removed and titrated with NaOH. The HBr partial pressure is calculated from the bulb volume and the number of moles of HBr assuming ideal gas behavior. A weighed solution sample | <pre>SOURCE AND PURITY OF MATERIALS: (1) Hydrogen bromide. Prepared from bromine and tetralin, and passed over red phosphorus and then phosphorus pentoxide. (2) o-Nitrotoluenc. Stored over calcium oxide and distilled; n²⁰_D, 1.5453.</pre> ESTIMATED ERROR: | | | |
| METHOD/APPARATUS/PROCEDURE: The method and apparatus are those of Saylor (1) as modified by O'Brien et al. (2). The main difference is the use of a 1 to 2 day instead of a 5 to 7 day equilibration time. The apparatus consists of two bulbs which are separated by a tap. The solvent is partially saturated with the gas, and the solution added to the lower bulb. The bulbs are partially evacuated, the tap opened, and the whole apparatus put in a thermostat from 1 to 2 days. The tap is closed. The HBr in the upper bulb is quantitatively removed and titrated with NaOH. The HBr partial pressure is calculated from the bulb volume and the number of moles of HBr assuming ideal gas behavior. A weighed solution sample is removed from the lower bulb and | <pre>SOURCE AND PURITY OF MATERIALS: (1) Hydrogen bromide. Prepared from bromine and tetralin, and passed over red phosphorus and then phosphorus pentoxide. (2) o-Nitrotoluene. Stored over calcium oxide and distilled; n²⁰, 1.5453. ESTIMATED ERROR: δT/K = 0.02 REFERENCES: 1. Saylor, J. H. J. Am. Chem. Soc. <u>1937</u>, 59, 1712. 2. O'Brien, S. J.; Kenny, C. L.</pre> | | | |

| (1) Hydrogen | | | ORIGINAL ME | ACTIDE MENTER - | |
|--|--|---|--|---|---|
| | COMPONENTS: (1) Hydrogen bromide; HBr; [10035-10-6] | | O'Brien, | S. J.; Bob | alek, E. G. |
| <pre>(2) 1-Methyl-3-nitrobenzene or m- nitrotoluene; C₇H₇NO₂; [99-08-1]</pre> | | J. Am. Chem. Soc. <u>1940</u> , 62, 3227 - 3230. | | | |
| VARIABLES: | | | PREPARED BY | : | |
| T/K: P/kPa: | 298.15 4.29 - 65. (32.2 - 49 | | | W. Ger | rard |
| EXPERIMENTAL VAL | UES: | | · | <u></u> | |
| T/K | Pressure P1 ^{/mmHg} | - | Henry's Constant k ¹ | Mol Ratio ⁿ l ^{/n} 2 | Mol Fraction ^x 1 |
| 298.15 | 32.2 73.5 116 402 493 | 0.0315 0.0688 0.112 0.374 0.449 | 1.35 1.41 1.36 1.42 1.45 | 0.00432 0.00943 0.0154 0.0513 0.0616 | 0.00430 0.00935 0.0152 0.0488 0.0580 |
| | (760 | 0.704 | 1.42 av. | | $0.0881)^{2}$ |
| | (780 | 0.704 | 1.42 dv. | 0.0900 | 0.0001) |
| | | | | | |
| | | | | | |
| | | AUXILIARY | INFORMATION | | |
| METHOD /APPARATUS | PROCEDURE : | AUXILIARY | | | TERIALS : |
| The method an Saylor (1) as al . (2). The | d apparatus modified h main diffe 2 day inst | s are those of by O'Brien <i>et</i> erence is the tead of a 5 to | SOURCE AND (1) Hydro bromi succe | PURITY OF MA gen bromid ne and tet | e. Prepared from ralin, and passed er red phosphorus |
| The method an Saylor (1) as al. (2). The use of a 1 to 7 day equilib The apparatus which are sep solvent is pa the gas, and the lower bul | d apparatus modified H main diffe 2 day inst ration time consists c arated by a rtially sat the solutic b. The bul | s are those of by O'Brien <i>et</i> erence is the tead of a 5 to a. bf two bulbs a tap. The turated with bn added to lbs are | SOURCE AND (1) Hydro bromi succe and p (2) m-Nit calci | PURITY OF MA gen bromid ne and tet ssively ov hosphorus ro toluene um oxide, | e. Prepared from ralin, and passed er red phosphorus |
| The method an Saylor (1) as al. (2). The use of a 1 to 7 day equilib The apparatus which are sep solvent is pa the gas, and the lower bul partially eva and the whole | d apparatus modified H main diffe 2 day inst ration time consists c arated by a rtially sat the solutio b. The bul cuated, the apparatus | s are those of by O'Brien <i>et</i> erence is the tead of a 5 to be. of two bulbs a tap. The turated with bon added to lbs are tap opened, put in a | SOURCE AND (1) Hydro bromi succe and p (2) m-Nit calci | PURITY OF MA gen bromid ne and tet ssively ov hosphorus ro toluene um oxide, 288.50 K, | e. Prepared from ralin, and passed er red phosphorus pentoxide. . Stored over and distilled, |
| The method an Saylor (1) as al. (2). The use of a 1 to 7 day equilib The apparatus which are sep solvent is pa the gas, and the lower bul partially eva | d apparatus modified H main diffe 2 day inst ration time consists of arated by a rtially sat the solutio b. The bul cuated, the apparatus om 1 to 2 d osed. The quantitati with NaOH. | a are those of by O'Brien <i>et</i> erence is the tead of a 5 to be of two bulbs a tap. The turated with on added to lbs are tap opened, put in a days. HBr in the ively removed The HBr | SOURCE AND (1) Hydro bromi succe and p (2) <i>m</i> -Nit calci m.p. | PURITY OF MA gen bromid ne and tet ssively ov hosphorus ro toluene um oxide, 288.50 K, ERROR: &T/K | e. Prepared from ralin, and passed er red phosphorus pentoxide. . Stored over and distilled, |

Hydrogen Bromide in Non-Aqueous Solvents

| COMPONENTS: | ORIGINAL MI | EASUREMENTS: | |
|--|---|--|---------------------------------------|
| (1) Hydrogen bromide; HBr; | Frazer, M. | J.; Gerrard, | w. |
| [10035-10-6] | Nature <u>196</u> 4 | <u>4</u> , 204, 1299 | - 1300 |
| (2) Thiols, thioethers, thiophene and tetrahydrothiophene | | | |
| VARIABLES: T/K: 273.15 | PREPARED BY | Y: | |
| Total P/kPa : 101.3 (barometric, nearly 1 atm) | W. Ge | errard | |
| EXPERIMENTAL VALUES: | · ' <u></u> | · · · · · · · · · · · · · · · · · · · | |
| | т/к | Mole ratio ⁿ HBr ^{/n} 2 | Mole fraction* [×] HBr |
| 2-Propanethiol, (2-propylmercaptan); C ₃ H ₈ S; [75-33-2] | 273.15 | 0.29 | 0.225 |
| 1-Butanethiol, (<i>l-butylmercaptan</i>); C ₄ H ₁₀ S; [109-79-5] | 273.15 | 0.35 | 0.259 |
| Benzenethiol, (thiophenol, mercapto- benzene); C ₆ H ₆ S; [108-98-5] | 273.15 | 0.18 | 0.153 |
| 2,2'-Thiobispropane, (d11sopropyl sulfide); C ₆ H ₁₄ S; [625-80-9] | 273.15 | 2.76 | 0.734 |
| 1,1'-Thiobisbutane, (<i>dibutyl sulfide</i>) C ₈ H ₁₈ S; [544-40-1] | ; 273.15 | 2.53 | 0.717 |
| 1,1'-Thiobisbenzene, (diphenyl sulfid C ₁₂ H ₁₀ S; [139-66-2] | e); 273.15 | 0.23 | 0.187 |
| Thiophene, (thiofuran); C ₄ H ₄ S; [110-02-1] | 273.15 | 0.14 | 0.123 |
| Tetrahydrothiophene; C ₄ H ₈ S; [110-01-0 |] 273.15 | 1.0 (white solid | formed) |
| * calculated by the compiler | | | |
| | INFORMATION | | |
| METHOD/APPARATUS/PROCEDURE | | PURITY OF MAT | FRIALS |
| The gas was passed into a weighed amount of solvent (about 2 g) in a | 1. Hydrogen | bromide. Se | |
| U-tube kept at 273.15 K. The pres- sure was atmospheric, approximately 1 atm. The maximum amount of gas absorbed was determined by weighing. | 2. Sulfur compounds. The purities were checked by boiling points and gas-liquid chromatography. After each measurement of solubility the gas was removed by treatment with water, the liquid was recovered and identified with the original compound. ESTIMATED ERROR: REFERENCES: | | |
| | | , | |

| nyarogen bronnae na | 455 Addebus 501/ents |
|---|---|
| COMPONENTS: | ORIGINAL MEASUREMENTS: |
| 1. Hydrogen Bromide; HBr; | Ahmed, W. |
| [10035-10-6] | Thesis, 1970 |
| 2. Sulfur dioxide; SO ₂ ; [7446-09-5] | University of London |
| 2 | |
| | |
| | |
| VARIABLES: T/K: 228.15 - 253.15 | PREPARED BY: |
| Total P/kPa: 101.325 (1 atm) | W. Gerrard |
| | (smoothed data calculated by H.L. Clever) |
| EXPERIMENTAL VALUES: | |
| | tio Mol Fraction |
| ⁿ HBr/ ^r | SO ₂ X _{HBr} |
| 228.15 0.25 | |
| 233.15 0.22 | |
| 243.15 0.13 | |
| 248.15 0.09 253.15 0.05 | |
| ······································ | * _**** <u>*******************************</u> |
| The mole fraction solubilities were c compiler. | alculated from the mole ratio by the |
| - | C7 246/(m/100) 207 000 10 (m/100) |
| | 67.346/(T/100) - 207.280 ln (T/100) |
| Standard Error About | Regression Line = 8.03×10^{-4} |
| | |
| T/K | Mol Fraction x |
| | X _{HBr} |
| 223.15 | 0.204 |
| 233.15 | 0.184 |
| 243.15 253.15 | 0.116 0.0541 |
| | |
| | |
| | |
| | |
| AUXILIARY | INFORMATION |
| METHOD /APPARATUS / PROCEDURE : | SOURCE AND PURITY OF MATERIALS: |
| Hydrogen bromide was passed into the | 1. Hydrogen Bromide. Good quality |
| liquid sulfur dioxide to saturation, | gas was obtained from a cylinder. |
| as determined by repeated observa- | It was passed through a tube at |
| tions. The final liquid was quan- titatively treated with water, and | 223 K before use. |
| the sulfurous acid and total bromide | 2. Sulfur dioxide. The best speci- |
| was determined by titrations. | men was passed through tubes at |
| | 263 K, and liquefied at the required temperature. |
| | |
| | |
| | ESTIMATED ERROR: |
| | $\delta T/K = 0.2$ |
| | $\delta X_1 / X_1 = 0.005$ |
| | |
| | REFERENCES : |
| | 1. Ahmed, W.; Gerrard, W.; |
| | Maladkar, V. K. |
| | J. Appl. Chem. <u>1970</u> , 20, 109. |
| | |
| | |
| | 1 |

| 450 Hydrogen Bronnde m | Non-Aqueous Solvenis |
|--|--|
| COMPONENTS: | ORIGINAL MEASUREMENTS: |
| <pre>(1) Hydrogen bromide; HBr; [10035-10-6]</pre> | Gerrard, W.; Mincer, A. M. A.; Wyvill, P. L. |
| <pre>(2) Boric acid, tripentyl ester or tripentyl borate; C₁₅H₃₃BO₃; [621-78-3]</pre> | J. Appl. Chem. <u>1960</u> , 10, 115-121. |
| VARIABLES : | PREPARED BY: |
| т/к: 273.15 - 307.15 | 1 |
| Total P/kPa: 101.325 (1 atm) | W. Gerrard (smoothed data calculated by H.L. Clever) |
| EXPERIMENTAL VALUES: | |
| T/K Mol Ra | tio Mol Fraction |
| $\underline{\qquad \qquad }^{n} HBr^{/n}C_{15}$ | H ₂₂ BO ₂ ^x 1 |
| | |
| 273.15 0.71 | |
| 280.45 0.61 285.95 0.52 | |
| 285.55 0.52 | |
| 290.65 0.46 | |
| 298.35 0.39 | |
| 306.05 0.31 | |
| 307.15 0.30 | 0 0.231 |
| The compiler calculated the mole frac | tion values. |
| Smoothed Data: $\ln x_1 = 51.682 - 66.7$ | 22/(T/100) - 27.993 ln (T/100) |
| 1 | - |
| Standard error about | the regression line is 3.26×10^{-3} |
| т/к м | ol Fraction |
| | ^x 1 |
| 273.15 | 0.417 |
| 283.15 | 0.362 |
| 293.15 303.15 | 0.307 0.253 |
| 313.15 | 0.206 |
| | |
| | |
| AUXILIARY | INFORMATION |
| METHOD APPARATUS/PROCEDURE | SOURCE AND PURITY OF MATERIALS: |
| The liquid component was weighed in | (1) Hydrogen bromide. Prepared by |
| a bubbler tube. The amount of gas | adding calculated amount of |
| absorbed was determined by re- | water to pure phosphorus tri- |
| weighing to constant weight. The | bromide (1). Dried over P205 |
| total pressure was barometric, very nearly 1 atm (101.325 kPa). | and cooled to 243 K to remove traces of bromine. |
| | (2) Denie and two perturbations |
| | (2) Boric acid, tripentyl ester. Carefully purified, and purity |
| | rigorously attested. |
| | |
| | ISTIMATED ERROR: |
| | $\delta x_1 / x_1 = 0.01$ |
| | REFERENCES : |
| | |
| | 1. Gerrard, W. Research, London, 1954, 7, S20. |
| | |
| | |
| | |
| | 1 |

| COMPONENTS: | EVALUATOR. |
|---|---|
| <pre>1. Hydrogen Iodide; HI; [10034-85-2]</pre> | Peter G. T. Fogg Department of Applied Chemistry and Life Sciences, |
| 2. Organic Solvents | Polytechnic of North London, Holloway, London, N7 8DB, U.K. |
| | January 1989 |

CRITICAL EVALUATION

The Solubility of Hydrogen Iodide in Organic Solvents.

Alkyl halides

Ahmed, Gerrard & Maladkar (1) reported the solubility at a total pressure of 101.3 kPa over the temperature range 243.15 K to 293.15 K in 1-chlorooctane, 1-bromooctane and 1-iodooctane. Solubility in lower 1-haloalkanes at this total pressure in the range 273.15 K to 303.15 K were also reported by Maladkar (2). The lower alkyl halides which were investigated are: 1-chloropropane, 1-chlorobutane, bromoethane, 1-bromopropane, 1-bromobutane, iodomethane, iodoethane, 1-iodopropane. Mole fraction solubilities at a total pressure of 101.3 kPa show an almost consistent pattern with values increasing with chain length for each series of halides and with values increasing from chloride to bromide to iodide for a fixed alkyl group. 1-Iodopropane spoils the pattern, however, as the mole fraction solubility in this solvent is less than in iodoethane.

Under the experimental conditions the difference between solubility at 101.3 kPa total pressure and solubility at 101.3 kPa partial pressure of hydrogen iodide can be neglected in the case of the 1-halooctanes. The lower halides have, however, significant vapor pressure at the temperatures of measurement. The vapor pressure of iodomethane at 303.15 K, the highest temperature of measurement, is 64.0 kPa. That of 1-bromoethane is 53.3 kPa at 294.15 K. Other alkyl halides have lower vapor pressures at the highest temperature of the measurement of solubility. Estimation of mole fraction solubility at a partial pressure of 101.3 kPa becomes more unreliable the greater the vapor pressure of the solvent. The evaluator has used two approximate methods to correct the measurements to give solubility at a partial pressure of 101.3 kPa. One method makes use of the relationship :

$$x_{\rm HI} = \frac{101.3 \ x_{\rm HI}}{101.3 \ - (1 - x_{\rm HI}') P_{\rm s}^{\circ}/k Pa}$$

 $x_{\rm HI}$ is the mole fraction solubility at a partial pressure of 101.3 kPa. $x_{\rm HI}^{+}$ is the mole fraction solubility at a total pressure of 101.3 kPa. $P_{\rm s}^{\circ}$ is the vapor pressure of pure solvent at the temperature of the solubility measurement.

The other method is based upon the assumption that partial vapor pressures of solute and solvent, s, change with composition of solution according to the Margules relationships. 1.e.

$$P_{HI} = P_{HI}^{\circ} x_{HI} \exp(\alpha x_{s}^{2})$$

$$P_{s} = P_{s}^{\circ} x_{s} \exp(\alpha x_{HI}^{2})$$

$$total = P_{HI} + P_{s}$$

 $\mathtt{P}^{\circ}_{\mathrm{HI}}$ is the vapor pressure of pure liquid hydrogen iodide.

Р

In the case of the systems under consideration the two methods of correction give very similar values of mole fraction solubility when the vapor pressure of pure solvent is less than about 13.3 kPa (100 mmHg). The vapor pressure of pure 1-chlorobutane is 11.1 kPa (83.5 mmHg) at 293.15 K. The mole fraction solubility at a total pressure of 101.3 kPa from Maladkar's measurements is 0.160. The corrected value for a partial pressure of 101.3 kPa according to the first method of correction is 0.218. The second method gives a value of 0.217.

COMPONENTS.

| 1. | Hydrogen Iodia | de; | HI; |
|----|----------------|-----|-----|
| | [10034-85-2] | | |

2. Organic Solvents

EVALUATOR.

Peter G. T. Fogg Department of Applied Chemistry and Life Sciences, Polytechnic of North London, Holloway, London, N7 8DB, U.K.

January 1989

CRITICAL EVALUATION:

Corrected values obtained by either method maintain a similar pattern to the uncorrected values in cases in which the vapor pressure of pure solvent is less than 13.3 kPa (100 mmHg). The mole fraction solubility usually increases with carbon number for a particular temperature and halide series and also from chloride to iodide for a fixed carbon number. The order of the 1-iodopropane and iodoethane is, however, again inverted. pattern does not persist with the corrected values of the more volatile The solvents.

The data for the 1-halooctanes published by Ahmed et al. and measured at six temperatures are self-consistent and may be accepted on a tentative basis. The data for the more volatile solvents, obtained at three temperatures in each case, may be accepted as approximating to a general pattern for these solvents but individual measurements should be used with caution.

Solvents containing oxygen

The solubility in 1-octanol was measured by Ahmed, Gerrard & Maladkar (1) at a total pressure of 101.3 kPa in range 243.15 K to 293.15 K. Mole fraction solubility is high in this solvent which has a vapor pressure of less than 1 mmHg under the conditions of measurement. The pattern of data is similar to that for hydrogen chloride and bromide in this solvent. Measurements may be accepted on a tentative basis.

Ahmed, Gerrard & Maladkar (1) also measured the solubility of hydrogen lodide in 1,1'-oxybisoctane at a total pressure of 101.3 kPa over a temperature range of 243.15 K to 283.15 K. Measured values are very high relative to a reference line based upon the Raoult's law equation. The variation in mole fraction solubility over the temperature range is small and almost linear with change in temperature. The value is 0.868 at 243.15 K and 0.723 at 283.15 K. The reference value for hydrogen iodide at 283.15 K from the Raoult's law equation is 0.138. The behaviour of hydrogen chloride and bromide in dialkyl ethers is similar. Other measurements of solubilities of hydrogen iodide in ethers are not available for comparison. The data should be accepted on a tentative basis.

Ahmed, Gerrard & Maladkar (1) published solubilities at a total pressure of 101.3 kPa in acetic acid over the range 259.15 K to 283.15 K and in hexanoic acid over the range 243.15 K to 293.15 K. In common with dissolution of hydrogen halides in other solvents containing oxygen, solubility of hydrogen iodide in these two acids is high relative to the reference line based on the Raoult's law equation. The mole fraction solubility of hydrogen iodide in acetic acid, as well as that of hydrogen chloride and bromide, is less than that in hexanoic acid. These measurements may be accepted on a tentative basis.

Solvents containing sulfur

Frazer & Gerrard (3) reported solubilities in thiols and sulfides at 273.15 K and a total pressure of 101.3 kPa. Solubilities at a partial pressure of 101.3 kPa are likely to be close to the measured solubilities. Mole fraction solubilities are above the value from the Raoult's law equation and increase in the order: benzenethiol < 1,1'-thiobisbenzene = 2~propanethiol < 1-butanethiol

< 1,1'-thiobisbutane < 2,2'-thiobispropane.

Solubilities in the last named solvents are very high with mole fraction solubilities of 0.743 and 0.761 respectively. Frazer & Gerrard reported a similar pattern of solubilities of hydrogen chloride and of hydrogen bromide in thiols and sulfides. These data may be accepted on a tentative basis.

| COMPO | NFN TS : | EVALUATOR. |
|-------|--------------------------------------|---|
| 1. | Hydrogen Iodide; HI; [10034-85-2] | Peter G. T. Fogg Department of Applied Chemistry and Life Sciences, |
| 2. | Organic Solvents | Polytechnic of North London, Holloway, London, N7 8DB, U.K. |
| 1 | | January 1989 |

CRITICAL EVALUATION.

Solvents containing boron

Ahmed (^) reported the solubility in trichloroborane at 273.15 K and 256.15 K at a total pressure of 101.3 kPa. Values of the mole fraction solubility, corrected to a partial pressure of 101.3 kPa, are relatively low and fall below the reference line based upon Raoult's law. According to data reported by Ahmed, the pattern of behaviour of hydrogen chloride in this solvent is similar. The general pattern of solubility of hydrogen iodide is likely to be reliable but the two individual measurements should be considered to be semi-quantitative until they are supported by other measurements on the system.

REFERENCES

- Ahmed, W.; Gerrard, W.; Maladkar, V. K. J. Appl. Chem. <u>1970</u>, 20, 109-115.
- 2. Maladkar, V. R. Thesis, 1970, University of London.
- 3. Frazer, M. J.; Gerrard, W. Nature, <u>1964</u>, 204, 1299-1300.
- 4. Ahmed, W. Thesis, 1970, University of London.

| 440 F | iyarogen louide in iy | on-Aqueous Solvents |
|---|---|---|
| COMPONENTS: 1. Hydrogen iodide; HI; [10034-85-2] | | ORIGINAL MEASUREMENTS: Ahmed, W.; Gerrard, W.; |
| 2. 1-Octanol; C ₃ H ₁₈ O; | [111-87-5] | Maladkar, V. K. J. Appl. Chem. <u>1970</u> , 20, 109 - 115. |
| VARIABLES: | | PREPARED BY: |
| T/K: 243.15 Total P/kPa: 101.325 | | (smoothed data calculated by H.L. Clever) |
| EXPERIMENTAL VALUES: | | |
| | T/K Mol Rat | |
| | ⁿ HI/ ⁿ C ₈ | H ₁₈ 0 X _{HI} |
| | 243.15 4.65 | 0.823 |
| | 253.15 2.65 | |
| | 263.15 1.98 273.15 1.62 | |
| | 283.15 1.38 | 0.580 |
| | 293.15 1.20 | 0.545 |
| The mole fraction sol compiler. | ubilities were ca | alculated from the mole ratio by the |
| Smoothed Data: ln X _H | I = -15.376 + 22 | .953/(T/100) + 6.456 ln (T/100) |
| | | regression line = 5.15×10^{-3} |
| | | |
| | T/K I | 101 Fraction |
| | | × _{HI} |
| 243.15 0.819 | | |
| | 253.15 263.15 | 0.732 0.666 |
| | 273.15 | 0.616 |
| | 283.15 | 0.577 |
| | 293.15 | 0.548 |
| | | |
| | AUXILIARY | INFORMATION |
| | | |
| METHOD APPARATUS / PROCEDURE | | SOURCE AND PURITY OF MATERIALS: |
| Hydrogen iodide was p bubbler tube at a tot | | 1. Hydrogen iodide. Good quality hydrogen iodide was obtained from |
| sured by a manometer | assembly. The | a cylinder, and passed through a |
| weight of the gas abso mined by re-weighing | | tube at 243 K. Check measure- ments were made by using gas |
| temperature was manual | | obtained from freshly prepared |
| to within 0.2 K. For | | phosphorus triiodide. |
| tion, see Gerrard (1, | | 2. 1-Octanol. Best obtainable |
| For temperatures belo cal titration was per | | specimen was purified, frac- tionally distilled, and attested. |
| cal citracion was per | rormed. | cionally distilled, and accested. |
| | | ESTIMATED ERROR: |
| | | $\delta T/K = 0.2$ |
| | | $\delta X/X = 0.01$ |
| | | |
| | 3 | REFERENCES : |
| | | 1. Gerrard, W. |
| | | J. Appl. Chem. Biotechnol. <u>1972</u> , 22, 623 - 650. |
| | | |
| | | 2. Gerrard, W. "Solubility of Gases and Liquids" Plenum Press, New York, 1976 |
| | | |

| COMPONENTS : | ORIGINAL MEASUREMENTS: |
|--|--|
| 1. Hydrogen iodide; HI; [10034-85-2] | Ahmed, W.; Gerrard, W.; |
| | Maladkar, V. K. |
| 2. 1,1'-Oxybisoctane or Dioctylether; C ₁₆ ^H ₃₄ ^{O;} [629-82-3] | J. Appl. Chem. <u>1970</u> , 20, 109 - 115. |
| | |
| VARIABLES: | PREPARED BY: |
| T/K: 243.15 - 283.15 Total P/kPa: 101.325 (1 atm) | W. Gerrard |
| | (smoothed data calculated by H.L. Clever) |
| EXPERIMENTAL VALUES: | |
| T/K Mol Ra | |
| | 5 ^H 34 ^O |
| 243.15 6.50 | |
| 253.15 5.20 263.15 3.93 | |
| 273.15 2.9 | |
| 283.15 2.63 | 0.723 |
| The mole fraction solubilities were ca compiler. | alculated from the mole ratio by the |
| Smoothed Data: ln X _{HI} = 6.355 - 7.162 | |
| Standard error about i | regression line = 8.32×10^{-3} |
| | 101 Fraction |
| _, _, _, | x _{HI} |
| 243.15 | 0.871 |
| 253.15 | 0.833 |
| 263.15 273.15 | 0.795 |
| 273.15 283.15 | 0.757 0.719 |
| | |
| AUXILIARY | INFORMATION |
| METHOD / APPARATUS / PROCEDURE : | SOURCE AND PURITY OF MATERIALS: |
| Hydrogen iodide was passed into a bubbler tube at a total pressure mea- sured by a manometer assembly. The weight of the gas absorbed was deter- mined by re-weighing the tube. The temperature was manually controlled to within 0.2 K. For full descrip- tion, see Gerrard (1,2). | Hydrogen iodide. Good quality hydrogen iodide was obtained from a cylinder, and passed through a tube at 243 K. Check measurements were made by using gas obtained from freshly pre- pared phosphorus triiodide. |
| For temperatures below 268 K a chem- ical titration was performed. | 2. 1,1'-Oxybisoctane or Dioctylether. Best obtainable specimen was purified, fractionally distilled, and attested. |
| | ESTIMATED ERROR: $\delta T/K = 0.2$ $\delta X/X = 0.01$ |
| | REFERENCES: 1. Gerrard, W. J. Appl. Chem. Biotechnol. <u>1972</u> , 22, 623 - 650. |
| | 2. Gerrard, W. "Solubility of Gases and Liquids" Plenum Press, New York, 1976 |

| COMPONENTS : | ORIGINAL MEASUREMENTS: |
|---|--|
| <pre>1. Hydrogen iodide; HI; [10034-85-2]</pre> | Ahmed, W.; Gerrard, W.; Maladkar, V. K. |
| 2. Acetic Acid; C ₂ H ₄ O; [64-19-7] | J. Appl. Chem. <u>1970</u> , 20, 109 - 115. |
| | |
| VARIABLES: | PREPARED BY: |
| T/K: 259.15 - 283.15 Total P/kPa: 101.325 (1 atm) | W. Gerrard |
| 10tal 1/kla. 101.525 (1 atm) | (smoothed data calculated by H.L. Clever) |
| EXPERIMENTAL VALUES: | · · · · · · · · · · · · · · · · · · · |
| T/K Mol Rat | tio Mol Fraction |
| ⁿ HI/ ⁿ C | NH O XHI |
| ······································ | |
| 259.15 0.7 273.15 0.6 | 78 0.438 525 0.385 |
| 283.15 0.6 | |
| The mole fraction solubilities were ca | alculated from the mole ratio by the |
| compiler. | neuropea riom ene more racio by the |
| Smoothed Data: $\ln X_{HI} = -2.6106 + 4.5$ | 598/(T/100) |
| Standard error about a | regression line = 1.32×10^{-2} |
| | 101 Fraction |
| | |
| | × _{HI} |
| 263.15 273.15 | 0.422 0.396 |
| 283.15 293.15 | 0.373 0.353 |
| | |
| | |
| | |
| | |
| | |
| AUXILIARY | INFORMATION |
| METHOD / APPARATUS / PROCEDURE : | SOURCE AND PURITY OF MATERIALS: |
| Hydrogen iodide was passed into a | 1. Hydrogen Iodide. Good quality |
| bubbler tube at a total pressure mea- sured by a manometer assembly. The | hydrogen iodide was obtained from a cylinder, and passed |
| weight of the gas absorbed was | through a tube at 243 K. Check |
| determined by re-weighing the tube. The temperature was manually con- | measurements were made by using gas obtained from freshly pre- |
| trolled to within 0.2 K. For full description, see Gerrard (1,2). | pared phosphorus trilodide. |
| | 2. Acetic Acid. Best obtainable specimen was purified, frac- |
| | tionally distilled, and attested. |
| | |
| | ESTIMATED ERROR: |
| | $\delta T/K = 0.2$ $\delta X/X = 0.03$ |
| | |
| | REFERENCES : |
| | 1. Gerrard, W. |
| | J. Appl. Chem. Biotechnol. <u>1972</u> , |
| | 22, 623 - 650. |
| | 2. Gerrard, W. "Solubility of Gases and Liquids" |
| | Plenum Press, New York, 1976 |
| | 1 |

| COMPONENTS: | ORIGINAL MEASUREMENTS: |
|---|---|
| Hydrogen iodide; HI; [10034-85-2] | Ahmed, W.; Gerrard, W.; Maladkar, V. K. |
| 2. Hexanoic acid; C ₆ H ₁₂ O ₂ ; | |
| | J. Appl. Chem. <u>1970</u> , 20, 109 - 115. |
| | |
| | |
| VARIABLES: | PREPARED BY: |
| T/K: 243.15 - 293.15 | W. Gerrard |
| Total P/kPa: 101.325 (1 atm) | (smoothed data calculated by H.L. Clever) |
| EXPERIMENTAL VALUES: | |
| T/K Mol Ra | tio Mol Fraction |
| ⁿ HI/ ⁿ C ₆ | |
| | |
| 243.15 2.7 253.15 2.0 | |
| 263.15 1.4 | |
| 273.15 1.0 | |
| 283.15 0.7 293.15 0.6 | |
| | |
| The mole fraction solubilities were c compiler. | alculated from the mole ratio by the |
| - | 236/(T/100) - 17.571 ln (T/100) |
| | 2 |
| | regression line = 5.11 x 10^{-3} |
| T/K | Mol Fraction |
| | X _{HI} |
| 243.15 | 0.734 |
| 253.15 | 0.662 |
| 263.15 273.15 | 0.586 0.511 |
| 283.15 | 0.439 |
| 293.15 | 0.374 |
| | |
| | |
| | |
| AUXILIARY | INFORMATION |
| METHOD/APPARATUS/PROCEDURE: | SOURCE AND PURITY OF MATERIALS: |
| Hydrogen iodide was passed into a | 1. Hydrogen iodide. Good quality |
| bubbler tube at a total pressure mea- sured by a manometer assembly. The | hydrogen iodide was obtained from a cylinder, and passed through a |
| weight of the gas absorbed was deter- | tube at 243 K. Check measure- |
| mined by re-weighing the tube. The | ments were made by using gas |
| temperature was manually controlled to within 0.2 K. For full descrip- | obtained from freshly prepared phosphorus triiodide. |
| tion, see Gerrard (1,2). | 2. Hexanoic acid. Best obtainable |
| For temperatures less than 268 K a | specimen was purified, frac- |
| chemical titration was conducted. | tionally distilled, and attested. |
| | |
| | ESTIMATED ERROR: |
| | $\begin{array}{rcl} \delta T/K &= & 0.2\\ \delta X/X &= & 0.01 \end{array}$ |
| | |
| | REFERENCES : |
| | 1. Gerrard, W. |
| | J. Appl. Chem. Biotechnol. <u>1972</u> , |
| | 22, 623 - 650. |
| | 2. Gerrard. W. |
| | "Solubility of Gases and Liquids" Plenum Press, New York, 1976 |
| | |

| COMPONENTS: | ORIGINAL MEASUREMENTS: | | |
|--|---|--|--|
| (1) Hydrogen Iodıde; HI;[10034-85-2](2) Alkyl halides | Maladkar, V. K. Thesis, 1970, University of London. | | |
| VARIABLES: T/K: 243.15 - 303.15 Total P/kPa : 101.325 (1 atm) | PREPARED BY: W. Gerrard | | |
| EXPERIMENTAL VALUES: T/K | Mole ratio Mole [*] Smoothed ^{**} ⁿ HI ^{/n} alk.hal. fraction mole fraction ^x HI ^x HI | | |
| 1-Chloropropane; C ₃ H ₇ Cl; 273.1 [340-54-5] 283.1 293.1 | 5 0.38 0.275 0.274 5 0.25 0.200 0.202 5 0.18 0.153 0.152 | | |
| Smoothing equation: ln x _{HI} = -9.895 Standard error in x _{HI} about the | + 23.489/(T/100) regression line = 2.52 × 10 ⁻³ | | |
| | 5 0.42 0.296 0.292 5 0.26 0.206 0.212 5 0.19 0.160 0.158 | | |
| Smoothing equation: ln x _{HI} = -10.244 Standard error in x _{HI} about the | + 24.672/(T/100) regression line = 7.79 × 10 ⁻³ | | |
| 293.1 | 5 0.16 0.138 | | |
| Smoothing equation: $\ln x_{\text{HI}} = -11.466 + 27.874/(T/100)$ Standard error in $x_{\text{HI}}^{\text{HI}}$ about the regression line = 4.65 × 10 ⁻³ * calculated by the compiler ** smoothing equation and smoothed values were calculated by H.L. Clever | | | |
| AUXILIARY | INFORMATION | | |
| METHOD/APPARATUS/PROCEDURE The gas was passed into a weighed amount of liquid in a bubbler tube as described by Ahmed <i>et al.</i> (1). Temperature control was manual to within about 0.5 K. Pressure control was within 1 mmHg. In addition to direct weighing of the gas absorbed, hydrogen iodide was quantitatively absorbed in water and titrated by silver nitrate. The data were cited in reference (2) | SOURCE AND PURITY OF MATERIALS: Hydrogen iodide was prepared from self prepared phosphorus tri-iodide, and dried by phosphorus pentoxide. It was passed through a tube at 243 K, and then frozen to a white solid, from which it was obtained by temperature control. Alkyl halides: Best specimens were dried over anhydrous calcium chloride, and freshly distilled. The purities were attested by the standard procedures. ESTIMATED ERROR: | | |
| DEFEDENCES | | | |
| REFERENCES: 1. Ahmed, W.; Gerrard, W.; Maladkar | , V. K. | | |
| J. Appl. Chem. <u>1970</u> , 20, 109. 2. Gerrard, W. "Solubility of Gases New York, <u>1976</u> . | and Liquids" Plenum Press, | | |

| COMPONENTS: | ORIGINAL MEASUREMENTS: |
|---|--|
| <pre>(1) Hydrogen Iodide; HI; [10034-85-2]</pre> | Maladkar, V. K. Thesis, 1970, University of London. |
| (2) Alkyl halides | |
| EXPERIMENTAL VALUES: T/K | Mole ratio Mole* Smoothed** HI ^{/n} alk.hal. fraction mole fraction ^x HI ^x HI |
| [106-94-5] 5 / 283.15 | 0.470.3200.3210.290.2250.2240.190.1600.1600.117 |
| Smoothing equation: $\ln x_{HI} = -11.294$ Standard error in x_{HI} about the | + 27.745/(T/100) regression line = 1.25 × 10 ⁻³ |
| 1-Bromobutane; C ₄ H ₅ Br; 273.15 [109-65-9] 283.15 293.15 | 0.4950.3310.3240.300.2310.2410.230.1870.183 |
| Smoothing equation: ln x _{HI} = -9.518 + Standard error in x _{HI} about the | 22.922/(T/100) regression line = 1.28×10^{-2} |
| Iodomethane; CH ₃ I; [74-88-4] 283.15 293.15 303.15 | 0.460.3150.3130.270.2130.2150.180.1530.152 |
| Smoothing equation: ln x _{HI} = -12.113 Standard error in x _{HI} about the | + 31.010/(T/100) regression line = 3.27 × 10 ⁻³ |
| Iodoethane; C ₂ H ₅ I; 273.15 [75-03-6] 283.15 293.15 299.15 303.15 | 0.46 0.315 0.33 0.248 0.237 0.24 0.194 0.179 |
| Smoothing equation: $\ln x_{HI} = -9.967 + Standard error in x_{HI}^{HI} about the$ | 24.997/(T/100) regression line = 1.35 × 10 ⁻² |
| 1-Iodopropane; C ₃ H ₇ I: 273.15 [107-08-4] 283.15 293.15 | 0.573 0.364 0.369 0.375 0.273 0.265 0.238 0.192 0.195 |
| Smoothing equation: $\ln x_{HI} = -10.357$ Standard error in x_{HI} about the r | + 25.569/(T/100) egression line = 9.76 × 10 ⁻³ |
| <pre>* calculated by the compiler ** smoothing equation and smoothed v</pre> | alues were calculated by H.L. Clever |
| | |
| | |
| | |
| | |
| | |

| COMPONENTS: | ORIGINAL MEASUREMENTS: |
|---|--|
| 1. Hydrogen iodide; HI; [10034-85-2] | Ahmed, W.; Gerrard, W.; |
| 2 1 Chlemesters, C. H. Cl. | Maladkar, V. K. |
| 2. 1-Chlorooctane; C ₈ H ₁₇ C1; | J. Appl. Chem. 1970 , 20, 109 - 115. |
| [111-85-3] | 2. npp. onom <u>1970</u> , 20, 203 123. |
| | |
| | |
| VARIABLES: | PREPARED BY: |
| T/K: 243.15 - 293.15 | W. Gerrard |
| Total P/kPa: 101.325 (1 atm) | (smoothed data calculated by H.L. Clever) |
| 1 •••••••••••••••••••••••••••••••••••• | (smoothed data calculated by h.b. clevel) |
| EXPERIMENTAL VALUES: T/K MOL RA | |
| ⁿ HI/ ⁿ C ₈ | H ₁₇ Cl ^X HI |
| | |
| 243.15 5.0 253.15 1.7 | 0.833 5 0.636 |
| 263.15 1.0 | |
| 273.15 0.6 | |
| 283.15 0.5 | |
| 293.15 0.3 | 75 0.273 |
| The mole fraction solubilities were ca | alculated from the mole ratio by the |
| compiler. | |
| Smoothed Data: $\ln X_{HI} = -15.978 + 28$ | .304/(T/100) + 4.676 ln (T/100) |
| | |
| Standard error about : | regression line = 4.66×10^{-3} |
| · | Mol Fraction |
| -, | × _{HI} |
| | |
| 243.15 | 0.833 |
| 253.15 263.15 | 0.635 0.498 |
| 273.15 | 0.400 |
| 283.15 | 0.328 |
| 293.15 | 0.274 |
| | |
| | |
| | |
| | · |
| AUXILIARY | INFORMATION |
| METHOD APPARATUS/PROCEDURE: | SOURCE AND PURITY OF MATERIALS: |
| | 1. Hydrogen iodide. Good quality |
| Hydrogen iodide was passed into a bubbler tube at a total pressure mea- | hydrogen iodide was obtained from |
| sured by a manometer assembly. The | a cylinder, and passed through a |
| weight of the gas absorbed was deter- | tube at 243 K. Check measure- |
| mined by re-weighing the tube. The | ments were made by using gas |
| temperature was manually controlled to within 0.2 K. For full descrip- | obtained from freshly prepared phosphorus triiodide. |
| tion, see Gerrard (1,2). | |
| | 2. 1-Chlorooctane. Best obtainable specimen was purified, frac- |
| For temperatures below 268 K a chem- ical titration was conducted. | tionally distilled, and attested. |
| | |
| | ESTIMATED ERROR: |
| | $\delta T/K = 0.2$ |
| | $\delta 1/K = 0.2$ $\delta X/X = 0.01$ |
| | , |
| | |
| | REFERENCES: |
| | 1. Gerrard, W. |
| | J. Appl. Chem. Biotechnol. <u>1972</u> , |
| | 22, 623 - 650. |
| | 2. Gerrard, W. |
| | "Solubility of Gases and Liquids" |
| | Plenum Press, New York, 1976 |
| | |

| Hydrogen Iodiae in Non-Aqueous Solvents 447 | | | | |
|---|--|---|--|--|
| COMPONENTS: 1. Hydrogen iodide: H | I; [10034-85-2] | ORIGINAL MEASUREMENTS: Ahmed, W.; Gerrard, W.; | | |
| 1. Hydrogen iodide; HI; [10034-85-2] | | Maladkar, V. K. | | |
| 2. 1-Bromooctane; C ₈ H [111-83-1] | 17 ^{Br;} | J. Appl. Chem. <u>1970</u> , 20, 109 - 115. | | |
| | | | | |
| VARIABLES: T/K: 243.15 | - 202 15 | PREPARED BY: | | |
| Total P/kPa: 101.325 | | W. Gerrard (smoothed data calculated by H.L. Clever) | | |
| EXPERIMENTAL VALUES: | T/K Mol R | atio Mol Fraction | | |
| | | | | |
| | ⁿ HI/ ⁿ C ₈ | H ₁₇ Br X _{HI} | | |
| | 243.15 5.7 | | | |
| | 253.15 1.8 263.15 1.1 | | | |
| | 273.15 0.6 | 8 0.405 | | |
| | 283.15 0.4 293.15 0.3 | | | |
| | · | | | |
| compiler. | | alculated from the mole ratio by the | | |
| | - | 499/(T/100) - 2.213 ln (T/100) | | |
| Stand | ard error about | regression line = 7.40×10^{-3} | | |
| | T/K | Mol Fraction | | |
| | | x _{HI} | | |
| | 243.15 | 0.850 | | |
| | 253.15 | 0.656 | | |
| | 263.15 273.15 | 0.514 0.409 | | |
| | 283.15 | 0.330 | | |
| 293.15 0.269 | | | | |
| | | | | |
| | | | | |
| | | INFORMATION | | |
| METHOD/APPARATUS/PROCEDURE | | SOURCE AND PURITY OF MATERIALS: | | |
| Hydrogen iodide was p bubbler tube at a tot | | 1. Hydrogen iodide. Good quality hydrogen iodide was obtained from | | |
| sured by a manometer | assembly. The | a cylinder, and passed through a | | |
| weight of the gas abs mined by re-weighing | orbed was deter- the tube. The | tube at 243 K. Check measure- ments were made by using gas | | |
| temperature was manua | lly controlled | obtained from freshly prepared | | |
| to within 0.2 K. For tion, see Gerrard (1, | | phosphorus triiodide. | | |
| , | | 2. 1-Bromooctane. Best obtainable specimen was purified, frac- | | |
| For temperatures below 268 K a chemi- cal titration was conducted. | | tionally distilled, and attested. | | |
| | | _ | | |
| | | ESTIMATED ERROR: | | |
| | | $\delta T/K = 0.2$ $\delta X/X = 0.015$ | | |
| | | | | |
| | | REFERENCES : | | |
| | | 1. Gerrard, W. | | |
| | | J. Appl. Chem. Biotechnol. <u>1972</u> , | | |
| | | 22, 623 - 650. | | |
| | | 2. Gerrard, W. "Solubility of Gases and Liquids" Plenum Press, New York, 1976 | | |
| L | | | | |

| , | | | |
|--|--|--|--|
| COMPONENTS : | ORIGINAL MEASUREMENTS: | | |
| 1. Hydrogen iodide; HI; [10034-85-2] | Ahmed, W.; Gerrard, W.; | | |
| 2. 1-Iodooctane; C ₈ H ₁₇ I; [629-27-6] | Maladkar, V. K. | | |
| $2.11000000000, 0_{8,17}, 000000000000000000000000000000000000$ | J. Appl. Chem. 1970, 20, 109 - 115. | | |
| | | | |
| | | | |
| | | | |
| | PREPARED BY: | | |
| T/K: 243.15 - 293.15 Total P/kPa: 101.325 (1 atm) | W. Gerrard | | |
| | (smoothed data calculated by H.L. Clever) | | |
| EXPERIMENTAL VALUES: | | | |
| T/K Mol Rat | | | |
| ⁿ HI/ ⁿ C ₈ H | A ₁₇ I ^X HI | | |
| 243.15 5.8 | 0.853 | | |
| 253.15 2.03 | 0.670 | | |
| 263.15 1.13 273.15 0.73 | 0.531 0.422 | | |
| 233.15 0.53 | 0.346 | | |
| 293.15 0.425 | 0.298 | | |
| The mole fraction solubilities were ca | alculated from the mole ratio by the | | |
| compiler. | | | |
| Smoothed Data: $\ln X_{HI} = -13.267 + 24$. | 441/(T/100) + 3.447 ln (T/100) | | |
| Standard error about r | regression line = 7.19 x 10^{-3} | | |
| | 101 Fraction | | |
| | X _{HI} | | |
| 243.15 | 0.859 | | |
| 253.15 | 0.664 | | |
| 263.15 273.15 | 0.526 0.425 | | |
| 283.15 | 0.351 | | |
| 293.15 | 0.295 | | |
| | | | |
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| | | | |
| AUXILIARY | INFORMATION | | |
| METHOD APPARATUS/PROCEDURE: | | | |
| Hydrogen iodide was passed into a | SOURCE AND PURITY OF MATERIALS: 1. Good quality hydrogen iodide was | | |
| bubbler tube at a total pressure mea- | obtained from a cylinder, and | | |
| sured by a manometer assembly. The | passed through a tube at 243 K. | | |
| weight of the gas absorbed was deter- | Check measurements were made by | | |
| mined by re-weighing the tube. The temperature was manually controlled | using gas obtained from freshly prepared phosphorus triiodide. | | |
| to within 0.2 K. For full descrip- | 2. 1-Iodooctane. Best obtainable | | |
| tion, see Gerrard (1,2). | specimen was purified, fraction- | | |
| For temperatures below 268 K a chem- | ally distilled, and attested. | | |
| ical titration was conducted. | | | |
| 1 | | | |
| | ESTIMATED ERROR: | | |
| | $\delta T/K = 0.2$ | | |
| | $\delta X/X = 0.01$ | | |
| | | | |
| | REFERENCES: | | |
| | 1. Gerrard, W. | | |
| | J. Appl. Chem. Biotechnol. 1972, | | |
| | 22, 623 - 650. | | |
| | 2. Gerrard, W. | | |
| 1 | | | |
| | "Solubility of Gases and Liquids" Plenum Press, New York, 1976 | | |

| | Un-Aqueous 30 | IVENILS | 445 |
|---|---|---|--------------------------------------|
| COMPONENTS: | ORIGINAL MEASUREMENTS: | | |
| (1) Hydrogen iodıde; HI; [10034-85-2] | Frazer, M. | J.; Gerrard, | ₩. |
| (2) Thiols, thioethers, thiophene and tetrahydrothiophene | Nature <u>196</u> | <u>4</u> , 204, 1 2 99 · | - 1300 |
| VARIABLES: | PREPARED B | Y: | |
| T/K: 273.15 Total P/kPa : 101.3 (barometric, nearly 1 atm) | W. G | errard | |
| EXPERIMENTAL VALUES: | - <u></u> | | |
| | т/к | Mole ratio ⁿ HI ^{/n} 2 | Mole fraction* ^x HI |
| 2-Propanethiol, (2-propylmercaptan); C ₃ H ₈ S; [75-33-2] | 273.15 | 0.45 | 0.310 |
| 1-Butanethiol, (<i>l-butylmercaptan</i>); C ₄ H ₁₀ S; [109-79-5] | 273.15 | 0.67 | 0.401 |
| Benzenethiol, (thiophenol, mercapto- benzene); C ₆ H ₆ S; [108-98-5] | 273.15 | 0.39 | 0.281 |
| 2,2'-Thiobispropane, (d11sopropyl sulfide); C ₆ H ₁₄ S; [625-80-9] | 273.15 | 3.18 | 0.761 |
| 1,1'-Thiobisbutane, (dibutyl sulfide) C ₈ H ₁₈ S; [544-40-1] | ; 273.15 | 2.89 | 0.743 |
| 1,1'-Thiobisbenzene, (diphenyl sulfid ^C 12 ^H 10 ^S ; [139-66-2] | e); 273.15 | 0.50 | 0.333 |
| Thiophene, (<i>thiofuran</i>); C ₄ H ₄ S; [110-02-1] | 273.15 | - (reacts furt) | ner) |
| Tetrahydrothiophene; C ₄ H ₈ S; [110-01-0 |] 273.15 | 1.0 (white solid | formed) |
| * calculated by the compiler | | | |
| | | | |
| | INFORMATION | | |
| METHOD/APPARATUS/PROCEDURE | | PURITY OF MATH | |
| The gas was passed into a weighed amount of solvent (about 2 g) in a U-tube kept at 273.15 K. The pres- sure was atmospheric, approximately 1 atm. The maximum amount of gas absorbed was determined by weighing. | Hydrogen iodide. Self made and carefully purifed. Sulfur compounds. The purities were checked by boiling points and gas-liquid chromatography. After each measurement of solubility the gas was removed by treatment | | |
| | with water, the liquid was recovered and identified with the original compound. | | |
| | ESTIMATED ERROR: | | |
| | REFERENCES: | <u> </u> | |
| | | | _ |

| | ORIGINAL MEASUREMENTS: |
|--|---|
| 1. Hydrogen Iodide; HI; | Ahmed, W. |
| [10034-85-2] | Mhosis 1070 |
| 2. Trichloroborane; BCl ₃ ; | Thesis, 1970 University of London |
| | University of London |
| [10294-34-5] | |
| | |
| VARIABLES: | |
| | PREPARED BY: |
| T/K: 256.15 - 273.15 Total P/kPa: 101.325 (1 atm) | W. Gerrard |
| 10001 1/ A10. 101.525 (1 atm) | |
| EXPERIMENTAL VALUES: | |
| | |
| T/K Mol Ra | |
| ⁿ HI/ ⁿ B | Cl ₃ X _{HI} |
| 272.15 0.00 | <u> </u> |
| 273.15 0.08 256.15 0.17 | |
| | 8 0:150 |
| The mole fraction solubilities were c | alculated from the mole ratio by the |
| compiler. | |
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| | INFORMATION |
| METHOD / APPARATUS / PROCEDURE : | SOURCE AND PURITY OF MATERIALS: |
| Trichloroborane was distilled into | 1. Hydrogen iodide was prepared |
| the bubbler tube at low temperature. | from self prepared phosphorus |
| Hydrogen iodide was passed through | triiodide, and dried by phospho- |
| for two hours. The final liquid was | rus pentoxide. It was passed |
| quantitatively treated with an | through a tube at 243 K, and |
| aqueous solution of sodium hydroxide. Borate and total halide were then | frozen to a white solid, from |
| determined by titrations. | which it was obtained by temperature control. |
| determined by citracions. | cemperature control. |
| | 2. Trichloroborane. The purest |
| | obtainable specimen was used. |
| | |
| | ESTIMATED ERROR: |
| | $\delta m/r = 0.2$ |
| | |
| | |
| | REFERENCES : |
| | |
| | 1. Ahmed, W.; Gerrard, W.; |
| | Maladkar, V. K. |
| | J. Appl. Chem. <u>1970</u> , 20, 109. |
| | |
| | 1 |
| | |

| COMPONENTS: | |
|--|--|
| COMPONENTS: (1) Hydrogen fluoride; HF; [7664-39-3] Hydrogen chloride; HCl; [7647-01-0] Hydrogen bromide; HBr; [10035-10-6] Hydrogen iodide; HI;[10034-85-2] | Appendix I Some Physical Properties of the Hydrogen Halides. |
| | |

Appendix I summarizes some physical property values of the hydrogen halides which will be of interest to the users of the solubility data. The property values are based on data in the International Critical Tables (ref 1), NBS Circular 500(ref 2), The Handbook of Chemistry and Physics, 64th Ed. (ref 3), and recent measurements of Henderson at al. (ref 4) on hydrogen chloride. The data were evaluated at time of publication, but the user should be alert for more up to date values in future publications. The data given here are believed to be adequate for most applications related to the solubility of the hydrogen halides.

Below are values of the enthalpy, entropy and heat capacity changes on fusion and on vaporization at atmospheric pressure. The values have been recalculated in kJ and J from values given in NBS Circular 500. The temperatures for fusion and vaporization from Circular 500 are given in Table I on the following page.

| Substance | $\Delta H/$ | kJ mol-1 | $\Delta S/\mathbf{J}$ | K ⁻¹ mol ⁻¹ | $\Delta C_p / \mathbf{J}$ | K^{-1} mol ⁻¹ |
|-----------|-------------|--------------|-----------------------|-----------------------------------|---------------------------|----------------------------|
| | Fusion | Vaporization | Fusion | Vaporization | Fusion | Vaporization |
| HF | 4.58 | 7.5 | 24.1 | 25.5 | 10.7 | -46 |
| HC1 | 1.99 | 16.2 | 12.5 | 85.8 | 8.8 | -29.9 |
| HBr | 2.41 | 17.6 | 12.9 | 85.3 | 6.9 | -30.8 |
| ΗI | 2.87 | 19.8 | 12.9 | 83.1 | 4.6 | -29.9 |

The enthalpy change on vaporization of HCl is 16.194 kJ mol⁻¹ at the normal boiling point according to Henderson $et \ al$. (ref 4).

Table I gives the fusion and normal boiling point temperatures, the critical temperatures and pressures, and the ideal mole fraction solubility at a number of temperatures at a gas partial pressure of one atmosphere.

The fusion and normal boiling point temperatures of HF, HBr and HI were taken from *Circular 500*, the values of HCl are from Henderson *et al*. The critical property values were taken from the compilation of R. Loebel in the *Handbook of Chemistry and Physics*. The critical temperature and pressure of HCl are from Henderson *et al*. The critical values differ by only about one percent from values given in the *International Critical Tables* which were compiled from data taken before 1928.

The ideal mole fraction solubilities are based on Raoults law. The values are for a gas partial pressure of one atm. For HF the required vapor pressures were calculated from the equation given in the Handbook of Chemistry and Physics. For HCl, HBr and HI the vapor pressures were taken from the International Critical Tables. The ideal mole fraction solubility values are useful in discussions about the departure of solubility from ideal behavior and the Gerrard Reference Line.

REFERENCES:

- 1. International Critical Tables, E. W. Washburn, Editor, McGraw-Hill Book Co., New York, <u>1928</u>, Volume III, p. 228.
- 2. Selected Values of Chemical Thermodynamic Properties [NBS Circular 500] Rossini,F.D.; Wagman,D.D.; Evans,W.H.; Levine,S.; Jaffe,I. U. S. Government Printing Office, Washington, DC <u>1952</u> (reprinted 1961), Part I, Series II, pp. 548-551.
- 3. Handbook of Chemistry and Physics, Weast, R. C., Editor, CRC Press, Inc., Boca Raton, FL, <u>1983</u>, 64th. Edition.
- 4. Henderson, C.; Lewis, D.G.; Prichard, P.C.; Staveley, L.A.K.; Fonseca, I.M. A.; Lobo, L.Q. J. Chem. Thermodynam. <u>1986</u>, 18, 1077-1088.

| COMPONENTS : | ···· | | <u> </u> | | | |
|--------------------|---|---|------------------------|-----------------------|---------------------------------|---------------------------------|
| | (1) Hydrogen fluoride; HF; | | Appendix I (continued) | | | |
| [7664- | [7664-39-3] Hydrogen chloride; HCl; | | ĺ | | ence Clever ent of Chemis | |
| [7647- | 01-0] | | | Emory U | niversity | - |
| | en bromi | de; HBr; | | Atlanta | , GA 30322 | USA |
| | [10035-10-6] Hydrogen iodide; HI; [10034-85-2] | | | 1983, J | uly; revised | 1986, Nov |
| | | | | | | |
| Table l. | Some ph normal solubil | ysical proper boiling, and ities. | ties of critica | the hyd: 1 tempera | rogen halides atures. Estim | . Melting, nated "ideal" |
| Tempera | ture | Hydrogen Fluoride | | ogen ride | Hydrogen Bromide | Hydrogen Iodide |
| t∕°C | Т/К | | | | | |
| -114.10 | 159.05 | - | Fusi | on(t.p.) | - | _ |
| - 86.82 | 186.28 | - | | _ | Fusion | - |
| - 84.95 - 83.07 | 188.20 190.09 | - Fusion | n.b. - | p. | - | - |
| - 80 | 193.15 | | 0.75 | 1 | | |
| - 70 | 203.15 | | 0.46 | | | |
| - 66.73 | 206.43 | - | - | | n.b.p. | - |
| - 60 | 213.15 | 4 | 0.29 | I. | 0.71 | |
| - 50.8 | 222.36 | - | - | | - | Fusion |
| - 50 | 223.15 | | 0.19 | | 0.46 | |
| - 40 | 233.15 | | 0.13 | | 0.30 | |
| - 35.36 | 237.80 | - | - | | - | n.b.p. |
| - 30 | 243.15 | | 0.09 | | 0.21 0.15 | 0.79 0.54 |
| - 20 - 10 | 253.15 263.15 | | 0.05 | 2 | 0.11 | 0.38 |
| 0 | 273.15 283.15 | | 0.03 | | 0.081 0.063 | 0.27 0.20 |
| 19.9 | | n.b.p. | _ | | _ | _ |
| [| 293.15 | 0.995 | 0.02 | A. | 0.049 | 0.15 |
| 20 25 | 298.15 | 0.84 | 0.02 | 1 | 0.043 | 0.13 |
| 30 40 | 303.15 313.15 | 0.71 0.51 | 0.01 0.01 | | 0.038 0.031 | 0.12 0.090 |
| 50 | 323.15 | 0.38 | 0.01 | | 0.025 | 0.072 |
| 51.53 | 324.68 | - | [p _c /M | Pa = .256] | - | - |
| 60 | 333.15 | | Ŭ | | 0.020 | 0.058 |
| 70 80 | 343.15 353.15 | | | | 0.017 0.014 | 0.047 0.039 |
| 90 | 363.2 | - | ~ | | [p _c /MPa = 8.56] | |
| 90 | 363.15 | | | | | 0.032 0.027 |
| 100 110 | 373.15 383.15 | | | | | 0.023 |
| 120 130 | 393.15 403.15 | | | | | 0.019 0.017 |
| 140 | 413.15 | | | | | 0.014 |
| 150 | 423.15 | | | | | |
| 150 | 423 | - | - | | - | [p _c /MPa = 8.30] |
| 188 | 461 | [p _c /MPa = 6.48] | - | | - | - |
| 190 | 463.15 | | | | | |

SYSTEM INDEX

Page numbers preceded by E refer to evaluation texts. Substances are indexed in the same manner as in Chemical Abstracts, e.g. toluene appears as benzene, methyl-; boron trichloride as borane, trichloro- etc.

| Acetic acid | | |
|---------------------|--|--|
| | + hydrogen bromide + hydrogen chloride + hydrogen 10dide | E388, 422 E196, 197, 199-203 E438, 442 |
| Acetic acid, bromo | | E208, 222 |
| Acetic acid, butyl | ester | |
| Acetic acid, chlor | | E207-E209, 212, 216 |
| Acetic acid, chlore | + hydrogen chloride o-, ethyl ester | E196, 205 |
| Acetic acid, chlore | + hydrogen chloride o-, phenyl ester | E208, 226 |
| Acetic acid, dichle | + hydrogen chloride | E208, 230 |
| | + hydrogen chloride | E208, 222 |
| Acetic acid, ethyl | ester + hydrogen chloride | E207-E209, 210, 211, 214, 215 |
| Acetic acid, methy | l ester + hydrogen chlorıde | E207-E209, 214, 215 |
| Acetic acid, 1-met | | E207-E209, 211, 216 |
| Acetic acid, 1-met | hylpropyl ester | |
| Acetic acid, 2-met | | E207-E209, 212 |
| Acetic acid, octyl | + hydrogen chloride ester | E207-E209, 212 |
| Acetic acid, penty | + hydrogen chloride l ester | E207-E209, 212 |
| Acetic acid, pheny | + hydrogen chloride | E207-E209, 217 |
| | + hydrogen chloride | E207-E209, 213 |
| Acetic acid, pheny | see benzeneacetic acid, ethyl es | ter |
| Acetic acid, pheny | lmethyl ester + hydrogen chlorıde | E207-E209, 213 |
| Acetic acid, propy | l ester + hydrogen chlorıde | E207-E209, 211, 216 |
| Acetic acid, trich | | E196, 206 |
| Acetic acid, trich | | |
| Allyl acetate ' | | E208, 220 |
| Allyl alcohol | see 1-propen-2-ol, acetate | |
| Allyl butyrate | see 2-propen-1-ol | |
| Allyl chloride | see butanoic acid, 2-propenyl es | ter |
| Allyl propionate | see propene, 3-chloro- | |
| | see propanoic acid, 2-propenyl- | |
| Anisole | see benzene, methoxy- | |
| Benzene | | |
| | + hydrogen bromide + hydrogen chloride | E384, 401-404 E53, E54, 56-63 |
| | + hydrogen fluoride | E1, 3, 4 |
| Benzene (aqueous) | + hydrogen chloride | E53, E54, 64, 65 |
| Benzene (ternary) | + hydrogen chloride | E21, E22, 38, E54, 71 |
| 1 | | |

| Benzene, bromo- | |
|--|----------------------------------|
| + hydrogen bromide + hydrogen chloride | E390, 430 E291, 309-311 |
| Benzene, bromo-, (ternary) + hydrogen chloride | E21, E22, 40 |
| Benzene, butoxy- + hydrogen chloride | E150-E155, 184 |
| Benzene, (butoxymethyl)- + hydrogen chloride | E150-E155, 170 |
| Benzene, chloro- + hydrogen bromide | E390, 430 |
| + hydrogen blomide + hydrogen chloride Benzene, chloro- (ternary) | E291-E293, 298-304 |
| + hydrogen chloride | E21, E22, 40, E54, 70 |
| Benzene, (chloromethyl)- + hydrogen chloride | E293, 298 |
| Benzene, 1-chloro-2-nitro- + hydrogen chloride | E314, E315, 320 |
| Benzene, 1-chloro-3-nitro- + hydrogen chloride | E314, E315, 321 |
| Benzene, 1-chloro-4-nitro- + hydrogen chloride | E314, E315, 322 |
| Benzene, chloro(trifluoromethyl)-, (ternary) | E293, 296 |
| + hydrogen chloride Benzene, chloro(trifluoromethyl)-, (multicomponent) | |
| + hydrogen chloride Benzene, 1,2-dichloro~ | E293, 297 |
| + hydrogen chloride Benzene, 1,2-dichloro-2-nitro- | E291, 305, 306 |
| + hydrogen chloride Benzene, 1,2-dichloro-4-nitro- | E314, E315, 321 |
| + hydrogen chloride Benzene, dichloro(trifluoromethyl)-, (multicomponer | E314, E315, 321 |
| + hydrogen chloride | E293, 297 |
| Benzene, dimethyl- + hydrogen chloride | 77 |
| Benzene, 1,2-dimethyl- + hydrogen chloride | E53, E54, 71, 74 |
| Benzene, 1,3-dimethyl- + hydrogen bromide | E384, E385, 408, 409 |
| + hydrogen chloride Benzene 1,3-dimethyl- (ternary) | E53, E54, 74 |
| + hydrogen chloride Benzene, 1,4-dimethyl- | E21, E22, 39, E54, 71 |
| + hydrogen chloride | E53, E54, 76 |
| Benzene 1,4-dimethyl- (ternary) + hydrogen chloride | E54, 71 |
| Benzene, ethoxy- + hydrogen chloride | E150-E155, 169, 183 |
| Benzene, (ethoxymethyl)- + hydrogen chloride | E150-E155, 170 |
| Benzene, ethyl- (ternary) + hydrogen chloride | E21, E22, 39 |
| Benzene, fluoro- + hydrogen chloride | E291, E293, 294 |
| Benzene, fluoro- (ternary) | |
| + hydrogen chloride Benzene, 10d0- | E21, E22, 40 |
| + hydrogen bromide + hydrogen chloride | E390, 430 E291, 312 |
| Benzene, 10do- (ternary) + hydrogen chloride | E21, E22, 40 |
| Benzene, methoxy- + hydrogen chloride | E150-E155, 163, 168, 181, 182 |
| Benzene, methoxy~, (ternary) + hydrogen chloride | E21, E22, 27 |
| Benzene, 1-methoxy-2-methyl- + hydrogen chloride | E150-E155, 169 |
| Benzene, (methoxymethyl)- | |
| + hydrogen chloride | E150-E155, 169 |

Benzene, methyl-+ hydrogen bromide E384, 405-407 + hydrogen chloride E53, E54, 57, 66-69, 72 Benzene, methyl- (ternary) E21, E22, 38, E53, E54, 70-73 + hydrogen chloride Benzene, (1-methylethyl) (ternary) E21, E22, 39 + hydrogen chloride Benzene, 1-methyl-2-nitro-E390, 432 E314, E315, 323 + hydrogen bromide + hydrogen chloride Benzene, 1-methyl-2-nitro-, (ternary) + hydrogen chloride E21, E22, 35 Benzene, 1-methyl-3-nitro-+ hydrogen bromide E390, 433 + hydrogen chloride E314, E315, 324, 325 Benzene, (2-methylpropyl)- (ternary) + hydrogen chloride E21, E22, 40 Benzene, nitro-+ hydrogen bromide E390, 431 + hydrogen chloride E314, E315, 317-322 Benzene, nitro- (ternary) + hydrogen chloride E21, E22, 34, 316 Benzene, 1,1'-oxybis-+ hydrogen chloride E150-E155, 170, 185, 186 + hydrogen fluoride E1, 5 Benzene, 1,1'-oxybis (methyl-+ hydrogen chloride E21, E22, 28 Benzene, 1,1'-[oxybis(methylene)]bis-E150-E155, 171 + hydrogen chloride Benzene, 1,1'-[oxybis(methylene)]bis-, (ternary) E21, E22, 29 🕨 hydrogen chloride Benzene, 1,2,3,4-tetramethyl- (ternary) + hydrogen chloride E54, 72 Benzene, 1,2,3,5-tetramethyl- (ternary) E54, 72 + hydrogen chloride Benzene, 1,1'-thiobis-E438, 449 hydrogen 10dide Benzene, 1,2,4-trichloro-E291, 307 hydrogen chloride Benzene, (trichloromethyl)-+ hydrogen chloride E293, 298, 308 Benzene, (trifluoromethyl)-+ hydrogen chloride E293, 295 Benzene, (trifluoromethyl)-, (multicomponent) + hydrogen chloride E293, 297 Benzene, (trifluoromethyl)-, (ternary) E21, E22, 40, E54, 72, E293, 296 + hydrogen chloride Benzene, 1,2,3-trimethyl- (ternary) E54, 71 + hydrogen chloride Benzene, 1,2,4-trimethyl- (ternary) + hydrogen chloride E54, 71 Benzene, 1,3,5-trimethyl-+ hydrogen bromide E384, E385, 410 Benzene, 1,3,5-trimethyl- (ternary) E21, E22, 39, E54, 71 + hydrogen chloride Benzeneacetic acid, ethyl ester + hydrogen chloride E207-E209, 218 Benzenemethanol + hydrogen chloride E145, 147 Benzenephenol + hydrogen chloride E330, E331, 334 Benzenepropanol + hydrogen chloride E145, 149 Benzenesulfonic acid, butyl ester + hydrogen chloride E330, E331, 333 Benzenesulfonic acid, 4-chloro-, butyl ester + hydrogen chloride E330, E331, 333 Benzenesulfonic acid, 4-methyl-, butyl ester + hydrogen chloride E330, E331, 333

| Benzenesulfonyl chlorıde + hydrogen chloride | E330, | E331, | 333, | 335 |
|---|-------|-------|------|-----|
| Benzenethiol + hydrogen bromide | E390, | 434 | | |
| + hydrogen iodide | E438, | | | |
| 1,3,2-Benzodioxaborole, 2-butoxy- + hydrogen chloride | E342, | 348 | | |
| 1,3,2-Benzodioxaborole, 2-ethoxy- + hydrogen chloride | E342, | 346 | | |
| 1,3,2-Benzodloxaborole, 2-methoxy- + hydrogen chloride | E342, | | | |
| 1,3,2-Benzodioxaborole, 2-octyloxy- | | | | |
| + hydrogen chloride 1,3,2-Benzodioxaborole, 2-pentoxy- | E342, | 348 | | |
| + hydrogen chloride 1,3,2-Benzodioxaborole, 2-propoxy- | E342, | 348 | | |
| + hydrogen chloride 1,4-Benzodioxan, 2-methyl- | E342, | 347 | | |
| + hydrogen chloride | E155, | 194 | | |
| 1,2-Benzodioxepin, 3,4-dıhydro- + hydrogen chloride | E155, | 193 | | |
| 1,4-Benzodioxin, 2,3-dihydro- + hydrogen chloride | E155, | 192 | | |
| 1,3-Benzodioxole | | | | |
| + hydrogen chloride Benzotrichloride | E155, | 191 | | |
| see benzene, (trichloromethyl)- Benzoyl chloride | | | | |
| + hydrogen chloride Benzyl acetate | E293, | 313 | | |
| see acetic acid, phenylmethyl es | ter | | | |
| Benzyl alcohol see benzenemethanol | | | | |
| Benzyl butyl ether see benzene, (butoxymethyl)- | | | | |
| Benzyl chloride | | | | |
| see benzene, (chloromethyl)- Benzyl ethyl ether | | | | |
| see benzene, (ethoxymethyl)- Benzyl methyl ether | | | | |
| see benzene (methoxymethyl)- Borane, butoxydichloro- | | | | |
| + hydrogen chloride | E342, | 348 | | |
| Borane, dichlorophenyl- + hydrogen chloride | E342, | 349 | | |
| Borane, trichloro- + hydrogen chloride | E342, | 350, | 351 | |
| + hydrogen 10dide Boric acid, tributyl ester | E438, | 450 | | |
| + hydrogen chloride | E342, | 345 | | |
| Boric acid, triethyl ester + hydrogen chlorıde | E342, | 343 | | |
| Boric acid, tripentyl ester + hydrogen chloride | E342, | 344 | | |
| + hydrogen bromide Boron trichloride | E391, | | | |
| see borane, trichloro- | | | | |
| Bromobenzene see benzene, bromo- | | | | |
| Bromobutane see butane, 1-bromo- | | | | |
| Bromoethane | | | | |
| see ethane, bromo- 2-Bromoethanol | | | | |
| see ethanol, 2-bromo- Bromoform | | | | |
| see methane, tribromo- Bromohexane | | | | |
| see hexane, 1-bromo- | | | | |
| Bromo-octane see octane, 1-bromo- | | | | |
| 1-Bromo-octane see octane, 1-bromo- | | | | |
| ···· · · · · · · | | | | |

| 1,3-Butadiene, 2,3-dimethyl- + hydrogen chloride 1,3-Butadiene, 2-methyl- + hydrogen bromide Butane + hydrogen bromide Butane (ternary) + hydrogen bromide Butane, 1,4-dibromo- + hydrogen chloride Butane, 1,1'-oxybis- + hydrogen chloride Butane, 1,1'-oxybis (3-methyl- + hydrogen chloride Butane, 1,1'-oxybis (3-methyl- + hydrogen chloride Butane, 1-bromo- hydrogen chloride Butane, 1-chloro- + hydrogen chloride Butane, 1-chloro- Butane, 1-ethoxy- + hydrogen chloride Butane, 1-ethoxy- Butane, 1-renoxy- + hydrogen chloride Butane, 1-propoxy- Butane, 1,1'-sulfonylbis- Butane, 1,1'-sulfonylbis- + hydrogen chloride + hydrogen chloride 1,3-Butanediol + hydrogen chloride Butane, 1,1'-thioblis- + hydrogen chloride Butanei (thylegen chloride Butane, 1,1'-thioblis- + hydrogen chloride Butanei (thylegen chloride Butane, 1,1'-thioblis- + hydrogen chloride Butanei (thylegen chloride Butanei (thylegen chloride Butanei (thylegen chloride Butanei (thylegen chloride Butanei (thylegen chloride Butanoic acid, thylegen chloride Butanoic acid, propylester + hydrogen chloride 2-Butanol + hydrogen chloride + h | |
|--|---|
| <pre>+ hydrogen chloride 1,3-Butadiene, 2-methyl- hydrogen bromide Butane + hydrogen bromide Butane (ternary) butane, 1,4-dibromo- + hydrogen bromide Butane, 1,4-dibromo- + hydrogen bromide Butane, 1,1'-oxybis- + hydrogen chloride Butane, 1,1'-oxybis (3-methyl- + hydrogen chloride Butane, 1,1'-oxybis (3-methyl- + hydrogen chloride Butane, 1-bromo- + hydrogen chloride Butane, 1-chloro- + hydrogen chloride Butane, 1-chloro- + hydrogen chloride Butane, 1-ethoxy- Butane, 1-ethoxy- + hydrogen chloride Butane, 1-methoxy- Butane, 1-propoxy- + hydrogen chloride Butane, 1,1'-sulforybis- + hydrogen chloride Butane, 1,1'-sulforybis- + hydrogen chloride Butane, 1,1'-thiobis- + hydrogen chloride 1,3-Butanediol Butanethiol Butanethiol Butanethiol Butanei cacid, ethyl ester + hydrogen chloride Butanoic acid, propen chloride + hydrogen chlori</pre> | 1,3-Butadiene, 2,3-dimethyl- |
| <pre>hydrogen chloride Butane + hydrogen bromide Butane (ternary) + hydrogen bromide Butane, 1,4-dibromo-</pre> | |
| <pre>+ hydrogen bromide Butane (ternary) + hydrogen bromide Butane, 1,4-dibromo- + hydrogen bromide Butane, 1,1'-oxybis- + hydrogen chloride Butane, 1,1'-oxybis (3-methyl- + hydrogen chloride Butane, 1,1'-oxybis (3-methyl- + hydrogen chloride Butane, 1,1'-oxybis (3-methyl- + hydrogen chloride + hydrogen chloride + hydrogen chloride Butane, 1-bromo- + hydrogen chloride Butane, 1-chloro- + hydrogen chloride Butane, 1-ethoxy- Butane, 2-ethoxy- + hydrogen chloride Butane, 1-methoxy- + hydrogen chloride Butane, 1-propoxy- + hydrogen chloride Butane, 1,1'-sulfonylbis- + hydrogen chloride Butane, 1,1'-thiobbis- Hydrogen chloride 1,3-Butanediol + hydrogen chloride Butanethiol + hydrogen chloride Butanethiol + hydrogen chloride Butanethiol + hydrogen chloride Butanethiol + hydrogen chloride Butanoic acid, ethyl ester + hydrogen chloride Butanoic acid, propyn] ester + hydrogen chloride 1-Butanol + hydrogen chloride - hydrogen chloride - hydrogen chloride - hydrogen chloride + hydrogen chloride - hydrogen chloride + hydrogen chloride - hydrogen chloride + hydrogen chloride - hydrogen chloride - hydrogen chloride + hydrogen chloride - hydrogen chloride - hydrogen chloride - hydrogen chloride - hydrogen chloride - hydrogen chloride - Butanol, 3-methyl- + hydrogen chloride - Butanol, 3-methyl- + hydrogen chloride - Butanol, 3-methyl- + hydrogen chloride - Butanol, 3-methyl- + hydrogen chloride - Buta</pre> | + hydrogen chloride |
| <pre>hydrogen bromide Butane, 1,4-dibromo-</pre> | + hydrogen bromide |
| <pre>+ hydrogen bromide Butane 1,1'-oxybis- + hydrogen chloride + hydrogen chloride Butane, 1,1'-oxybis (famethyl- + hydrogen chloride Butane, 1-bromo- + hydrogen chloride + hydrogen chloride Butane, 1-chloro- + hydrogen chloride Butane, 1-chloro- + hydrogen chloride Butane, 1-chloro- + hydrogen chloride Butane, 1-ethoxy- Butane, 2-ethoxy- Butane, 1-methoxy- + hydrogen chloride Butane, 1-forpopxy- Butane, 1,1'-sulfonylbis- + hydrogen chloride Butane, 1,1'-sulfonylbis- + hydrogen chloride 1,3-Butanediol + hydrogen chloride Butanethiol + hydrogen chloride butanethiol + hydrogen chloride butanethiol + hydrogen chloride butanethiol + hydrogen chloride butanethiol + hydrogen chloride butanethiol + hydrogen chloride Butanoic acid, ethyl ester + hydrogen chloride Butanoic acid, propenyl ester + hydrogen chloride 1-Butanol + hydrogen chloride 1-Butanol, 2-methyl- + hydrogen chloride 1-Butanol, 3-methyl- + hydrogen chloride - Butanoic, 3-methyl- + hydrogen chloride + hydrogen chloride - Butanoi, 3-methyl- + hydrogen chloride</pre> | + hydrogen bromide |
| <pre>hydrogen chloride hydrogen bromide Butane, 1,1'-oxybis (ternary) hydrogen chloride Butane, 1,1'-oxybis (3-methyl- hydrogen chloride hydrogen chloride hydrogen chloride hydrogen chloride hydrogen chloride hydrogen chloride hydrogen chloride butane, 1-chloro- hydrogen chloride Butane, 1-ethoxy- hydrogen chloride Butane, 1-methoxy- hydrogen chloride Butane, 1-propoxy- hydrogen chloride Butane, 1,1'-sulfonylbis- hydrogen chloride Butane, 1,1'-thiobis- hydrogen chloride 1,3-Butanediol hydrogen chloride Butanethiol butanethiol butanethiol hydrogen chloride butanethiol hydrogen chloride butanethiol hydrogen chloride butanethiol hydrogen chloride butanoic acid, ethyl ester hydrogen chloride butanoic acid, propyl ester hydrogen chloride hydrogen ch</pre> | + hydrogen bromide |
| Butane, 1,1'-oxybis - (ternary) + hydrogen chloride Butane, 1,1'-oxybis (3-methyl- + hydrogen chloride + hydrogen chloride + hydrogen chloride + hydrogen chloride Butane, 1-chloro- + hydrogen chloride Butane, 1-ethoxy- Butane, 1-methoxy- + hydrogen chloride Butane, 1-methoxy- + hydrogen chloride Butane, 1-propoxy- + hydrogen chloride Butane, 1,1'-sulfonylbis- + hydrogen chloride Butane, 1,1'-sulfonylbis- + hydrogen chloride Butane, 1,1'-thiobis- + hydrogen chloride 1,3-Butanediol 4,4-Butanediol + hydrogen chloride Butanethiol Butanoic acid, ethyl ester + hydrogen chloride Butanoic acid, propnyl ester + hydrogen chloride 1-Butanol + hydrogen chloride + h | + hydrogen chloride |
| Butane, 1,1'-oxybis (3-methyl- + hydrogen chloride + hydrogen chloride + hydrogen chloride + hydrogen chloride + hydrogen chloride Butane, 1-chloro- + hydrogen chloride Butane, 1-ethoxy- Butane, 2-ethoxy- + hydrogen chloride Butane, 1-methoxy- + hydrogen chloride Butane, 1-propoxy- + hydrogen chloride Butane, 1,1'-sulfonylbis- + hydrogen chloride Butane, 1,1'-thiobis- Butane, 1,1'-thiobis- + hydrogen chloride 1,3-Butanediol + hydrogen chloride 2,3-Butanediol + hydrogen chloride Butanethiol Butanoic acid Butanoic acid, ethyl ester + hydrogen chloride Butanoic acid, gropenyl ester + hydrogen chloride Butanoic acid, propynyl ester + hydrogen chloride 1-Butanol + hydrogen chloride + hydrog | |
| <pre>+ hydrogen chloride + hydrogen fluoride + hydrogen chloride + hydrogen chloride + hydrogen chloride Butane, 1-chloro- + hydrogen chloride Butane, 1-ethoxy- + hydrogen chloride Butane, 1-methoxy- + hydrogen chloride Butane, 1-methoxy- + hydrogen chloride Butane, 1-propoxy- + hydrogen chloride Butane, 1,1'-sulfonylbis- + hydrogen chloride Butane, 1,1'-thiobis- + hydrogen chloride 1,3-Butanediol + hydrogen chloride 1,4-Butanediol + hydrogen chloride Butanethiol + hydrogen chloride butanethiol + hydrogen chloride + hydrogen chloride butanoic acid Butanoic acid, ethyl ester + hydrogen chloride Butanoic acid, propeyl ester + hydrogen chloride Butanoic acid, propyl ester + hydrogen chloride 1-Butanol + hydrogen chloride 1-Butanol, 2-methyl- + hydrogen chloride + hydrogen chloride - Butanol, 3-methyl- + hydrogen chloride - But</pre> | + hydrogen chloride |
| Butane, 1-bromo- + hydrogen chloride + hydrogen iodide Butane, 1-chloro- + hydrogen chloride Butane, 1-ethoxy- Butane, 2-ethoxy- + hydrogen chloride Butane, 1-methoxy- Butane, 1-propoxy- + hydrogen chloride Butane, 1,1'-sulfonylbis- + hydrogen chloride Butane, 1,1'-thiobis- + hydrogen chloride Butane, 1,1'-thiobis- + hydrogen chloride 1,3-Butanediol 1,4-Butanediol + hydrogen chloride Butanethiol Butanoic acid Butanoic acid, ethyl ester + hydrogen chloride Butanoic acid, groepnyl ester + hydrogen chloride Butanoic acid, propenyl ester + hydrogen chloride Butanoic acid, propenyl ester + hydrogen chloride Butanoic acid, propenyl ester + hydrogen chloride Butanoic acid, propyl ester + hydrogen chloride Butanoic acid, propynyl ester + hydrogen chloride Butanoic acid, propynyl ester + hydrogen chloride Butanoic acid, propynyl ester + hydrogen chloride 1-Butanol, 2-methyl- + hydrogen chloride + hydrogen chloride | |
| <pre>+ hydrogen chloride + hydrogen iodide = hydrogen chloride + hydrogen chloride = butanoic acid, propyl ester = hydrogen chloride = butanoic acid, propyl ester = hydrogen chloride = butanoic acid, propyl ester = hydrogen chloride = hydrogen chloride = butanoic acid, propyl ester = hydrogen chloride = butanoic acid, propyl ester = hydrogen chloride = hydrogen chloride = hydrogen chloride = hydrogen iodide 1-Butanol = hydrogen chloride = hydrogen iodide 1-Butanol, 2-methyl= = hydrogen chloride = hydr</pre> | |
| Butane, 1-chloro- + hydrogen chloride + hydrogen chloride Butane, 1-ethoxy- Butane, 2-ethoxy- + hydrogen chloride Butane, 1-methoxy- + hydrogen chloride Butane, 1.propoxy- + hydrogen chloride Butane, 1,1'-sulfonylbis- + hydrogen chloride Butane, 1,1'-thiobis- + hydrogen bromide + hydrogen chloride 1,3-Butanediol + hydrogen chloride 2,3-Butanediol + hydrogen chloride Butanethiol + hydrogen chloride Butanoic acid Butanoic acid, ethyl ester + hydrogen chloride Butanoic acid, propyl ester + hydrogen chloride 1-Butanol, 2-methyl- + hydrogen chloride 1-Butanol, 3-methyl-, carbonate | + hydrogen chloride |
| <pre>+ hydrogen iodide Butane, 1-ethoxy- Butane, 2-ethoxy- + hydrogen chloride Butane, 1-methoxy- Butane, 1-propoxy- + hydrogen chloride Butane, 1,1'-sulfonylbis- + hydrogen chloride Butane, 1,1'-thiobis- + hydrogen bromide + hydrogen chloride 1,3-Butanediol + hydrogen chloride 1,4-Butanediol + hydrogen chloride Butanethiol + hydrogen chloride Butanoic acid Butanoic acid, ethyl ester + hydrogen chloride Butanoic acid, gropenyl ester + hydrogen chloride Butanoic acid, propenyl ester + hydrogen chloride Butanoic acid, propenyl ester + hydrogen chloride Butanoic acid, propynyl ester + hydrogen chloride 1-Butanol + hydrogen chloride 1-Butanol, 3-methyl- + hydrogen chloride 1-Butanol, 3-methyl-, carbonate</pre> | Butane, 1-chloro- |
| <pre>+ hydrogen chloride Butane, 2-ethoxy- Butane, 1-methoxy- Butane, 1-propoxy- + hydrogen chloride Butane, 1,1'-sulfonylbis- + hydrogen chloride Butane, 1,1'-thiobis- + hydrogen chloride Butane, 1,1'-thiobis- + hydrogen bromide + hydrogen chloride 1,3-Butanediol + hydrogen chloride 2,3-Butanediol Butanethiol + hydrogen chloride Butanoic acid Butanoic acid, ethyl ester + hydrogen chloride Butanoic acid, gropenyl ester + hydrogen chloride Butanoic acid, propenyl ester + hydrogen chloride Butanoic acid, propenyl ester + hydrogen chloride Butanoic acid, propynyl ester + hydrogen chloride 1-Butanol, 2-methyl- + hydrogen chloride 1-Butanol, 3-methyl- + hydrogen chloride 1-Butanol, 3-methyl-, carbonate</pre> | + hydrogen iodide |
| <pre>+ hydrogen chloride Butane, 1-methoxy- + hydrogen chloride Butane, 1,1'-sulfonylbis- + hydrogen chloride Butane, 1,1'-thiobis- + hydrogen bromide + hydrogen bromide + hydrogen chloride 1,3-Butanediol + hydrogen chloride 2,3-Butanediol + hydrogen chloride Butanethiol + hydrogen chloride Butanoic acid Butanoic acid, ethyl ester + hydrogen chloride Butanoic acid, gropenyl ester + hydrogen chloride Butanoic acid, propenyl ester + hydrogen chloride Butanoic acid, propenyl ester + hydrogen chloride Butanoic acid, propenyl ester + hydrogen chloride Butanoic acid, propynyl ester + hydrogen chloride 1-Butanol, 2-methyl- + hydrogen chloride 1-Butanol, 3-methyl-, carbonate</pre> | |
| Butane, 1-methoxy- + hydrogen chloride Butane, 1-propoxy- + hydrogen chloride Butane, 1,1'-sulfonylbis- + hydrogen chloride Butane, 1,1'-thiobis- + hydrogen bromide + hydrogen chloride 1,3-Butanediol + hydrogen chloride 1,4-Butanediol + hydrogen chloride 2,3-Butanediol + hydrogen chloride Butanethiol + hydrogen chloride Butanoic acid Butanoic acid, ethyl ester + hydrogen chloride Butanoic acid, 3-methyl- + hydrogen chloride Butanoic acid, propyl ester + hydrogen chloride 1-Butanol + hydrogen chloride + hydroge | |
| Butane, 1-propoxy- + hydrogen chloride Butane, 1,1'-sulfonylbis- + hydrogen chloride Butane, 1,1'-thiobis- + hydrogen bromide + hydrogen bromide + hydrogen chloride 1,3-Butanediol + hydrogen chloride 2,3-Butanediol + hydrogen chloride Butanethiol + hydrogen chloride Butanoic acid + hydrogen chloride Butanoic acid, ethyl ester + hydrogen chloride Butanoic acid, 3-methyl- + hydrogen chloride Butanoic acid, propyl ester + hydrogen chloride 1-Butanol + hydrogen chloride 1-Butanol, 2-methyl- + hydrogen chloride 1-Butanol, 3-methyl-, carbonate | Butane, 1-methoxy- |
| <pre>+ hydrogen chloride Butane, 1,1'-sulfonylbis- + hydrogen chloride Butane, 1,1'-thiobis- + hydrogen bromide + hydrogen iodide 1,3-Butanediol + hydrogen chloride 1,4-Butanediol + hydrogen chloride 2,3-Butanediol + hydrogen chloride Butanethiol + hydrogen bromide + hydrogen chloride Butanoic acid Butanoic acid, ethyl ester + hydrogen chloride Butanoic acid, propenyl ester + hydrogen chloride Butanoic acid, propyl ester + hydrogen chloride 1-Butanol + hydrogen chloride 1-Butanol, 2-methyl- + hydrogen chloride 1-Butanol, 3-methyl- + hydrogen chloride + hydr</pre> | |
| <pre>+ hydrogen chloride Butane, 1,1'-thiobis-</pre> | + hydrogen chloride |
| <pre>+ hydrogen bromide + hydrogen iodide 1,3-Butanediol 1,4-Butanediol 2,3-Butanediol butanethiol + hydrogen chloride Butanethiol + hydrogen chloride + hydrogen chloride Butanoic acid Butanoic acid, ethyl ester + hydrogen chloride Butanoic acid, 3-methyl- + hydrogen chloride Butanoic acid, propenyl ester + hydrogen chloride Butanoic acid, propyl ester + hydrogen chloride 1-Butanol + hydrogen chloride 1-Butanol, 2-methyl- + hydrogen chloride 1-Butanol, 3-methyl-, carbonate</pre> | + hydrogen chloride |
| <pre>+ hydrogen iodide 1,3-Butanediol 1,4-Butanediol 2,3-Butanediol butanethiol + hydrogen chloride Butanethiol + hydrogen chloride + hydrogen chloride Butanoic acid Butanoic acid, ethyl ester + hydrogen chloride Butanoic acid, a-methyl- + hydrogen chloride Butanoic acid, propenyl ester + hydrogen chloride Butanoic acid, propyl ester + hydrogen chloride 1-Butanol + hydrogen chloride 1-Butanol, 2-methyl- + hydrogen chloride 1-Butanol, 3-methyl-, carbonate</pre> | Butane, 1,1 -thiodis- |
| <pre>+ hydrogen chloride 1,4-Butanediol 2,3-Butanediol Butanethiol + hydrogen chloride Butanoic acid Butanoic acid, ethyl ester + hydrogen chloride Butanoic acid, gropenyl ester + hydrogen chloride Butanoic acid, propenyl ester + hydrogen chloride Butanoic acid, propyl ester + hydrogen chloride Butanoic acid, propynyl ester + hydrogen chloride 1-Butanol + hydrogen chloride 1-Butanol, 2-methyl- + hydrogen chloride 1-Butanol, 3-methyl-, carbonate</pre> | + hydrogen iodide |
| <pre>+ hydrogen chloride 2,3-Butanediol Butanethiol + hydrogen chloride + hydrogen bromide + hydrogen chloride Butanoic acid Butanoic acid, ethyl ester + hydrogen chloride Butanoic acid, ethyl ester + hydrogen chloride Butanoic acid, propenyl ester + hydrogen chloride Butanoic acid, propyl ester + hydrogen chloride Butanoic acid, propyl ester + hydrogen chloride Butanoic acid, propynyl ester + hydrogen chloride 1-Butanol + hydrogen chloride 2-Butanol + hydrogen chloride 1-Butanol, 2-methyl- + hydrogen chloride 1-Butanol, 3-methyl-, carbonate</pre> | + hydrogen chloride |
| + hydrogen chloride Butanethiol + hydrogen bromide + hydrogen chloride + hydrogen chloride Butanoic acid Butanoic acid, ethyl ester + hydrogen chloride Butanoic acid, 3-methyl- + hydrogen chloride Butanoic acid, propyl ester + hydrogen chloride Butanoic acid, propynyl ester + hydrogen chloride Butanoic acid, propynyl ester + hydrogen chloride 1-Butanol 2-Butanol + hydrogen chloride + hydrogen chloride 1-Butanol, 3-methyl- + hydrogen chloride - Butanol, 3-methyl-, carbonate | + hydrogen chloride |
| <pre>+ hydrogen bromide + hydrogen chloride + hydrogen iodide Butanoic acid Butanoic acid, ethyl ester + hydrogen chloride Butanoic acid, 3-methyl- + hydrogen chloride Butanoic acid, propenyl ester + hydrogen chloride Butanoic acid, propyl ester + hydrogen chloride Butanoic acid, propynyl ester + hydrogen chloride 1-Butanol 2-Butanol + hydrogen chloride + hydrogen iodide 1-Butanol, 2-methyl- + hydrogen chloride 1-Butanol, 3-methyl-, carbonate</pre> | + hydrogen chloride |
| <pre>+ hydrogen iodide Butanoic acid Butanoic acid, ethyl ester + hydrogen chloride Butanoic acid, ethyl ester + hydrogen chloride Butanoic acid, propenyl ester + hydrogen chloride Butanoic acid, propyl ester + hydrogen chloride Butanoic acid, propynyl ester + hydrogen chloride 1-Butanol + hydrogen chloride 2-Butanol + hydrogen chloride 1-Butanol, 2-methyl- + hydrogen chloride 1-Butanol, 3-methyl-, carbonate</pre> | + hydrogen bromide |
| Butanoic acid + hydrogen chloride Butanoic acid, ethyl ester + hydrogen chloride Butanoic acid, 3-methyl- + hydrogen chloride Butanoic acid, propyl ester + hydrogen chloride Butanoic acid, propynyl ester + hydrogen chloride 1-Butanol 2-Butanol + hydrogen chloride + hydrogen chloride + hydrogen chloride + hydrogen chloride + hydrogen chloride + hydrogen chloride 1-Butanol, 2-methyl- + hydrogen chloride 1-Butanol, 3-methyl- + hydrogen chloride 1-Butanol, 3-methyl-, carbonate | + hydrogen chloride |
| <pre>+ hydrogen chloride Butanoic acid, ethyl ester + hydrogen chloride Butanoic acid, 3-methyl- + hydrogen chloride Butanoic acid, propenyl ester + hydrogen chloride Butanoic acid, propynyl ester + hydrogen chloride 1-Butanol 2-Butanol + hydrogen chloride + hydrogen chloride + hydrogen iodide 1-Butanol, 2-methyl- + hydrogen chloride 1-Butanol, 3-methyl-, carbonate</pre> | |
| <pre>+ hydrogen chloride Butanoic acid, 3-methyl-</pre> | + hydrogen chloride |
| <pre>+ hydrogen chloride Butanoic acid, propenyl ester + hydrogen chloride Butanoic acid, propyl ester + hydrogen chloride Butanoic acid, propynyl ester + hydrogen chloride 1-Butanol 2-Butanol + hydrogen chloride + hydrogen iodide 1-Butanol, 2-methyl- + hydrogen chloride 1-Butanol, 3-methyl- + hydrogen chloride 1-Butanol, 3-methyl-, carbonate</pre> | + hydrogen chloride |
| <pre>+ hydrogen chloride Butanoic acid, propyl ester + hydrogen chloride Butanoic acid, propynyl ester + hydrogen chloride 1-Butanol 2-Butanol + hydrogen chloride + hydrogen iodide 1-Butanol, 2-methyl- + hydrogen chloride 1-Butanol, 3-methyl- + hydrogen chloride 1-Butanol, 3-methyl-, carbonate</pre> | |
| Butanoic acid, propyl ester + hydrogen chloride Butanoic acid, propynyl ester + hydrogen chloride 1-Butanol 2-Butanol + hydrogen chloride + hydrogen iodide 1-Butanol, 2-methyl- + hydrogen chloride 1-Butanol, 3-methyl- + hydrogen chloride 1-Butanol, 3-methyl-, carbonate | |
| Butanoic acid, propynyl ester + hydrogen chloride 1-Butanol 2-Butanol + hydrogen chloride + hydrogen iodide 1-Butanol, 2-methyl- + hydrogen chloride 1-Butanol, 3-methyl- + hydrogen chloride 1-Butanol, 3-methyl-, carbonate | Butanoic acid, propyl ester |
| 1-Butanol + hydrogen chloride 2-Butanol + hydrogen chloride + hydrogen iodide 1-Butanol, 2-methyl- + hydrogen chloride 1-Butanol, 3-methyl- + hydrogen chloride 1-Butanol, 3-methyl-, carbonate | Butanoic acid, propynyl ester |
| 2-Butanol + hydrogen chloride + hydrogen iodide 1-Butanol, 2-methyl- + hydrogen chloride 1-Butanol, 3-methyl- + hydrogen chloride 1-Butanol, 3-methyl-, carbonate | 1-Butanol |
| + hydrogen chloride + hydrogen iodide 1-Butanol, 2-methyl- + hydrogen chloride 1-Butanol, 3-methyl- + hydrogen chloride 1-Butanol, 3-methyl-, carbonate | |
| 1-Butanol, 2-methyl- + hydrogen chloride 1-Butanol, 3-methyl- + hydrogen chloride 1-Butanol, 3-methyl-, carbonate | + hydrogen chloride |
| + hydrogen chloride 1-Butanol, 3-methyl- + hydrogen chloride 1-Butanol, 3-methyl-, carbonate | + hydrogen iodide 1-Butanol, 2-methyl- |
| + hydrogen chloride 1-Butanol, 3-methyl-, carbonate | + hydrogen chloride |
| | + hydrogen chloride |
| | |

E41, E42, 51 E41, E42, 50 E383, E384, 392 E383, E384, 399 E389, E390, 429 E150-E155, 160, 168 E389, 428 E21, E22, 25 E150-E155, 161, 168, 178, 179 E1, 5 E241, 276 E437, E438, 445 E240, E241, 268 E437, E438, 444 E150-E155, 176, 177 E150-E155, 158 E150-E155, 167, 173-175 E150-E155, 159 E330, E331, 333 E390, 434 E438, 449 E138, 139, 143 E138, 139, 144 E138, 139, 144 E390, 434 E330, E331, 334 E438, 449 E196, 198 E207-E209, 213 E196, 198 E209, 220 E209, 220 E209, 220 E78-E93, 98, 106, 108, 111, 114 E78-E93, 98, 109 E78-E93, 99 E78-E93, 115 E208, 234

System Index

2-Butenoic acid, ethyl ester E209, 219 + hydrogen chloride 2-Buten-1-ol E133, 134, 135 + hydrogen chloride 3-Buten-1-ol E133, 134, 136 + hydrogen chloride 2-Buten-1-ol acetate E209, 219 + hydrogen chloride Butoxydichloroborane see borane, butoxydichloro-Butyl acetate see acetic acid, butyl ester Butyl benzenesulfonate see benzenesulfonic acid, butyl ester Butyl p-chlorobenzenesulfonate see benzenesulfonic acid, 4-chloro-, butyl ester Butyl chloroformate see carbonochloridic acid, butyl ester Butyl chlorosulfate see chlorosulfuric acid, butyl ester Butyl ethanesulfonate see ethanesulfonic acid, butyl ester 2-Butyl ethyl ether see butane, 2-buty1-Butyl phenyl ether see benzene, butoxy-Butyl propyl ether see butane, 1-propoxy-Butyl methanesulfonate see methanesulfonic acid, butyl ester Butyl p-toluenesulfonate see benzenesulfonic acid, 4-methyl-, butyl ester tert-Butylbenzene see benzene, (2-methylpropyl)-Butylbromide see butane, 1-bromo-Butylchloride see butane, 1-choro-1,3-Butylene glycol see 1,3-butanediol 2,3-Butylene glycol see 2,3-butanediol 1-Butylmercaptan see 1-butanethiol Butyric acid see butanoic acid 3-Butyn-1-ol E133, 134, 135 + hydrogen chloride 3-Butyn-2-ol E133, 134, 135 + hydrogen chloride Carbon disulfide + hydrogen chloride E330, E331, 341 Carbon tetrachloride see methane, tetrachloro-Carbonochloridic acid, butyl ester E208, 227 hydrogen chloride Carbonochloridic acid, ethyl ester + hydrogen chloride E208, 221, 224 Carbonochloridic acid, hexyl ester hydrogen chloride E208, 229 Carbonochloridic acid, propyl ester E208, 221, 225 + hydrogen chloride Chloroacetic acid see acetic acid, chloro-Chlorobenzene see benzene, chloro-Chlorobutane see butane, 1-chloro-2-Chloroethanol see ethanol, 2-chloro-Chloroform see methane, trichloro-

```
1-Chlorohexadecane
                   see hexadecane, 1-chloro-
1-Chlorohexane
                   see hexane, 1-chloro-
1-Chloro-2-propanol
                   see 2-propanol, 1-chloro-
1-Chloro-octane
                   see octane, 1-chloro-
Crotyl acetate
               see 2-buten-1-ol acetate
Cumene
                   see benzene, (1-methylethyl)-
Cyclic ethylene butyl borate
               see 1,3,2-dioxaborolane, 2-butoxy-
Cyclic o-phenylene butyl borate
               see 1,3,2-benzodioxaborole, 2-butoxy-
Cyclic o-phenylene ethyl borate
               see 1,3,2-benzodioxaborole, 2-ethoxy-
Cyclic o-phenylene methyl borate
               see 1,3,2-benzodioxaborole, 2-methoxy-
Cyclic o-phenylene octyl borate
               see 1,3,2-benzodioxaborole, 2-octyloxy-
Cyclic o-phenylene pentyl borate
               see 1,3,2-benzodioxaborole, 2-pentyloxy-
Cyclic o-phenylene propyl borate
               see 1,3,2-benzodioxaborole, 2-propoxy-
Cyclohexane
                                                      E41, E42, 44-46
                    + hydrogen chloride
Cyclohexanol
                    + hydrogen chloride
                                                      E145, 146
Cyclohexanol, 2-methyl-
                    + hydrogen chloride
                                                      E145, 146
Cyclohexene (ternary)
                    + hydrogen chloride
Decane
                    + hydrogen bromide
                                                      E383, 397,
                                                                 398
                                                     E9-E11, 19
                    + hydrogen chloride
1-Decanol
                    + hydrogen bromide
                                                      E385, E387, 414
                                                      E78-E93, 117, 119,
                    + hydrogen chloride
                                                      123
Dibenzyl ether
                   see benzene, 1,1'-[oxybis (methylene)]bis-
1,2-Dibromoethane
                    see ethane, 1,2-dibromo-
1,2-Dibromo-2-propanol
                    see 2-propanol, 1,2-dibromo-
1,3-Dibromo-2-propanol
                   see 2-propanol, 1,3-dibromo-
Dibutyl ether
                   see butane, 1,1'-oxybis-
Dibutyl sulfide
               see butane, 1,1-thiobis-
Dibutyl sulfone
               see butane, 1,1'-sulfonylbis-
1,2-Dichloroethane
                   see ethane, 1,2-dichloro-
\alpha\beta-Dichloroethyl ether
               see ethane, 1-chloro-1-(2-chloroethoxy)-
BB'-Dichloroethyl ether
               see ethane, 1,1'-oxybis[2-chloro-
2,2-Dichloroethyl ether
                    see ethane, 1,1-oxybis (2-chloro-
1,1-Dichloro-3-hydroxypropane
                   see 1-propanol, 3,3-dichloro-
Dichloromethane
                   see methane, dichloro-
Dichloromethyl ether
               see methane oxybis[chloro-
Dichlorophenylborane
               see borane, dichlorophenyl-
γγ'-Dichloropropyl ether
               see propane, 1,1'-oxybis[3-chloro-
```

Diethyl ether see ethane, 1,1-oxybis-Diethyl sulfide see ethane, 1,1-thiobis-Diheptyl ether see heptane, 1,1'-oxybis-Dihexyl ether see hexane, 1,1'-oxybis-Diisoamyl ether see butane, 1,1'-oxybis[3-methyl-Diisopropyl sulfide see propane, 2,2'-thiobis-Dissopropyl sulfone see propane, 2,2'-sulfonylbis-Dissopentyl ether see butane, 1,1'-oxybis (3-methyl-Diphenyl sulfide see benzene, 1,1'-thiobis-Dipropyl sulfone see propane, 1,1'-sulfonylbis-1,2-Dimethylbenzene see benzene, 1,2-dimethy1-1,3-Dimethylbenzene see benzene, 1,3-dimethyl-1,4-Dimethylbenzene see benzene, 1,4-dimethyl-2,3-Dimethyl-1,3-butadiene see 1,3-butadiene, 2,3-dimethyl-Dioctyl ether see octane, 1,1'-oxybis-1,3,2-Dioxaborolane, 2-butoxy-+ hydrogen chloride E342, 346 1,4-Dioxane E150-E155, 171, 189 + hydrogen chloride 1,4-Dioxane (ternary) + hydrogen chloride E21, E22, 26 Dipentyl ether see pentane, 1,1'-oxybis-Diphenyl ether see benzene, 1,1'-oxybis-Dipropyl ether see propane, 1,1'-oxybis-Dodecane + hydrogen chloride E9, E11, 13 Dodecane, 1-chloro-+ hydrogen chloride E240, E241, 271 1-Dodecanol E385, E387, 415 + hydrogen bromide E78-E93, 124 + hydrogen chloride Ethane, bromo-E241, 274 E437, E438, 444 + hydrogen chloride + hydrogen iodide Ethane, 1-chloro-1-(2-chloroethoxy)-+ hydrogen chloride E150-155, 172 Ethane, 1,2-dibromo-E389, E390, 429 E241, 274, 275 + hydrogen bromide + hydrogen chloride Ethane, 1,1-dichloro-E240, 259, 260 hydrogen chloride Ethane, 1,2-dichloro-E389, E390, 425 E236, E239, E240, + hydrogen bromide + hydrogen chloride E242, 256-258, 261-263 Ethane, 1-iodo-+ hydrogen iodide E437, E438, 445 Ethane, 1-methoxy-E150-E155, 156 + hydrogen chloride Ethane, 1,1'-oxybis-+ hydrogen chloride E150-E155, 157, 164-166 Ethane, 1,1'-oxybis- (ternary) + hydrogen chloride E21, E22, 23, E54, 73

| Ethane, 1,1'-oxybis(2-chloro- + hydrogen chloride | E150-E155, 172, 187, |
|---|---|
| Ethane, 1,1'-oxybis(2-chloro-, (ternary) | 188 |
| + hydrogen chloride Ethane, pentachloro- | E21, E22, 26 |
| + hydrogen chloride Ethane, 1,1,2,2-tetrabromo- | E240, E242, 256, 267 |
| + hydrogen chloride Ethane, 1,1,2,2-tetrachloro- | E241, 274 |
| + hydrogen chloride | E240, E242, 256, 258, 265, 266 |
| Ethane, 1,1-thiobis-, (ternary) + hydrogen chloride | E21, E22, 33 |
| Ethane, 1,1,1-triethoxy- + hydrogen chloride | E150-E155, 190 |
| 1,2-Ethanediol + hydrogen chloride | E138, E139, 140-142 |
| + hydrogen fluoride Ethanesulfonic acid, butyl ester | E1, 5 |
| + hydrogen chloride | E330, E331, 333 |
| Ethanesulfonyl chloride + hydrogen chloride | E330, E331, 332 |
| Ethanol | E385, 411 |
| + hydrogen bromide + hydrogen chloride | E385, 417 E78-E93, 95-97, 101, 104, 105 |
| Ethanol, 2-bromo- + hydrogen chloride | E127, 129 |
| Ethanol, 2-chloro- + hydrogen bromide | E387, 418 |
| + hydrogen chloride | E127, 128, 129 |
| Ethanol, 2,2-dichloro- + hydrogen bromide | E387, 417 |
| Ethanol, phenyl- + hydrogen chloride | E145, 148 |
| Ethanol, 2,2,2-trichloro- | · |
| + hydrogen bromide + hydrogen chloride | E387, 419, 420 E127, 131, 132 |
| Ethanol, 2,2,2-trichloro-, phosphite + hydrogen chloride | E342, 364 |
| Ethanol, 2,2,2-trifluoro- | E127, 131 |
| + hydrogen chloride Ethanol, 2,2,2-trichloro-, acetate | |
| + hydrogen chloride Ethene, chloro- | E209, 223 |
| + hydrogen chloride Ethene, tetrachloro- | E241, 281-283 |
| + hydrogen chloride Ethene, tetrachloro-, (ternary) | E241, 286, 288 |
| + hydrogen chloride | E54, 72 |
| Ethene, trichloro- + hydrogen chloride | E241, 258, 286, 287 |
| Ethyl acetate see acetic acid, ethyl ester | |
| Ethyl bromoacetate see acetic acid, ethyl ester | |
| Ethyl butanoate see butanoic acid, ethyl ester | |
| Ethyl butyl ether see butane, 1-ethoxy- | |
| Ethyl butylrate see butanoic acid, ethyl ester | |
| Ethyl chloroformate see carbonochloridic acid ethyl e | |
| Ethyl crotonate see 2-butenoic acid, ethyl ester | |
| Ethyl dichloroacetate | |
| see acetic acid, dichloro-, ethyl Ethyl formate | lester |
| see formic acid, ethyl ester Ethyl nitrate | |
| see nitric acid, ethyl ester | |

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System Index
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Ethyl phenyl ether see benzene, ethoxy-Ethyl propanoate see propanoic acid, ethyl ester Ethyl propionate see propanoic acid, ethyl ester Ethyl sec-butyl ether see butane, 2-ethoxy-Ethyl trichloroacetate see acetic acid, trichloro-, ethyl ester Ethylbenzene see benzene, ethyl-Ethylene dichloride see ethane, 1,2-dichloro-Ethylene glycol see 1,2-ethanediol Fluorobenzene see benzene, fluoro-Fluorosulfuric acid + hydrogen fluoride E1, 6 Formic acid + hydrogen chloride E196, 197 Formic acid, ethyl ester + hydrogen chloride E207-E209, 210 Furan, tetrahydro-+ hydrogen chloride E150-E155, 171 Furan, tetrahydro-, (ternary) + hydrogen chloride E21, E22, 30 Glycerol see 1,2,3-propanetriol Hemimellitene see benzene, 1,2,3-trimethyl-Heptane E383, E384, 395 + hydrogen bromide + hydrogen chloride E7-E11, 12, 17, 18, 40 Heptane (ternary) E21, E22, 23-40, E54, + hydrogen chloride E55, 70 Heptane, 1,1'-oxybis-+ hydrogen chloride E150-E155, 162 Heptane, 1-methoxy-+ hydrogen chloride E150-E155, 159 1-Heptanol E385, E387, 414 + hydrogen bromide E78-E93, 117, 119 + hydrogen chloride 4-Heptanol + hydrogen chloride E78-E93, 100 3-Hepten-1-ol + hydrogen chloride E133, 134, 137 1-Heptoxyoctane see octane, 1-heptoxy-Heptyl methyl ether see heptane, 1-methoxy-Hexadecane + hydrogen chloride E8-E11, 13, 20 Hexadecane, 1-chloro-+ hydrogen chloride E240, E241, 272, 273 1-Hexadecanol + hydrogen bromide E385, E387, 415 + hydrogen chloride E78~E93, 126 1-Hexadecene E41, E42, 52 + hydrogen chloride Hexane E383, 393, 394 + hydrogen bromide + hydrogen chloride E7-E11, 12-16 Hexane (ternary) E383, E384, 400 + hydrogen bromide Hexane, 1-bromo-E389, 428 E241, 277 + hydrogen bromide + hydrogen chloride

| Hexane, 1-chloro- | + hydrogen chloride | E240, E241, 269 |
|---------------------|---|----------------------------------|
| Hexane, 1,6-dibrom | o- + hydrogen bromide | E389, E390, 429 |
| Hexane, 1-methoxy- | + hydrogen chloride | E150-E155, 159 |
| Hexane, 1,1'-oxybi: | s- + hydrogen chloride | E150-E155, 162 |
| Hexane, 1-pentoxy- | + hydrogen chloride | E150-E155, 161 |
| 1-Hexanol | + hydrogen bromide | E385, E387, 413 |
| | + hydrogen chloride | E78-E93, 113, 116, 118 |
| 1-Hexanol, 3,5,5-t | rimethyl- + hydrogen chloride | E78-E93, 100 |
| Hexanoic acıd | + hydrogen bromide | E388, 423 |
| | + hydrogen chloride + hydrogen iodide | E196, 204 E438, 443 |
| 3-Hexen-1-ol | + hydrogen chloride | E133, 134, 137 |
| Hexylbromide | see hexane, 1-bromo- | 121 124 121 |
| Hexylchloride | | |
| Hexyl chloroformate | | |
| Hexyl methyl ether | see carbonochloridic acid, hexyl | ester |
| Hydroxybenzene | see hexane, 1-methoxy- | |
| Hydrogen sulfide | see phenol | |
| | + hydrogen sulfide | E330, E331, 339 |
| Iodobenzene, | see benzene, 10do- | |
| 1-Iodo-octane | see octane, 1-iodo- | |
| Isobutyl acetate | see acetic acid, 2-methyl propyl | ester |
| Isobutylbenzene | see benzene, (2-methylpropyl)- | |
| Isodurene | see benzene 1,2,3,5-tetramethy1- | |
| Isopropylbenzene | see benzene, (1-methylethyl)- | |
| Isovaleric acid, | see butanoic acid, 3-methyl- | |
| Mercaptobenzene | | |
| Mesitylene | see benzenethiol | |
| Methane, dichloro- | see benzene, 1,3,5-trimethyl- | |
| Methane, dichiolo | + hydrogen bromide + hydrogen chloride | E388, E389, 424 |
| Methane, 1-iodo- | + hydrogen bromide | E236, 244 |
| Nathana awybic(ch) | + hydrogen iodide | E389, 428 E437, E438, 445 |
| Methane, oxybis[ch] | + hydrogen chloride | E150-E155, 172 |
| Methane, tetrachlor | + hydrogen bromide | E388, E389, 425, 427 |
| | + hydrogen chloride | E236, E237, 245, 246, 250-255 |
| Methane, tetrachlor | - (ternary) + hydrogen chloride | E21, E22, 36 |
| Methane, tribromo- | + hydrogen chloride | |
| Methane, trichloro- | + hydrogen bromide | E388, E389, 424, 426 |
| | + hydrogen chloride | E236, E238, 245-249 |
| 1 | | |

463

Methanesulfonic acid, butyl ester E330, E331, 333 hydrogen chloride Methanesulfonyl chloride E330, E331, 332 + hydrogen chloride Methanol + hydrogen chloride E78-E93, 94-97, 101-103 Methyl acetate see acetic acid, methyl ester 3-Methylallyl alcohol see 2-buten-1-ol 2-Methyl-1,3-butadiene see 1,3-butadiene, 2-methyl-3-Methyl butanoic acid see butanoic acid, 3-methyl-2-Methyl-1-butanol see 1-butanol, 2-methyl Methyl butyl ether see butane, 1-methoxy-2-Methyl cyclohexanol see cyclohexanol, 2-methyl Methyl ethyl ether see ethane, 1-methoxy-Methyl heptyl ether see heptane, 1-methoxy-Methyl hexyl ether see hexane, 1-methoxy-Methyl octyl ether see octane, 1-methoxy-4-Methyl-2-pentanol see 2-pentanol, 4-methyl Methyl pentyl ether see pentane, 1-methoxy-Methyl phenyl ether see benzene, methoxy-2-Methyl propanoic acid see propanoic acid, 2-methyl-2-Methyl propanol see 1-propanol, 2-methyl-2-Methyl-1-propanol see 1-propanol, 2-methyl 2-Methyl-2-propen-1-ol E133, 134, 136 + hydrogen chloride 2-Methylpropyl acetate see acetic acid, 2-methyl propyl ester 3-Methylpropyl acetate see acetic acid, 1-methyl propyl ester 2-Methylpropylbenzene see benzene, 2-methylpropyl-Methyl propyl ether see propane, 1-methoxy-Methyl o-tolyl ether see benzene, 1-metoxy-2-methyl-Monochloroacetic acid see acetic acid, chloro-Nitric acid, ethyl ester (ternary) E21, E22, 37 + hydrogen chloride Nitrobenzene see benzene, nitrom-Nitrotoluene see benzene, 1-methyl-3-nitroo-Nitrotoluene see benzene, 1-methyl-2-nitro-1-Nonanol + hydrogen bromide E385, E387, 414 + hydrogen chloride E78-E93, 119 Nonyl acetate see acetic acid, nonyl ester 1-Octadecanol + hydrogen chloride E78-E93, 125

| Octame+ hydrogen bromideE383, E384, 396Octane, 1-bromo-+ hydrogen follorideE389, 425Octane, 1-chloro-+ hydrogen iodideE389, 425Octane, 1-chloro-+ hydrogen iodideE389, 425Octane, 1-heptoxy-+ hydrogen iodideE389, 425Octane, 1-heptoxy-+ hydrogen chlorideE389, 425Octane, 1-heptoxy-+ hydrogen chlorideE389, 425Octane, 1-heptoxy-+ hydrogen chlorideE389, 425Octane, 1-methoxy-+ hydrogen chlorideE389, 425Octane, 1-methoxy-+ hydrogen chlorideE387, E384, 448Octane, 1,1'-oxybis-+ hydrogen chlorideE387, 421+ hydrogen chlorideE387, 421E300, 110, 110, 116-Octanel+ hydrogen chlorideE385, 437, 414, 416+ hydrogen chlorideE385, 440E385, 4401-Octanol+ hydrogen chlorideE385, 4401-Octanol+ hydrogen chlorideE385, 4401-Octanol+ hydrogen chlorideE385, 4401-Octane (ternary)+ hydrogen chlorideE54, 71Octyl acetatesee actic acid, octyl esteroctylbromidesee actic acid, octyl esteroctylbromide+ hydrogen chloride1,3-Pentadiene+ hydrogen chloride+ hydrogen chlorideE150-E155, 160, 168Pentane, 1,1'-oxybis-Pentane, 1,1'-oxybis-+ hydrogen chlorideE150-E155, 158Pentane, 1,1'-oxybis-+ hydrogen chlorideE138, 139, 1441-S-Pentanedi+ hydrogen chloride | Octane | |
|--|---|---|
| hydrogen fluoride bydrogen chloride hydrogen chloride hydrogen chloride hydrogen iodide bydrogen iodide bydrogen iodide bydrogen chloride ctans, 1-heptoxy- hydrogen chloride ctans, 1-heptoxy- hydrogen chloride ctans, 1-heptoxy- hydrogen chloride ctans, 1-heptoxy- hydrogen chloride ctans, 1-methoxy- hydrogen chloride ctans, 1, 1'-oxybis- hydrogen chloride thydrogen chloride thydrogen chloride ctans, 441 ctans, 1, 1'-oxybis- hydrogen chloride thydrogen chloride< | + hydrogen bromide | |
| Octane, 1-bromo- hydrogen chloride hydrogen iodideE389, 425 E241, 278, 279 E437, E438, 447Octane, 1-chloro- hydrogen iodideE389, 425 E240, E241, 270 E241, 280 E389, 425 E391, 424 E438, 448Octane, 1-nethoxy- thydrogen chloride thydrogen chloride thydrogen chloride thydrogen chloride thydrogen chloride thydrogen chloride thydrogen chloride thydrogen chloride E385, 4441-Octanol thydrogen chloride thydrogen chloride t | | |
| <pre>bydrogen chloride E241, 278, 279 bydrogen iodide E389, 425 E389, 425 E240, E241, 270 bydrogen chloride E389, 425 E240, E241, 270 bydrogen chloride E150-E155, 162 Cctane, 1-heptoxy- bydrogen bromide E389, 425 bydrogen chloride E437, E438, 448 Cctane, 1-methoxy- bydrogen iodide E150-E155, 162 Cctane, 1-methoxy- bydrogen chloride E389, 425 E241, 280 bydrogen chloride E150-E155, 163, 180 E150-E155, 160, 163 E10-E150 Cctyl acetate see acetic acid, octyl ester Cctylbromide see ethane, pantachloro- 1,3-Pentadien + hydrogen chloride E150-E155, 160, 168 Pentane, 1,1'-oxybis- + hydrogen chloride E150-E155, 160, 168 Pentane, 1,1'-oxybis- + hydrogen chloride E150-E155, 160, 168 Pentane, 1,1'-oxybis- + hydrogen chloride E138, 139, 144 1-Pentanol 1,5-Pentanoliol + hydrogen chloride E138, 139, 144 + hydrogen chloride E38, 5387, 413 E78-E93, 100, 113, 115, 116 1-Pentanol, 4-methyl- + hydrogen chloride E78-E93, 100, 113, 115, 115 Pentane, 2,4,4-trimethyl- + hydrogen chloride E78-E93, 100, 113, 115, 116 2-Pentanol, 4-methyl- + hydrogen chloride E385, E387, 413 E78-E93, 100, 113, 115, 116 2-Pentanol, 4-methyl- + hydrogen chloride E78-E93, 100, 113, 115, 116 2-Pentanol, 4-methyl- + hydrogen chloride E78-E93, 100, 113, 115, 116 2-Pentanol, 2,4,4-trimethyl- + hydrogen chloride E41, E42, 47 2-Pentanol, 2,4,4-trimethyl- + hydrogen chloride E41, E42, 48 2-Pentene, 2,4,4-trimethyl- + hydrogen chloride E41, E42, 48 2-Pentene, 2,4,4-trimethyl- + hydrogen chloride E41, E42, 48 2-Pentene, 2,4,4-trimethyl- + hydrogen</pre> | Octane, 1-bromo- | |
| <pre>b hydrogen iodide E437, E438, 447 Cottane, 1-holoro-</pre> | | E389, 425 E241, 278, 279 |
| <pre>+ hydrogen bromide by definition between the set of the set o</pre> | + hydrogen iodide | |
| + hydrogen chloride E240, E241, Z70 Octane, 1-heptoxy- hydrogen chloride E150-E155, 162 Octane, 1-iodo- hydrogen chloride E389, 425 - hydrogen chloride E247, E438, 448 Octane, 1-methoxy- hydrogen chloride E150-E155, 160 Octane, 1-methoxy- hydrogen bromide E387, 421 - hydrogen chloride E150-E155, 163,180 Octane, 1,1'-oxybis- hydrogen bromide E387, 421 - hydrogen chloride E387, 421 E150-E155, 163,180 - hydrogen bromide Hydrogen chloride E387, 421 - hydrogen chloride E385-E387, 414, 416 E78-E93, 100, 110, 119-121 - Octanol + hydrogen chloride E78-E93, 100, 110, 119-121 - Octanol + hydrogen chloride E54, 71 - Octanol <td></td> <td>F389 425</td> | | F389 425 |
| Octane, 1-heptoxy- thydrogen chlorideE150-E155, 162Octane, 1-iodo- hydrogen chlorideE389, 425 E241, 280 E437, E438, 448Octane, 1-methoxy- hydrogen chlorideE150-E155, 160Octane, 1,1'-oxybis- hydrogen chlorideE387, 421 E150-E155, 163,1801-Octanol hydrogen bromide hydrogen chlorideE387, 421 E150-E155, 163,1801-Octanol hydrogen chlorideE385-E387, 414, 416 E78-E93, 100, 110, 119-1212-Octanol thydrogen chlorideHydrogen chloride1-Octene (ternary) octyl acetatehydrogen chloride0ctyl acetate see octane, 1-bromo-E54, 71Pentachloroethane see octane, 1-bromo-E41, E42, 49Pentane, 1,1'-oxybis- hydrogen chlorideE41, E42, 49Pentane, 1,1'-oxybis- hydrogen chlorideE54, 71Octanesee ethane, pentachloro- 1,3-PentadieneF, E8, E11, 12Pentane, 1,1'-oxybis- hydrogen chlorideE41, E42, 49Pentane, 1,1'-oxybis- hydrogen chlorideE150-E155, 160, 168Pentane, 1,1'oxybis- hydrogen chlorideE150-E155, 160, 168Pentane, 1, 1'oxybis- hydrogen chlorideE160-E155, 158Pentane, 1, 1'oxybis- hydrogen chlorideE38, 139, 1441-Pentanolhydrogen chlorideE78-E93, 199, 113, 115, 1161-Pentanolhydrogen chlorideE78-E93, 199, 113, 115, 1161-Pentane, 2,4,4-trimethyl- hydrogen chlorideE41, E42, 482-Pentanol, 4-methyl- hydrogen chlorideE41, E42, 482-Pentanol, 4-methyl- hydrogen chlorideE41, E42, 482-Pentanol, | | |
| hydrogen chlorideE150-E155, 162Octane, 1-indo- hydrogen chloride hydrogen chloride hydrogen chloride hydrogen chloride hydrogen chloride hydrogen chloride hydrogen chloride thydrogen chloride E387, 421 E150-E155, 160Octane, 1.1"-oxybis- hydrogen chloride hydrogen chloride hydrogen chloride hydrogen chloride thydrogen chloride thydr | · · | E437, E438, 446 |
| Octane, 1-iodo- hydrogen bromide hydrogen chloride E389, 425 E241, 280 E437, E438, 448 Octane, 1methoxy- hydrogen chloride hydrogen chloride E150-E155, 160 Octane, 1,1'-oxybis- hydrogen chloride hydrogen chloride E387, 421 E150-E155, 163,180 1-Octanol hydrogen bromide hydrogen chloride E387, 421 E150-E155, 163,180 2-Octanol hydrogen bromide hydrogen chloride E385-E387, 414, 416 E78-E93, 100, 110, 119-121 2-Octanol hydrogen chloride E78-E93, 122 1-Octene (ternary) + hydrogen chloride E54, 71 Octyl acetate see acetic acid, octyl ester Octyl acetate See octane, 1-bromo- see it, 5-pentanediol E150-E155, 160, 168 Pentamethylene glycol see it, 5-pentanediol E150-E155, 160, 168 Pentane, 1,1'-oxybis- hydrogen chloride E7, E8, E11, 12 Pentane, 1,1'-oxybis- + hydrogen chloride E150-E155, 160, 168 Pentane, 1,1'-oxybis- + hydrogen chloride E13, 139, 114 Pentane, 2,2,4-trimethyl- + hydrogen chloride E138, 139, 114 1-Pentanol + hydrogen chloride E78-E93, 109, 113, 115, 116 1-Pentanol + hydrogen chloride E78-E93, 109, 113, | | E150-E155, 162 |
| <pre>+ hydrogen holoride E241, 280 E437, E438, 448 Octane, 1-methoxy- Octane, 1,1'-oxybis- Cotane, 1,1'-oxybis- + hydrogen chloride E150-E155, 160 + hydrogen bromide E387, 421 + hydrogen chloride E438, 441 1-Octanol + hydrogen bromide E438, 441 1-Octanol + hydrogen chloride E438, 440 2-Octanol + hydrogen chloride E438, 440 2-Octanol + hydrogen chloride E54, 71 Octyl acetate see acetic acid, octyl ester Octylbromide see octane, 1-bromo- Pentachloroethame see ethane, pentachloro- 1,3-Pentadiene + hydrogen chloride E150-E155, 160, 168 Pentame thylene glycol see 1,5-pentamediol Pentane, 1.1'-oxybis- + hydrogen chloride E150-E155, 160, 168 Pentane, 1.1'-oxybis- + hydrogen chloride E150-E155, 160, 168 Pentane, 1.1'-oxybis- + hydrogen chloride E150-E155, 160, 168 Pentane, 2,2,4-trimethyl- + hydrogen chloride E138, 139, 144 1-Pentanol + hydrogen chloride E138, 139, 144 1-Pentanol + hydrogen chloride E78-E93, 199, 113, 115, 116 9-Pentanel + hydrogen chloride E78-E93, 99 2-Pentanol, 4-methyl- + hydrogen chloride E78-E93, 199, 113, 115, 116 9-Pentanol + hydrogen chloride E78-E93, 199, 113, 115, 116 9-Pentanol, 4-methyl- + hydrogen chloride E78-E93, 199, 113, 115, 116 9-Pentene, 2,4,4-trimethyl- + hydrogen chloride E44, 70 2-Pentene, 2,4,4-trimethyl- + hydrogen chloride E54, 70 2-Pentene, 2,4,4-trimethyl- + hydrogen chloride E54, 71 3-Pentan-1-ol + hydrogen chloride E54, 71 3-Pentan-1-ol + hydrogen chloride E41, 134, 136</pre> | Octane, 1-iodo- | |
| <pre>+ hydrogen lodide E437, E438, 448 Octane, 1-methoxy- + hydrogen chloride E150-E155, 160 Octane, 1,1'-oxybis- + hydrogen chloride E387, 421 + hydrogen chloride E385-E387, 413, 416 E50-E155, 163,180 E438, 441 1-Octanol + hydrogen chloride E385-E387, 414, 416 E78-E93, 100, 110, 119-121 2-Octanol + hydrogen chloride E78-E93, 100, 110, 119-121 0-Ottane (ternary) -Octyl acetate see acetic acid, octyl ester Octylbromide see acetic acid acid pentame + hydrogen chloride E41, E42, 49 Pentamethylene glycol Pentane, 1,1'-oxybis- + hydrogen chloride E150-E155, 160, 168 Pentane, 1-methoxy- + hydrogen chloride E150-E155, 158, 158 Pentane, 2,2,4-trimethyl- + hydrogen chloride E150-E155, 158 Pentane, 2,2,4-trimethyl- + hydrogen chloride E138, 139, 144 1-Pentanol + hydrogen chloride E138, 5387, 413, 115, 116 3-Pentanol + hydrogen chloride E78-E93, 109, 113, 115, 116 3-Pentanol + hydrogen chloride E78-E93, 109, 113, 115, 116 1-Pentene, 2,4,4-trimethyl- + hydrogen chloride E78-E93, 109, 113, 115, 116 3-Pentanol, 4-methyl- + hydrogen chloride E41, E42, 47 1-Pentene, 2,4,4-trimethyl- + hydrogen chloride E41, E42, 48 2-Pentene, 2,4,4-trimethyl- + hydrogen chloride E41, E42, 48 2-Pentene, 2,4,4-trimethyl- + hydrogen chloride E44, 71 3-Penten-1-ol + hydrogen chloride E133, 134, 136</pre> | | |
| <pre>hydrogen chloride E150-E155, 160 Octane, 1,1'-oxybis- + hydrogen bromide + hydrogen chloride E387, 421 + hydrogen chloride E385-E387, 414, 416 E78-E93, 100, 110, 119-121 2-Octanol + hydrogen chloride E385-E387, 414, 416 E78-E93, 100, 110, 119-121 2-Octanol + hydrogen chloride E54, 71 Octyl acetate see acetic acid, octyl ester Octylbromide see octane, 1-bromo- Pentachloroethame 1,3-Pentadiene + hydrogen chloride E150-E155, 160, 168 Pentame thylene glycol See 1,5-pentanediol Pentane, 1,1'-oxybis- + hydrogen chloride E150-E155, 160, 168 Pentane, 1,-methoxy- + hydrogen chloride E150-E155, 158 Pentane, 2,2,4-trimethyl- + hydrogen chloride E385, E387, 413, 113, 1,5-Pentanol + hydrogen chloride E138, 139, 144 + hydrogen chloride E385, E387, 413 + hydrogen chloride E385, E387, 413 + hydrogen chloride E78-E93, 109, 113, 115, 116 -Pentanol + hydrogen chloride E78-E93, 109, 113, 115, 116 -Pentene, 2,4,4-trimethyl- + hydrogen chloride E78-E93, 100 -Pentene, 2,4,4-trimethyl- + hydrogen chloride E78-E93, 100 -Pentene, 2,4,4-trimethyl- + hydrogen chloride E78-E93, 100 -Pentene, 2,4,4-trimethyl- + hydrogen chloride E41, E42, 47 -Pentene, 2,4,4-trimethyl- + hydrogen chloride E41, E42, 47 -Pentene, 2,4,4-trimethyl- + hydrogen chloride E41, E42, 48 -Penten-1-ol + hydrogen chloride E54, 70 -Penten-1-ol + hydrogen chloride E54, 71 -Penten-1-ol + hydrogen chloride E133, 134, 136</pre> | + hydrogen 10dide | |
| Octane, 1,1'-oxybis- hydrogen chloride hydrogen iodideE387, 421 E150-E155, 163,180 E438, 4101-Octanol+ hydrogen chloride + hydrogen chlorideE385-E387, 414, 416 E78-E93, 100, 110, 119-1212-Octanol+ hydrogen chloride + hydrogen chlorideE78-E93, 100, 110, 119-1211-Octene (ternary)+ hydrogen chloride see acetic acid, octyl esterE54, 71Octyl acetate See octane, 1-bromo-E54, 71Pentachloroethane see ethane, pentachloro- 1,3-Pentadiene Pentane, 1,1'-oxybis- thydrogen chlorideE41, E42, 49Pentame + hydrogen chloride see 1,5-pentanediolE150-E155, 160, 168Pentane, 1,1'-oxybis- + hydrogen chlorideE150-E155, 156, 158Pentane, 1,1'-oxybis- + hydrogen chlorideE10-E155, 158, 139, 1441-Pentane, 1,2,2,4-trimethyl- + hydrogen chlorideE385, E387, 413, E78-E93, 109, 113, 115, 1163-Pentanol + hydrogen chlorideE78-E93, 100, 110, 113, 115, 1163-Pentanol + hydrogen chlorideE78-E93, 100, 113, 115, 1163-Pentanol + hydrogen chlorideE78-E93, 100, 113, 115, 1163-Pentanol + hydrogen chlorideE78-E93, 100, 113, 115, 1163-Pentene, 2,4,4-trimethyl- + hydrogen chlorideE78-E93, 1001-Pentene, 2,4,4-trimethyl- + hydrogen chlorideE41, E42, 471-Pentene, 2,4,4-trimethyl- + hydrogen chlorideE54, 702-Pentene, 2,4,4-trimethyl- + hydrogen chlorideE54, 713-Penten-1-ol + hydrogen chlorideE54, 713-Penten-1-ol + hydrogen chlorideE54, 714-Penten-1-ol + hydrogen chloride <td></td> <td>E150-E155. 160</td> | | E150-E155. 160 |
| <pre>+ hydrogen chloride F150=E155, 163,180 + hydrogen iodide E438, 441 + hydrogen chloride F78=E33, 100, 110, 119-121 + hydrogen chloride E78=E33, 100, 110, 119-121 -Octanol + hydrogen chloride E54, 71 Octyl acetate see acetic acid, octyl ester Octylbromide see ottane, 1-bromo- Pentachloroethame see ethane, pentachloro- 1,3-Pentadiene + hydrogen chloride E41, E42, 49 Pentamethylene glycol see 1,5-pentanediol Pentane, 1,1'-oxybis + + hydrogen chloride E150=E155, 160, 168 Pentane, 1.=methoxy + + hydrogen chloride E150=E155, 160, 168 Pentane, 1.=methoxy + + hydrogen chloride E10=E155, 158 Pentane, 2,2,4-trimethyl- 1,5-Pentanol + hydrogen chloride E138, 139, 144 1-Pentanol + hydrogen chloride E78=E33, 100, 113, 115, 116 3-Pentanol + hydrogen chloride E78=E33, 100 + hydrogen chloride E78=E33, 100, 113, 15, 116 3-Pentanol + hydrogen chloride E78=E33, 100 + hydrogen chloride E78=E33, 100, 113, 15, 116 3-Pentanol + hydrogen chloride E78=E33, 100 + hydrogen chloride E78=E33, 100, 113, 15, 116 3-Pentanol + hydrogen chloride E78=E33, 100 + hydrogen chloride E41, E42, 47 1-Pentene, 2,4,4-trimethyl-(ternary) + hydrogen chloride E41, E42, 48 2-Pentene, 2,4,4-trimethyl-(ternary) + hydrogen chloride E54, 70 2-Pentene, 2,4,4-trimethyl-(ternary) + hydrogen chloride E54, 70 2-Pentene, 2,4,4-trimethyl-(ternary) + hydrogen chloride E54, 70 2-Pentene, 2,4,4-trimethyl-(ternary) + hydrogen chloride E54, 71 3-Penten-1-ol + hydrogen chloride E54, 71 4-Penten-1-ol + hydrogen chloride E54, 71</pre> | Octane, 1,1'-oxybis- | |
| + hydrogen iodide E438, 441 1-Octanol + hydrogen chloride E385-E387, 414, 416 E78-E93, 100, 110, 119-121 + hydrogen chloride E438, 440 2-Octanol + hydrogen chloride E54, 71 Octyl acetate see acetic acid, octyl ester Octylacetate see octane, 1-bromo- Pentachloroethane see ethane, pentachloro- 1,3-Pentadiene + hydrogen chloride E41, E42, 49 Pentamethylene glycol set 7, E8, E11, 12 Pentane, 1ir-cybis- + hydrogen chloride E150-E155, 160, 168 Pentane, 2,2,4-trimethyl- + hydrogen chloride E385, E387, 413, 1-Pentanol + hydrogen chloride E385, E387, 413 E78-E93, 100, 110, 119-121 Pentane, 1ir-cybis- + hydrogen chloride E138, 139, 144 1-Pentanol + hydrogen chloride E138, 139, 144 1-Pentanol + hydrogen chloride E78-E93, 100, 113, 15-Pentanelol + hydrogen chloride E78-E93, 100, 113, 15-Pentanelol + hydrogen chloride E385, E387, 413 E78-E93, 109, 113, 1-Pentene, 2,4,4-trimethyl- + hydrogen chloride E78-E93, 110 - Pentanol + hydrogen chloride E78-E93, 110 - Pentene, 2,4,4-trimethyl- (ternary) + hydrogen chloride E78-E93, 110 - Pentene, 2,4,4-trimethyl-(ternary) + hydrogen chloride E41, E42, 47 - Pentene, 2,4,4-trimethyl-(ternary) + hydrogen chloride E54, 70 2-Pentene, 2,4,4-trimethyl-(ternary) + hydrogen chloride E54, 71 3-Penten-1-ol + hydrogen chloride E54, 71 - Pontene-1-ol | | |
| <pre>+ hydrogen bromide E385-E387, 414, 416 F78-E93, 100, 110, 119-121 + hydrogen chloride E78-E93, 100, 110, 119-121 + hydrogen chloride E54, 71 Octyl acetate See acetic acid, octyl ester Octylbromide See octane, 1-bromo- Pentachloroethane + hydrogen chloride E41, E42, 49 Pentamethylene glycol See 1,5-pentanediol Pentane + hydrogen chloride E150-E155, 160, 168 Pentane, 1,1'-oxybis- + hydrogen chloride E150-E155, 158 Pentane, 1-methoxy- + hydrogen chloride E150-E155, 158 Pentane, 2,2,4-trimethyl- + hydrogen chloride E138, 139, 144 + hydrogen chloride E38, 5387, 414, 416 E78-E93, 100, 110, 115, Pentanel + hydrogen chloride E150-E155, 158 Pentane, 1-methoxy- + hydrogen chloride E9, E11, 12 1,5-Pentanediol + hydrogen chloride E138, 139, 144 + hydrogen chloride E38, 5387, 413, 115, 116 3-Pentanol + hydrogen chloride E78-E93, 109, 113, 115, 116 3-Pentanol + hydrogen chloride E78-E93, 109, 113, 115, 116 3-Pentanol, 4-methyl- + hydrogen chloride E78-E93, 99 2-Pentanol, 4-methyl- + hydrogen chloride E41, E42, 47 + hydrogen chloride E41, E42, 47 1-Pentene, 2,4,4-trimethyl- + hydrogen chloride E41, E42, 47 1-Pentene, 2,4,4-trimethyl- + hydrogen chloride E41, E42, 48 2-Pentene, 2,4,4-trimethyl- + hydrogen chloride E41, E42, 48 2-Pentene, 2,4,4-trimethyl-(ternary) + hydrogen chloride E41, E42, 48 2-Pentene, 2,4,4-trimethyl-(ternary) + hydrogen chloride E41, E42, 48 2-Penten-1-ol + hydrogen chloride E54, 70 2-Pentene, 2,4,4-trimethyl-(ternary) + hydrogen chloride E54, 71 3-Penten-1-ol + hydrogen chloride E54, 71 3-Penten-1-ol + hydrogen chloride E54, 71 3-Penten-1-ol + hydrogen chloride E54, 71</pre> | | |
| <pre>+ hydrogen chloride E78-E93, 100, 110, 119-121 E438, 440 2-Octanol + hydrogen chloride E78-E93, 122 1-Octene (ternary) + hydrogen chloride E54, 71 Octyl acetate see acetic acid, octyl ester Octylbromide see octane, 1-bromo- Pentachloroethane see ethane, pentachloro- 1,3-Pentadiene + hydrogen chloride E41, E42, 49 Pentamethylene glycol see 1,5-pentanediol Pentane + hydrogen chloride E150-E155, 160, 168 Pentane, 1-methoxy- Pentane, 1-methoxy- Pentane, 2,2,4-trimethyl- 1,5-Pentanol + hydrogen chloride E138, 139, 144 1-Pentanol + hydrogen chloride E138, 139, 144 1-Pentanol + hydrogen chloride E78-E93, 100, 113, 115, 116 3-Pentane + hydrogen chloride E138, 139, 144 1-Pentanol + hydrogen chloride E138, 139, 144 1-Pentanol + hydrogen chloride E138, 139, 144 1-Pentene, 2,4,4-trimethyl- + hydrogen chloride E78-E93, 99 2-Pentanol, 4-methyl- + hydrogen chloride E141, E42, 47 1-Pentene, 2,4,4-trimethyl- + hydrogen chloride E41, E42, 48 2-Pentene, 2,4,4-trimethyl- + hydrogen chloride E54, 70 2-Pentene, 2,4,4-trimethyl- + hydrogen chloride E41, E42, 48 2-Pentene, 2,4,4-trimethyl- + hydrogen chloride E41, E42, 48 2-Pentene, 2,4,4-trimethyl- + hydrogen chloride E54, 71 3-Penten-1-ol + hydrogen chloride E54, 71</pre> | | F385_F387 /1/ /16 |
| + hydrogen iodide119-121 E438, 4402-Octanol+ hydrogen chlorideE78-E93, 1221-Octene (ternary)+ hydrogen chlorideE54, 71Octyl acetatesee acetic acid, octyl esterOctyl acetatesee octane, 1-bromo-Pentachloroethame+ hydrogen chlorideE41, E42, 49Pentamethylene glycolsee 1,5-pentanediolE7, E8, E11, 12Pentane, 1,1'-oxybis- + hydrogen chlorideE150-E155, 160, 168Pentane, 1-methoxy- + hydrogen chlorideE130-E155, 158Pentane, 2,2,4-trimethyl- + hydrogen chlorideE138, 139, 1441-Pentanol+ hydrogen chlorideE78-E93, 109, 113, 115, 1163-Pentanol + hydrogen chlorideE78-E93, 109, 113, 115, 1163-Pentanol + hydrogen chlorideE78-E93, 100+ hydrogen chlorideE78-E93, 110-Pentene, 2,4,4-trimethyl- + hydrogen chlorideE41, E42, 47-Pentene, 2,4,4-trimethyl- + hydrogen chlorideE54, 70-Pentene, 2,4,4-trimethyl- + hydrogen chlorideE54, 702-Pentene, 2,4,4-trimethyl- + hydrogen chlorideE54, 702-Pentene, 2,4,4-trimethyl- + hydrogen chlorideE54, 702-Pentene, 2,4,4-trimethyl- + hydrogen chlorideE41, E42, 482-Pentene, 2,4,4-trimethyl- + hydrogen chlorideE54, 713-Penten-1-ol + hydrogen chlorideE41, E42, 482-Pentene, 2,4,4-trimethyl- + hydrogen chlorideE54, 713-Penten-1-ol + hydrogen chlorideE41, E42, 482-Penten-1-ol + hydrogen chlorideE54, 713-Penten-1-ol + | | |
| 2-Octanol + hydrogen chloride E78-E93, 122 1-Octene (ternary) + hydrogen chloride E54, 71 Octyl acetate see acetic acid, octyl ester Octylbromide see octane, 1-bromo- Pentachloroethane see ethane, pentachloro- 1,3-Pentadiene + hydrogen chloride E41, E42, 49 Pentamethylene glycol see 1,5-pentanediol Pentane + hydrogen chloride E7, E8, E11, 12 Pentane, 1,1'-oxybis- Pentane, 1-methoxy- + hydrogen chloride E150-E155, 160, 168 Pentane, 2,2,4-trimethyl- + hydrogen chloride E9, E11, 12 1,5-Pentanediol + hydrogen chloride E138, 139, 144 1-Pentanol + hydrogen chloride E385, E387, 413 + hydrogen chloride E78-E93, 109, 113, 115 3-Pentanol + hydrogen chloride E78-E93, 99 2-Pentanol, 4-methyl- + hydrogen chloride E41, E42, 47 1-Pentene, 2,4,4-trimethyl- + hydrogen chloride E41, E42, 47 1-Pentene, 2,4,4-trimethyl- + hydrogen chloride E41, E42, 47 1-Pentene, 2,4,4-trimethyl- + hydrogen chloride E41, E42, 48 2-Pentene, 2,4,4-trimethyl- + hydrogen chloride E54, 70 2-Pentene, 2,4,4-trimethyl- + hydrogen chloride E54, 71 3-Penten-1-ol + hydrogen chloride E41, E42, 48 4-Penten-1-ol | | |
| 1-Octene (ternary) Octyl acetate see acetic acid, octyl ester Octylbromide see octane, 1-bromo- Pentachloroethane see ethane, pentachloro- 1,3-Pentadiene + hydrogen chloride E41, E42, 49 Pentamethylene glycol see 1,5-pentanediol Pentane + hydrogen chloride E7, E8, E11, 12 Pentane, 1,1'-oxybis- + hydrogen chloride E150-E155, 160, 168 Pentane, 1-methoxy- Pentane, 2,2,4-trimethyl- + hydrogen chloride E130-E155, 158 Pentanel + hydrogen chloride E138, 139, 144 1-Pentanol + hydrogen chloride E385, E387, 413 + hydrogen chloride E78-E93, 109, 113, 115, 116 3-Pentanol + hydrogen chloride E78-E93, 109, 113, 115, 116 3-Pentane, 2,4,4-trimethyl- + hydrogen chloride E41, E42, 47 1-Pentene, 2,4,4-trimethyl- + hydrogen chloride E41, E42, 47 1-Pentene, 2,4,4-trimethyl- + hydrogen chloride E41, E42, 47 1-Pentene, 2,4,4-trimethyl- + hydrogen chloride E54, 70 2-Pentene, 2,4,4-trimethyl- + hydrogen chloride E54, 71 3-Penten-1-ol + hydrogen chloride E54, 71 3-Penten-1-ol + hydrogen chloride E54, 71 3-Penten-1-ol + hydrogen chloride E133, 134, 136 | | E438, 440 |
| <pre>+ hydrogen chloride E54, 71 Octyl acetate see acetic acid, octyl ester Octylbromide see octane, 1-bromo- Pentachloroethane 1,3-Pentadiene + hydrogen chloride E41, E42, 49 Pentamethylene glycol see 1,5-pentanediol Pentane + hydrogen chloride E7, E8, E11, 12 Pentane, 1,1'-oxybis- + hydrogen chloride E150-E155, 160, 168 Pentane, 1-methoxy- + hydrogen chloride E9, E11, 12 1,5-Pentanediol + hydrogen chloride E9, E11, 12 1,5-Pentanediol + hydrogen chloride E138, 139, 144 1-Pentanol + hydrogen chloride E78-E93, 109, 113, 115, 116 3-Pentanel, 4-methyl- + hydrogen chloride E78-E93, 109, 113, 115, 116 1-Pentene, 2,4,4-trimethyl- + hydrogen chloride E41, E42, 47 1-Pentene, 2,4,4-trimethyl- + hydrogen chloride E41, E42, 47 2-Pentene, 2,4,4-trimethyl- + hydrogen chloride E41, E42, 48 2-Pentene, 2,4,4-trimethyl-(ternary) + hydrogen chloride E133, 134, 136</pre> | | E78-E93, 122 |
| Octyl acetatesee acetic acid, octyl esterOctylbromidesee acetic acid, octyl esterOctylbromidesee octane, 1-bromo-Pentachloroethanesee ethane, pentachloro-1,3-Pentadiene+ hydrogen chlorideE41, E42, 49Pentamethylene glycolsee 1,5-pentanediolPentane+ hydrogen chlorideE7, E8, E11, 12Pentane, 1,1'-oxybis- + hydrogen chlorideE150-E155, 160, 168Pentane, 1-methoxy- + hydrogen chlorideE150-E155, 158Pentane, 2,2,4-trimethyl- + hydrogen chlorideE138, 139, 1441-Pentanol+ hydrogen chlorideE385, E387, 413 E78-E93, 109, 113, 115, 1163-Pentanol+ hydrogen chlorideE78-E93, 992-Pentanol, 4-methyl- + hydrogen chlorideE78-E93, 1101-Pentene, 2,4,4-trimethyl- + hydrogen chlorideE41, E42, 471-Pentene, 2,4,4-trimethyl- + hydrogen chlorideE54, 702-Pentene, 2,4,4-trimethyl- + hydrogen chlorideE41, E42, 482-Pentene, 2,4,4-trimethyl- + hydrogen chlorideE54, 713-Penten-1-ol+ hydrogen chlorideE133, 134, 136 | | E54, 71 |
| Octylbromidesee octane, 1-bromo-Pentachloroethanesee ethane, pentachloro-1,3-Pentadiene+ hydrogen chlorideE41, E42, 49Pentamethylene glycolsee 1,5-pentanediolE150-E155, 160, 168Pentane+ hydrogen chlorideE150-E155, 160, 168Pentane, 1.1'-oxybis- + hydrogen chlorideE150-E155, 150, 168Pentane, 1-methoxy- + hydrogen chlorideE150-E155, 158Pentane, 2,2,4-trimethyl- + hydrogen chlorideE138, 139, 1441Pentanediol+ hydrogen chlorideE385, E387, 413 E78-E93, 109, 113, 115, 1163-Pentanol+ hydrogen chlorideE78-E93, 109, 113, 115, 1163-Pentanol+ hydrogen chlorideE78-E93, 1101-Pentene, 2,4,4-trimethyl- + hydrogen chlorideE41, E42, 471-Pentene, 2,4,4-trimethyl- + hydrogen chlorideE54, 702-Pentene, 2,4,4-trimethyl-(ternary) + hydrogen chlorideE54, 712-Pentene, 2,4,4-trimethyl-(ternary) + hydrogen chlorideE54, 713-Penten-1-ol+ hydrogen chlorideE54, 71 | Octyl acetate | |
| see octane, 1-bromo-Pentachloroethane see ethane, pentachloro-1,3-Pentadiene + hydrogen chlorideE41, E42, 49Pentamethylene glycol see 1,5-pentanediolE41, E42, 49Pentame Pentane + hydrogen chlorideE7, E8, E11, 12Pentane, 1,1'-oxybis- + hydrogen chlorideE150-E155, 160, 168Pentane, 1-methoxy- + hydrogen chlorideE150-E155, 150, 168Pentane, 2,2,4-trimethyl- + hydrogen chlorideE130-E155, 158Pentane, 2,2,4-trimethyl- + hydrogen chlorideE385, E387, 4131,5-Pentanediol + hydrogen chlorideE385, E387, 4131-Pentanol + hydrogen chlorideE78-E93, 109, 113, 115, 1163-Pentanol + hydrogen chlorideE78-E93, 1101-Pentene, 2,4,4-trimethyl- + hydrogen chlorideE41, E42, 471-Pentene, 2,4,4-trimethyl-(ternary) + hydrogen chlorideE54, 702-Pentene, 2,4,4-trimethyl-(ternary) + hydrogen chlorideE54, 713-Penten-1-ol + hydrogen chlorideE54, 71 | | |
| see ethane, pentachloro- 1,3-Pentadiene + hydrogen chloride Pentamethylene glycol see 1,5-pentanediol Pentane + hydrogen chloride Pentane, 1,1'-oxybis- + hydrogen chloride Pentane, 1methoxy- + hydrogen chloride Pentane, 2,2,4-trimethyl- + hydrogen chloride 1,5-Pentanediol 1-Pentanol + hydrogen chloride - hydrogen chloride Pentane, 2,4,4-trimethyl- + hydrogen chloride - Pentanol, 4-methyl- + hydrogen chloride 1-Pentene, 2,4,4-trimethyl- + hydrogen chloride 2-Pentene, 2,4,4-trimethyl- + hydrogen chloride 2-Penten-1-ol + hydrogen chloride 2-Penten-1-ol | - | |
| 1,3-Pentadiene+ hydrogen chlorideE41, E42, 49Pentamethylene glycolsee 1,5-pentanediolF41, E42, 49Pentane+ hydrogen chlorideE7, E8, E11, 12Pentane, 1,1'-oxybis- + hydrogen chlorideE150-E155, 160, 168Pentane, 1-methoxy- + hydrogen chlorideE150-E155, 150, 168Pentane, 2,2,4-trimethyl- + hydrogen chlorideE9, E11, 121,5-Pentanediol + hydrogen chlorideE138, 139, 1441-Pentanol * hydrogen chlorideE385, E387, 413 E78-E93, 109, 113, 115, 1163-Pentanol * hydrogen chlorideE78-E93, 992-Pentanol, 4-methyl- + hydrogen chlorideE78-E93, 1101-Pentene, 2,4,4-trimethyl-(ternary) + hydrogen chlorideE41, E42, 472-Pentene, 2,4,4-trimethyl- + hydrogen chlorideE54, 702-Pentene, 2,4,4-trimethyl- + hydrogen chlorideE41, E42, 482-Pentene, 2,4,4-trimethyl- + hydrogen chlorideE41, E42, 482-Penten-1-ol + hydrogen chlorideE41, E42, 48 | | |
| + hydrogen chlorideE41, E42, 49Pentamethylene glycolsee 1,5-pentanediolPentane+ hydrogen chlorideE7, E8, E11, 12Pentane, 1,1'-oxybis- + hydrogen chlorideE150-E155, 160, 168Pentane, 1-methoxy- + hydrogen chlorideE150-E155, 150, 168Pentane, 2,2,4-trimethyl- + hydrogen chlorideE9, E11, 121,5-Pentanediol+ hydrogen chlorideE138, 139, 1441-Pentanol+ hydrogen chlorideE385, E387, 413 E78-E93, 109, 113, 115, 1163-Pentanol+ hydrogen chlorideE78-E93, 992-Pentanol, 4-methyl- + hydrogen chlorideE41, E42, 471-Pentene, 2,4,4-trimethyl- + hydrogen chlorideE54, 702-Pentene, 2,4,4-trimethyl- + hydrogen chlorideE54, 712-Pentene, 2,4,4-trimethyl- + hydrogen chlorideE41, E42, 482-Pentene, 2,4,4-trimethyl- + hydrogen chlorideE54, 713-Penten-1-ol + hydrogen chlorideE54, 71 | Pentachloroethane | |
| Pentamethylene glycol see 1,5-pentanediol Pentane + hydrogen chloride E7, E8, E11, 12 Pentane, 1,1'-oxybis- + hydrogen chloride E150-E155, 160, 168 Pentane, 1-methoxy- + hydrogen chloride E150-E155, 158 Pentane, 2,2,4-trimethyl- + hydrogen chloride E9, E11, 12 1,5-Pentanediol + hydrogen chloride E138, 139, 144 1-Pentanol + hydrogen bromide E385, E387, 413 E78-E93, 109, 113, 115, 116 3-Pentanol + hydrogen chloride E78-E93, 99 2-Pentanol, 4-methyl- + hydrogen chloride E78-E93, 99 2-Pentene, 2,4,4-trimethyl- + hydrogen chloride E41, E42, 47 1-Pentene, 2,4,4-trimethyl- + hydrogen chloride E54, 70 2-Pentene, 2,4,4-trimethyl- + hydrogen chloride E41, E42, 48 2-Pentene, 2,4,4-trimethyl- + hydrogen chloride E54, 71 3-Penten-1-ol + hydrogen chloride E133, 134, 136 | see ethane, pentachloro- | |
| Pentane+ hydrogen chloride $E7, E8, E11, 12$ Pentane, 1,1'-oxybis- + hydrogen chloride $E150-E155, 160, 168$ Pentane, 1-methoxy- + hydrogen chloride $E150-E155, 150$ Pentane, 2,2,4-trimethyl- + hydrogen chloride $E150-E155, 158$ Pentane, 2,2,4-trimethyl- + hydrogen chloride $E138, 139, 144$ 1.5-Pentanediol+ hydrogen chloride $E138, 139, 144$ 1-Pentanol+ hydrogen chloride $E385, E387, 413$ $E78-E93, 109, 113, 115, 116$ 3-Pentanol+ hydrogen chloride $E78-E93, 99$ 2-Pentanol, 4-methyl- + hydrogen chloride $E78-E93, 110$ 1-Pentene, 2,4,4-trimethyl-(ternary) + hydrogen chloride $E41, E42, 47$ 2-Pentene, 2,4,4-trimethyl-(ternary) + hydrogen chloride $E54, 70$ 2-Pentene, 2,4,4-trimethyl-(ternary) + hydrogen chloride $E54, 71$ 3-Penten-1-ol+ hydrogen chloride $E54, 71$ | see ethane, pentachloro- 1,3-Pentadiene | E41, E42, 49 |
| + hydrogen chloride Pentane, $1,1'-oxybis-$ + hydrogen chloride Pentane, $1-methoxy-$ + hydrogen chloride Pentane, $2,2,4-trimethyl-$ + hydrogen chloride 1,5-Pentanediol 1,5-Pentanediol + hydrogen chloride 1,5-Pentanel + hydrogen chloride 1-Pentanol + hydrogen chloride 2-Pentanol, 4-methyl- + hydrogen chloride 1-Pentene, 2,4,4-trimethyl- + hydrogen chloride 2-Pentene, 2,4,4-trimethyl- (ternary) + hydrogen chloride 2-Penten-1-ol + hydrogen chloride 2-Penten-1-ol | see ethane, pentachloro- 1,3-Pentadiene + hydrogen chloride Pentamethylene glycol | E41, E42, 49 |
| + hydrogen chloride E150-E155, 160, 168 Pentane, 1-methoxy- + hydrogen chloride E150-E155, 158 Pentane, 2,2,4-trimethyl- + hydrogen chloride E9, E11, 12 1,5-Pentanediol + hydrogen chloride E138, 139, 144 1-Pentanol + hydrogen bromide E385, E387, 413 E78-E93, 109, 113, 115, 116 3-Pentanol + hydrogen chloride E78-E93, 99 2-Pentanol, 4-methyl- + hydrogen chloride E78-E93, 110 1-Pentene, 2,4,4-trimethyl-(ternary) + hydrogen chloride E41, E42, 47 1-Pentene, 2,4,4-trimethyl-(ternary) + hydrogen chloride E41, E42, 48 2-Pentene, 2,4,4-trimethyl-(ternary) + hydrogen chloride E41, E42, 48 2-Pentene, 2,4,4-trimethyl-(ternary) + hydrogen chloride E54, 70 2-Pentene, 2,4,4-trimethyl-(ternary) + hydrogen chloride E54, 71 3-Penten-1-ol + hydrogen chloride E133, 134, 136 | see ethane, pentachloro- 1,3-Pentadiene + hydrogen chloride Pentamethylene glycol see 1,5-pentanediol | E41, E42, 49 |
| Pentane, 1-methoxy- + hydrogen chlorideE150-E155, 158Pentane, 2,2,4-trimethyl- + hydrogen chlorideE9, E11, 121,5-Pentanediol + hydrogen chlorideE138, 139, 1441-Pentanol + hydrogen chlorideE385, E387, 413 E78-E93, 109, 113, 115, 1163-Pentanol + hydrogen chlorideE78-E93, 992-Pentanol, 4-methyl- + hydrogen chlorideE78-E93, 1101-Pentene, 2,4,4-trimethyl- + hydrogen chlorideE41, E42, 471-Pentene, 2,4,4-trimethyl- + hydrogen chlorideE54, 702-Pentene, 2,4,4-trimethyl- + hydrogen chlorideE41, E42, 482-Pentene, 2,4,4-trimethyl-(ternary) + hydrogen chlorideE54, 713-Penten-1-ol + hydrogen chlorideE54, 71 | see ethane, pentachloro- 1,3-Pentadiene + hydrogen chloride Pentamethylene glycol see 1,5-pentanediol Pentane + hydrogen chloride | |
| Pentane, 2,2,4-trimethyl- + hydrogen chlorideE9, E11, 121,5-Pentanediol+ hydrogen chlorideE138, 139, 1441-Pentanol+ hydrogen chlorideE385, E387, 4131-Pentanol+ hydrogen chlorideE78-E93, 109, 113, 115, 1163-Pentanol+ hydrogen chlorideE78-E93, 992-Pentanol, 4-methyl- + hydrogen chlorideE78-E93, 1101-Pentene, 2,4,4-trimethyl- + hydrogen chlorideE41, E42, 471-Pentene, 2,4,4-trimethyl-(ternary) + hydrogen chlorideE54, 702-Pentene, 2,4,4-trimethyl-(ternary) + hydrogen chlorideE54, 713-Penten-1-ol + hydrogen chlorideE54, 71 | see ethane, pentachloro- 1,3-Pentadiene + hydrogen chloride Pentamethylene glycol see 1,5-pentanediol Pentane + hydrogen chloride Pentane, 1,1'-oxybis- | E7, E8, E11, 12 |
| + hydrogen chloride E9, E11, 12 1,5-Pentanediol + hydrogen chloride E138, 139, 144 1-Pentanol + hydrogen bromide E385, E387, 413 + hydrogen chloride E78-E93, 109, 113, 115, 116 3-Pentanol + hydrogen chloride E78-E93, 99 2-Pentanol, 4-methyl- + hydrogen chloride E78-E93, 110 1-Pentene, 2,4,4-trimethyl- + hydrogen chloride E41, E42, 47 1-Pentene, 2,4,4-trimethyl- + hydrogen chloride E54, 70 2-Pentene, 2,4,4-trimethyl- + hydrogen chloride E41, E42, 48 2-Pentene, 2,4,4-trimethyl- + hydrogen chloride E41, E42, 48 2-Pentene, 2,4,4-trimethyl-(ternary) + hydrogen chloride E54, 71 3-Penten-1-ol + hydrogen chloride E133, 134, 136 | see ethane, pentachloro- 1,3-Pentadiene + hydrogen chloride Pentamethylene glycol see 1,5-pentanediol Pentane + hydrogen chloride Pentane, 1,1'-oxybis- + hydrogen chloride Pentane, 1-methoxy- | E7, E8, E11, 12 E150-E155, 160, 168 |
| + hydrogen chloride E138, 139, 144 1-Pentanol + hydrogen bromide E385, E387, 413 + hydrogen chloride E78-E93, 109, 113, 115, 116 3-Pentanol + hydrogen chloride E78-E93, 99 2-Pentanol, 4-methyl- + hydrogen chloride E78-E93, 110 1-Pentene, 2,4,4-trimethyl- + hydrogen chloride E41, E42, 47 1-Pentene, 2,4,4-trimethyl- + hydrogen chloride E54, 70 2-Pentene, 2,4,4-trimethyl- + hydrogen chloride E41, E42, 48 2-Pentene, 2,4,4-trimethyl- + hydrogen chloride E54, 71 3-Penten-1-ol + hydrogen chloride E133, 134, 136 | see ethane, pentachloro- 1,3-Pentadiene + hydrogen chloride Pentamethylene glycol see 1,5-pentanediol Pentane + hydrogen chloride Pentane, 1,1'-oxybis- + hydrogen chloride Pentane, 1-methoxy- + hydrogen chloride | E7, E8, E11, 12 E150-E155, 160, 168 |
| 1-Pentanol + hydrogen bromide + hydrogen chloride 3-Pentanol 2-Pentanol, 4-methyl- + hydrogen chloride 1-Pentene, 2,4,4-trimethyl- + hydrogen chloride 1-Pentene, 2,4,4-trimethyl- + hydrogen chloride 2-Pentene, 2,4,4-trimethyl-(ternary) + hydrogen chloride 2-Pentene, 2,4,4-trimethyl- + hydrogen chloride 3-Penten-1-ol + hydrogen chloride 4-Penten-1-ol | see ethane, pentachloro- 1,3-Pentadiene + hydrogen chloride Pentamethylene glycol see 1,5-pentanediol Pentane + hydrogen chloride Pentane, 1,1'-oxybis- + hydrogen chloride Pentane, 1-methoxy- + hydrogen chloride Pentane, 2,2,4-trimethyl- + hydrogen chloride | E7, E8, E11, 12 E150-E155, 160, 168 E150-E155, 158 |
| + hydrogen chloride $= 78-E93, 109, 113, 115, 116$ 3-Pentanol + hydrogen chloride $= 78-E93, 99$ 2-Pentanol, 4-methyl- + hydrogen chloride $= 78-E93, 110$ 1-Pentene, 2,4,4-trimethyl- + hydrogen chloride $= E41, E42, 47$ 1-Pentene, 2,4,4-trimethyl-(ternary) + hydrogen chloride $= E54, 70$ 2-Pentene, 2,4,4-trimethyl-(ternary) + hydrogen chloride $= E41, E42, 48$ 2-Pentene, 2,4,4-trimethyl-(ternary) + hydrogen chloride $= E54, 71$ 3-Penten-1-ol + hydrogen chloride $= E133, 134, 136$ | see ethane, pentachloro- 1,3-Pentadiene + hydrogen chloride Pentamethylene glycol see 1,5-pentanediol Pentane + hydrogen chloride Pentane, 1,1'-oxybis- + hydrogen chloride Pentane, 1-methoxy- + hydrogen chloride Pentane, 2,2,4-trimethyl- + hydrogen chloride 1,5-Pentanediol | E7, E8, E11, 12 E150-E155, 160, 168 E150-E155, 158 E9, E11, 12 |
| 3-Pentanol + hydrogen chloride = 54, 70 $2-Pentene, 2,4,4-trimethyl- + hydrogen chloride = 54, 70$ $2-Pentene, 2,4,4-trimethyl- (ternary) + hydrogen chloride = 54, 70$ $2-Pentene, 2,4,4-trimethyl- (ternary) + hydrogen chloride = 54, 70$ $2-Pentene, 2,4,4-trimethyl- (ternary) + hydrogen chloride = 54, 70$ $3-Penten-1-ol + hydrogen chloride = 54, 71$ $4-Penten-1-ol = 54, 71$ | see ethane, pentachloro- 1,3-Pentadiene + hydrogen chloride Pentamethylene glycol see 1,5-pentanediol Pentane + hydrogen chloride Pentane, 1,1'-oxybis- + hydrogen chloride Pentane, 1-methoxy- + hydrogen chloride Pentane, 2,2,4-trimethyl- + hydrogen chloride 1,5-Pentanediol + hydrogen chloride 1-Pentanol | E7, E8, E11, 12 E150-E155, 160, 168 E150-E155, 158 E9, E11, 12 E138, 139, 144 |
| + hydrogen chloride E78-E93, 99 2-Pentanol, 4-methyl- + hydrogen chloride E78-E93, 110 1-Pentene, 2,4,4-trimethyl- + hydrogen chloride E41, E42, 47 1-Pentene, 2,4,4-trimethyl-(ternary) + hydrogen chloride E54, 70 2-Pentene, 2,4,4-trimethyl-(ternary) + hydrogen chloride E41, E42, 48 2-Pentene, 2,4,4-trimethyl-(ternary) + hydrogen chloride E54, 71 3-Penten-1-ol + hydrogen chloride E133, 134, 136 | see ethane, pentachloro- 1,3-Pentadiene + hydrogen chloride Pentamethylene glycol see 1,5-pentanediol Pentane + hydrogen chloride Pentane, 1,1'-oxybis- + hydrogen chloride Pentane, 1-methoxy- + hydrogen chloride Pentane, 2,2,4-trimethyl- + hydrogen chloride 1,5-Pentanediol + hydrogen chloride 1-Pentanol + hydrogen bromide | E7, E8, E11, 12 E150-E155, 160, 168 E150-E155, 158 E9, E11, 12 E138, 139, 144 E385, E387, 413 |
| 2-Pentanol, 4-methyl- + hydrogen chloride E78-E93, 110 1-Pentene, 2,4,4-trimethyl- + hydrogen chloride E41, E42, 47 1-Pentene, 2,4,4-trimethyl-(ternary) + hydrogen chloride E54, 70 2-Pentene, 2,4,4-trimethyl-(ternary) + hydrogen chloride E41, E42, 48 2-Pentene, 2,4,4-trimethyl-(ternary) + hydrogen chloride E54, 71 3-Penten-1-ol + hydrogen chloride E133, 134, 136 | see ethane, pentachloro- 1,3-Pentadiene + hydrogen chloride Pentamethylene glycol see 1,5-pentanediol Pentane + hydrogen chloride Pentane, 1,1'-oxybis- + hydrogen chloride Pentane, 1-methoxy- + hydrogen chloride Pentane, 2,2,4-trimethyl- + hydrogen chloride 1,5-Pentanediol + hydrogen chloride 1-Pentanol + hydrogen bromide + hydrogen chloride | E7, E8, E11, 12 E150-E155, 160, 168 E150-E155, 158 E9, E11, 12 E138, 139, 144 E385, E387, 413 E78-E93, 109, 113, |
| 1-Pentene, 2,4,4-trimethyl- + hydrogen chloride E41, E42, 47 1-Pentene, 2,4,4-trimethyl-(ternary) + hydrogen chloride E54, 70 2-Pentene, 2,4,4-trimethyl- + hydrogen chloride E41, E42, 48 2-Pentene, 2,4,4-trimethyl-(ternary) + hydrogen chloride E54, 71 3-Penten-1-ol + hydrogen chloride E133, 134, 136 4-Penten-1-ol | see ethane, pentachloro- 1,3-Pentadiene + hydrogen chloride Pentamethylene glycol see 1,5-pentanediol Pentane + hydrogen chloride Pentane, 1,1'-oxybis- + hydrogen chloride Pentane, 1-methoxy- + hydrogen chloride Pentane, 2,2,4-trimethyl- + hydrogen chloride 1,5-Pentanediol + hydrogen chloride 1-Pentanol + hydrogen bromide + hydrogen chloride 3-Pentanol | E7, E8, E11, 12 E150-E155, 160, 168 E150-E155, 158 E9, E11, 12 E138, 139, 144 E385, E387, 413 E78-E93, 109, 113, 115, 116 |
| + hydrogen chloride 1-Pentene, 2,4,4-trimethyl-(ternary) + hydrogen chloride 2-Pentene, 2,4,4-trimethyl- + hydrogen chloride 2-Pentene, 2,4,4-trimethyl-(ternary) + hydrogen chloride 3-Penten-1-ol + hydrogen chloride 4-Penten-1-ol + hydrogen chloride 4-Penten-1-ol | see ethane, pentachloro- 1,3-Pentadiene + hydrogen chloride Pentamethylene glycol see 1,5-pentanediol Pentane + hydrogen chloride Pentane, 1,1'-oxybis- + hydrogen chloride Pentane, 1-methoxy- + hydrogen chloride Pentane, 2,2,4-trimethyl- + hydrogen chloride 1,5-Pentanediol + hydrogen bromide + hydrogen bromide 3-Pentanol + hydrogen chloride 3-Pentanol + hydrogen chloride 2-Pentanol, 4-methyl- | E7, E8, E11, 12 E150-E155, 160, 168 E150-E155, 158 E9, E11, 12 E138, 139, 144 E385, E387, 413 E78-E93, 109, 113, 115, 116 E78-E93, 99 |
| + hydrogen chloride E54, 70 2-Pentene, 2,4,4-trimethyl- + hydrogen chloride E41, E42, 48 2-Pentene, 2,4,4-trimethyl-(ternary) + hydrogen chloride E54, 71 3-Penten-1-ol + hydrogen chloride E133, 134, 136 4-Penten-1-ol | see ethane, pentachloro- 1,3-Pentadiene + hydrogen chloride Pentamethylene glycol see 1,5-pentanediol Pentane + hydrogen chloride Pentane, 1,1'-oxybis- + hydrogen chloride Pentane, 1-methoxy- + hydrogen chloride 1,5-Pentanediol + hydrogen chloride 1Pentanol + hydrogen chloride 3-Pentanol + hydrogen chloride 3-Pentanol + hydrogen chloride 2-Pentanol, 4-methyl- + hydrogen chloride | E7, E8, E11, 12 E150-E155, 160, 168 E150-E155, 158 E9, E11, 12 E138, 139, 144 E385, E387, 413 E78-E93, 109, 113, 115, 116 E78-E93, 99 |
| 2-Pentene, 2,4,4-trimethyl- + hydrogen chloride E41, E42, 48 2-Pentene, 2,4,4-trimethyl-(ternary) + hydrogen chloride E54, 71 3-Penten-1-ol + hydrogen chloride E133, 134, 136 4-Penten-1-ol | see ethane, pentachloro- 1,3-Pentadiene + hydrogen chloride Pentamethylene glycol see 1,5-pentanediol Pentane + hydrogen chloride Pentane, 1,1'-oxybis- + hydrogen chloride Pentane, 1-methoxy- + hydrogen chloride 1,5-Pentanediol + hydrogen chloride 1-Pentanol + hydrogen chloride 3-Pentanol + hydrogen chloride 3-Pentanol + hydrogen chloride 1-Pentene, 2,4,4-trimethyl- + hydrogen chloride 1-Pentene, 2,4,4-trimethyl- + hydrogen chloride | E7, E8, E11, 12 E150-E155, 160, 168 E150-E155, 158 E9, E11, 12 E138, 139, 144 E385, E387, 413 E78-E93, 109, 113, 115, 116 E78-E93, 99 E78-E93, 110 |
| + hydrogen chloride 2-Pentene, 2,4,4-trimethyl-(ternary) + hydrogen chloride 3-Penten-1-ol + hydrogen chloride 4-Penten-1-ol | see ethane, pentachloro- 1,3-Pentadiene + hydrogen chloride Pentamethylene glycol see 1,5-pentanediol Pentane + hydrogen chloride Pentane, 1,1'-oxybis- + hydrogen chloride Pentane, 1-methoxy- + hydrogen chloride Pentane, 2,2,4-trimethyl- + hydrogen chloride 1,5-Pentanediol + hydrogen chloride 1-Pentanol + hydrogen chloride 3-Pentanol + hydrogen chloride 3-Pentanol + hydrogen chloride 1-Pentene, 2,4,4-trimethyl- + hydrogen chloride 1-Pentene, 2,4,4-trimethyl-(ternary) | E7, E8, E11, 12 E150-E155, 160, 168 E150-E155, 158 E9, E11, 12 E138, 139, 144 E385, E387, 413 E78-E93, 109, 113, 115, 116 E78-E93, 99 E78-E93, 110 E41, E42, 47 |
| + hydrogen chloride E54, 71 3-Penten-1-ol 4-Penten-1-ol | see ethane, pentachloro- 1,3-Pentadiene + hydrogen chloride Pentamethylene glycol see 1,5-pentanediol Pentane + hydrogen chloride Pentane, 1,1'-oxybis- + hydrogen chloride Pentane, 1-methoxy- + hydrogen chloride Pentane, 2,2,4-trimethyl- + hydrogen chloride 1,5-Pentanediol + hydrogen chloride 1-Pentanol + hydrogen chloride 3-Pentanol + hydrogen chloride 3-Pentanol + hydrogen chloride 1-Pentene, 2,4,4-trimethyl- + hydrogen chloride 1-Pentene, 2,4,4-trimethyl- + hydrogen chloride 2-Pentene, 2,4,4-trimethyl- (ternary) + hydrogen chloride 2-Pentene, 2,4,4-trimethyl- | E7, E8, E11, 12 E150-E155, 160, 168 E150-E155, 158 E9, E11, 12 E138, 139, 144 E385, E387, 413 E78-E93, 109, 113, 115, 116 E78-E93, 99 E78-E93, 110 E41, E42, 47 E54, 70 |
| 3-Penten-1-ol + hydrogen chloride E133, 134, 136 4-Penten-1-ol | see ethane, pentachloro- 1,3-Pentadiene + hydrogen chloride Pentamethylene glycol see 1,5-pentanediol Pentane + hydrogen chloride Pentane, 1,1'-oxybis- + hydrogen chloride Pentane, 1-methoxy- + hydrogen chloride Pentane, 2,2,4-trimethyl- + hydrogen chloride 1,5-Pentanediol + hydrogen chloride 1-Pentanol + hydrogen chloride 3-Pentanol + hydrogen chloride 2-Pentanol, 4-methyl- + hydrogen chloride 1-Pentene, 2,4,4-trimethyl- + hydrogen chloride 1-Pentene, 2,4,4-trimethyl- + hydrogen chloride 2-Pentene, 2,4,4-trimethyl- + hydrogen chloride 2-Pentene, 2,4,4-trimethyl- + hydrogen chloride 2-Pentene, 2,4,4-trimethyl- + hydrogen chloride 2-Pentene, 2,4,4-trimethyl- + hydrogen chloride | E7, E8, E11, 12 E150-E155, 160, 168 E150-E155, 158 E9, E11, 12 E138, 139, 144 E385, E387, 413 E78-E93, 109, 113, 115, 116 E78-E93, 99 E78-E93, 110 E41, E42, 47 E54, 70 |
| 4-Penten-1-ol | see ethane, pentachloro- 1,3-Pentadiene + hydrogen chloride Pentamethylene glycol see 1,5-pentanediol Pentane + hydrogen chloride Pentane, 1,1'-oxybis- + hydrogen chloride Pentane, 1-methoxy- + hydrogen chloride Pentane, 2,2,4-trimethyl- + hydrogen chloride 1,5-Pentanediol + hydrogen chloride 1-Pentanol + hydrogen chloride 3-Pentanol + hydrogen chloride 2-Pentanol, 4-methyl- + hydrogen chloride 1-Pentene, 2,4,4-trimethyl- + hydrogen chloride 1-Pentene, 2,4,4-trimethyl- + hydrogen chloride 2-Pentene, 2,4,4-trimethyl- + hydrogen chloride 2-Pentene, 2,4,4-trimethyl- + hydrogen chloride 2-Pentene, 2,4,4-trimethyl- (ternary) + hydrogen chloride 2-Pentene, 2,4,4-trimethyl-(ternary) | E7, E8, E11, 12 E150-E155, 160, 168 E150-E155, 158 E9, E11, 12 E138, 139, 144 E385, E387, 413 E78-E93, 109, 113, 115, 116 E78-E93, 99 E78-E93, 110 E41, E42, 47 E54, 70 E41, E42, 48 |
| | see ethane, pentachloro- 1,3-Pentadiene + hydrogen chloride Pentamethylene glycol see 1,5-pentanediol Pentane + hydrogen chloride Pentane, 1,1'-oxybis- + hydrogen chloride Pentane, 1-methoxy- + hydrogen chloride Pentane, 2,2,4-trimethyl- + hydrogen chloride 1,5-Pentanediol + hydrogen chloride 1-Pentanol + hydrogen bromide + hydrogen chloride 3-Pentanol + hydrogen chloride 2-Pentanol, 4-methyl- + hydrogen chloride 1-Pentene, 2,4,4-trimethyl- + hydrogen chloride 1-Pentene, 2,4,4-trimethyl-(ternary) + hydrogen chloride 2-Pentene, 2,4,4-trimethyl- (ternary) + hydrogen chloride 2-Pentene, 2,4,4-trimethyl- + hydrogen chloride 3-Pentene, 2,4,4-trimethyl- (ternary) + hydrogen chloride 2-Pentene, 2,4,4-trimethyl- + hydrogen chloride 3-Penten-1-ol | E7, E8, E11, 12 E150-E155, 160, 168 E150-E155, 158 E9, E11, 12 E138, 139, 144 E385, E387, 413 E78-E93, 109, 113, 115, 116 E78-E93, 99 E78-E93, 110 E41, E42, 47 E54, 70 E41, E42, 48 E54, 71 |
| | see ethane, pentachloro- 1,3-Pentadiene + hydrogen chloride Pentamethylene glycol See 1,5-pentanediol Pentane + hydrogen chloride Pentane, 1,1'-oxybis- + hydrogen chloride Pentane, 1-methoxy- + hydrogen chloride Pentane, 2,2,4-trimethyl- + hydrogen chloride 1,5-Pentanediol + hydrogen chloride 1-Pentanol + hydrogen chloride 3-Pentanol + hydrogen chloride 3-Pentanol + hydrogen chloride 1-Pentene, 2,4,4-trimethyl- + hydrogen chloride 1-Pentene, 2,4,4-trimethyl- + hydrogen chloride 2-Pentene, 2,4,4-trimethyl- + hydrogen chloride 3-Penten-1-ol + hydrogen chloride 3-Penten-1-ol | E7, E8, E11, 12 E150-E155, 160, 168 E150-E155, 158 E9, E11, 12 E138, 139, 144 E385, E387, 413 E78-E93, 109, 113, 115, 116 E78-E93, 99 E78-E93, 110 E41, E42, 47 E54, 70 E41, E42, 48 E54, 71 |

Pentyl acetate see acetic acid, pentyl ester Pentyl hexyl ether see hexane, 1-pentoxy-Petroleum + hydrogen chloride E41, E42, 43 Phenetole see benzene, ethoxy-Phenol + hydrogen chloride E155, 195 Phenyl acetate see acetic acid, phenyl ester Phenyl ethyl ether see benzene, ethoxy-Phenyl chloroformate see carbonochloridic acid, phenyl ester Phenylethanol see ethanol, phenyl-Phenylphosphonic dichloride see phosphonic dichloride phenyl-Phenylphosphonothioic dichloride see phosphonothioic dichloride, phenyl-Phenylphosphonous dichloride see phosphonous dichloride, phenyl-, Phenyl-1-propanol see 1-propanol, phenyl-3-Phenylpropanol see benzenepropanol Phosphonic dichloride, phenyl-E342, 356 + hydrogen chloride Phosphonochloridic acid, diphenyl ester E342, 363 + hydrogen chloride Phosphonochloridic acid, monophenyl ester + hydrogen chloride E342, 362 Phosphonothioic dichloride, phenyl-E342, 357 + hydrogen chloride Phosphonous dichloride, phenyl-+ hydrogen chloride E342, 355 Phosphoric acid, tributyl ester E342, 358, 359 + hydrogen chloride Phosphoric acid, triethyl ester + hydrogen chloride E342, 358 Phosphoric acid, trimethyl ester E342, 358 + hydrogen chloride Phosphoric acid, tripropyl ester + hydrogen chloride E342, 358 Phosphoric acid, tris(2-methylpropyl) ester E342, 358 + hydrogen chloride Phosphorus trichloride E342, 353 + hydrogen chloride Phosphorous acid, di-2-propenyl ester E342, 360 + hydrogen chloride Phosphorous acid, triphenyl ester E342, 361 + hydrogen chloride Phosphoryl chloride E342, 354 + hydrogen chloride Piperylene see 1,3-pentadiene Prehnitene see benzene, 1,2,3,4-tetramethyl-Propane, 1-bromo-+ hydrogen bromide E389, 428 E437, E438, 445 + hydrogen iodide Propane, 1-chloro-E437, E438, 444 + hydrogen iodide Propane, 1,3-dibromo-E389, E390, 429 + hydrogen bromide Propane, 1-iodo-+ hydrogen bromide E389, 428 E437, E438, 445 + hydrogen iodide Propane, 1-methoxy-+ hydrogen chloride E150-E155, 157 Propane, 1,1'-oxybis-+ hydrogen chloride E150-E155, 158, 167 Propane, 1,1'-oxybis- (ternary) + hydrogen chloride Propane, 1,1'-oxybis(3-chloro-+ hydrogen chloride E150-E155, 172 Propane, 2,2-thiobis-E390, 434 E438, 449 + hydrogen bromide + hydrogen iodide Propane, 1,1'-sulfinylbis-E330, E331, 333 + hydrogen chloride Propane, 2,2'-sulfinylbis-E330, E331, 333 + hydrogen chloride 1,3-Propanediol + hydrogen chloride E138, 139, 143 2-Propanethiol E390, 434 + hydrogen bromide E330, E331, 334 E438, 449 + hydrogen chloride + hydrogen iodide 1,2,3-Propanetriol + hydrogen fluoride E1, 4 2-Propanesulfonyl chloride E330, E331, 332 + hydrogen chloride Propanoic acid + hydrogen chloride E196, 198 Propanoic acid, 2-methyl-+ hydrogen chloride E196, 198 Propanoic acid, ethyl ester + hydrogen chloride E207-E209, 213 1-Propanol + hydrogen chloride E78-E93, 98, 106, 107 2-Propanol + hydrogen chloride E78-E93, 96, 98 2-Propanol, 1-bromo-+ hydrogen chloride E127, 130 2-Propanol, 1-chloro-+ hydrogen chloride E127, 130 2-Propanol, 1,3-dibromo-+ hydrogen chloride E127, 130 1-Propanol, 2,3-dibromo-+ hydrogen chloride E127, 131 1-Propanol, 2,2-dimethyl-+ hydrogen bromide E385, 412 1-Propanol, 2-methylhydrogen chloride E78-E93, 99 1-Propanol, phenyl-+ hydrogen chloride E145, 149 Propargyl alcohol see 2-propyn-1-ol Propargyl butyrate see butanoic acid, 2-propynyl ester Propene, 3-chloro-1-+ hydrogen chloride E241, 289, 290 2-Propen-1-ol + hydrogen chloride E133, 134, 135 Propyl acetate see acetic acid, propyl ester 1-Propylchloroformate see carbonochloridic acid, propyl ester Propylene glycol see 1,3-propanetriol 2-Propyl mercaptan see 2-propanethiol 2-Propyn-1-ol + hydrogen chloride E133, 134, Pseudocumene see benzene, 1,2,4-trimethyl-2H-Pyran, tetrahydro-, (ternary) + hydrogen chloride E21, E22, 32 Pyridine, 2-chloro-6-(trichloromethyl)-+ hydrogen chloride E314, E315, 327

```
Pyridine, 3,5-dichloro-2-(trichloromethyl)-
                                                     E314, E315, 328
                   + hydrogen chloride
Pyridine, 3,4,5-trichloro-2-(dichloromethyl)-
                    + hydrogen chloride
                                                     E314, E315, 329
Pyridine, 2-(trichloromethyl)-
                                                     E314, E315, 326
                   + hydrogen chloride
Sec-butanol
                   see 2-butanol
Sec-butyl acetate
                   see acetic acid, 1-methylpropyl ester
Sec-butyl alcohol
                   see 2-butanol
Silane, tetrachloro-
                                                     E365, 377, 378
                   + hydrogen chloride
Silane, triethoxy-
                                                     E365, 376
                    + hydrogen chloride
Silane, triethoxy- (ternary)
                   + hydrogen chloride
                                                     E365, 375
Silicic acid, tetraethyl ester
                                                     E365, E367, 370
                   + hydrogen chloride
Silicic acid, tetraethyl ester (ternary)
                                                     E365, 375
                    + hydrogen chloride
Silicic acid, tetrakis(2-chloroethyl) ester
                                                     E365, E367, 374
                   + hydrogen chloride
Silicic acid, tetramethyl ester
                                                     E365, E367, 369
                   + hydrogen chloride
Silicic acid, tetra(4-methyl-2-pentyl) ester
                   + hydrogen chloride
                                                     E365, E366, 372, 373
Silicic acid, tetrapropyl ester
                                                     E365, 371
                   + hydrogen chloride
Silicon tetrachloride
                   see silane, tetrachloro-
Stannane, tetrachloro-
                                                     E379, 380, 381
                   + hydrogen chloride
Sulfuric acid
                                                     E330, E331, 332
                   + hydrogen chloride
Sulfuric acid, chloro-, butyl ester
                   + hydrogen chloride
                                                     E330, E331, 333
Sulfuric acid, dichloro-
                   + hydrogen chloride
                                                     E330, E331, 332
Sulfur dioxide
                                                     E390, E391, 435
                   + hydrogen bromide
                   + hydrogen chloride
                                                     E330, E331, 340
Sulfuryl chloride
                                                     E330, E331, 333
                   + hydrogen chloride
1,1,2,2-Tetrabromoethane
                   see ethane, 1,1,2,2-tetrabromo-
1,1,2,2-Tetrachloroethane
                   see ethane, 1,1,2,2-tetrachloro-
Tetrachloroethene
                   see ethene, tetrachloro-
1-Tetradecanol
                                                     E385, E387, 415
                   + hydrogen bromide
                                                     E78-E93, 125
                   + hydrogen chloride
Tetrahydrofuran
                   see furan, tetrahydro-
Tetrahydropyran
                   see 2H-pyran,tetrahydro-
1,2,3,4-Tetramethylbenzene
                   see benzene, 1,2,3,4-tetramethy1-
Tetramethylene glycol
                   see 1,4-butanediol
Tetramethylene sulfone
                   see thiophene, tetrahydro-, 1,1-dioxide
Thionyl chloride
                                                     E330, E331, 337, 338
                   + hydrogen chloride
1,1,2-Trichloroethane
                   see ethane, 1,1,2-trichloro-
1,2,3-Trimethylbenzene
                   see benzene, 1,2,3-trimethyl-
1,2,4-Trimethylbenzene
                   see benzene, 1,2,4-trimethyl-
```

3,5,5-Trimethyl-1-hexanol see 1-hexanol, 3,5,5-trimethyl-Thiofuran see thiophene Thiophene + hydrogen bromide E390, 434 E330, E331, 334 + hydrogen chloride E438, 449 + hydrogen iodide Thiophene (ternary) E54, 72 + hydrogen chloride Thiophene, tetrahydro-E390, 434 + hydrogen bromide + hydrogen iodide E438, 449 Thiophene, tetrahydro-, 1,1-dioxide E330, E331, 333 + hydrogen chloride Thiophenol see benzenethiol Tin tetrachloride see stannane, tetrachloro-Titanium chloride E379, 382 + hydrogen chloride Titanium tetrachloride see titanium chloride Toluene see benzene, methyl-Tribromomethane see methane, tribromo-Tributyl borate see boric acid, tributyl ester Trichloroacetic acid see acetic acid, trichloro-2,2,2-Trichloroethanol phosphite see ethanol, 2,2,2-trichloro-, phosphite Trichloroethene see ethene, trichloro-Trichloromethane see methane, trichloro-Triethyl borate see boric acid, triethyl ester Trifluoromethylbenzene see benzene, trifluoromethyl-2,2,4-Trimethylpentane see pentane, 2,2,4-trimethyl-2,2,4-Trimethyl-1-pentene see 1-pentene, 2,2,4-trimethyl-2,2,4-Trimethyl-2-pentene see 2-pentene, 2,2,4-trimethyl-Vinyl chloride see ethene, chlorom-Xylene see benzene, 1-2-dimethylo-Xylene see benzene, 1,3-dimethy1p-Xylene see benzene, 1,4-dimethy1-

REGISTRY NUMBER INDEX

Page numbers preceded by E refer to evaluation texts. E21, E22, 36, E236, E238, 245, 246, 250-255, E368, E389, 56-23-5 425, 427 E1, 5 56-81-5 60-29-7 E21, E22, 23, 73, E150, E152, E153, 157, 164-166, 175 E78-E84, E87, E89, E92, 95-97, 101, 104, 105, E385, E387, 64-17-5 411 E196, 197 64-18-6 64-19-7 E196, 197, 199-203, E388, 422, E438, 442 E78-E84, E86, E89, E92, 94-97, 101-103 E78, E79, E88, E91, E92, 96, 98 67-56-1 67-63-0 E236, E238, 247, 248, 249, E338, E389, 424, 426 67-66-3 E78, E79, E83, E84, E87, E89, E92, 98, 106, 107 71-23-8 E78-E80, E82-E84, E86, E87, E89, E92, 98, 106, 108, 71-36-3 111-114 E78, E79, E83, E84, E87, E89, E92, 109, 113, 115, 116, E385, E387, 413 71-41-0 E21, E22, 38, E53, E54, 56-65, 71, E384, 401-404 71-43-2 E389, E390, 428, E437, E438, 445 E241, 274, E437, E438, 444 74-88-4 74-96-4 75-01-4 E241, 281-283 E437, E438, 445 E236, E237, 244, 245, 246, E388, E389, 424 75-03-6 75-09-2 E330, E331, 341 E241, 274 75-15-0 75-25-2 75-33-2 E330, E331, 334, E390, 434, E438, 449 E240, 259, 260 E385, E387, 412 E127, 131 E240, E241, 256, 267 75-34-3 75-84-3 75-89-8 76-01-7 76-03-9 E196, 206 E155, 190 E352, 358 78-39-7 78-40-0 78-79-5 E41, E42, 50 78-83-1 E78, E79, E88, E90, 99 E78, E79, E86, E88, E91, E92, 98, 109 78-92-2 E240, E242, 258, 264 79-00-5 E240, 258, 286, 287 E196, 198 E196, 205 79-01-6 79-09-4 79-11-8 79-20-9 E207, E208, 210, 214, 215 79-27-6 E241, 274 E196, 198 E236, E239, E240, E242, 256, 258, 265, 266 E330, E331, 333 79-31-2 79-34-5 80-44-4 88-72-2 E21, E22, 35, E314, E315, 323, E390, 432 E314, 320 71, 74 88-73-3 95-47-6 95-50-1 E291, 305, 306 95-63-6 71 E127, 131 E127, 130 E293, 298, 308 96-13-9 96-21-9 98-07-7 E21, E22, 40, 72, E293, 295, 296, 297 98-08-8 98-09-9 E330, E331, 333

98-88-4 E293, 313 39 E21, E22, 98-82-8 98-95-3 E21, E22, 34, E314, E315, 316-320, 322, E390, 431 E314, E315, 324, 325, E390, 433 99-08-1 E330, E331, 336 98-09-9 99-54-7 E314, 321 100-00-5 E314, 321 E21, E22, 39 100 - 41 - 4E293, 298 E145, 147 100-44-7 100-51-6 E21, E22, 27, E153, E154, 163, 168, 181, 182 100-66-3 E1, 5, E21, E22, 28, E153, E154, 170, 185, 186 E207, 218 101-02-0 101-84-8 101 - 97 - 3E21, E22, 29, E153, E154, 171 103-50-4 103-73-1 E153, E154, 169, 183 E208, 222 105-36-2 105-37-3 E207, E208, 213 105-39-5 E208, 226 E207, E208, 212 105-46-4 E207, E208, 213 105-54-4 105-58-8 E208, E209, 231 105-66-8 E209, 220 106-42-3 71, 76 106-93-4 E241, 274, 275, E389, E390, 429 E389, E390, 428 106-94-5 E383, E384, 392, 399 E281, 289, 290 E236, E239, E242, 256-258, 261-263, E389, E390, 425 E127, 128, 129, E387, 418 106-97-8 107-05-1 107-06-2 107 - 07 - 3107-08-4 E389, E390, 428, E437, E438, 445 107-18-6 E133, 135 E133, 134 107-19-7 107-21-1 E1, 5, E138, E139, 140-142 107-39-1 E41, E42, 47, 70 E41, E42, 48, 70 107-40-4 E138, E139, 143 107-88-0 107-92-6 E196, 198 E78, E79, E88, E91, E92, 110, 117 108-11-2 E150, E152, E153, 175 108-20-3 E207, E208, 211, 216 108 - 21 - 4E209, 219 108-22-5 E21, E22, 39, 71, 75, E384, E385, 408, 409 E21, E22, 39, 72, E384, E385, 410 E21, E22, 40, E291, 309, 310, 311, E390, 430 108-38-3 108-67-8 108-86-1 E21, E22, 38, E53, E54, 57, 66-73, E384, 405-407 E21, E22, 40, 72, E291, E293, 299-304, E390, 430 108-88-3 108-90-7 E145, 146 108-93-0 108-95-2 E155, 195 E330, E331, 334, E390, 434, E438, 449 108-98-5 E207, E208, 211, 216 109-60-4 E209, 221, 225 109-61-5 E389, E390, 429 109-64-8 E241, 276, E437, E438, 445 109-65-9 E7-E11, 12 109-66-0 E240, E241, 268, E437, E438, 444 109-69-3 E330, E331, 334, E390, 434, E438, 449 E207, E208, 210 109 - 79 - 5E207, E208, 109-94-4 E21, E22, 30, E153, E154, 171 109-99-9 E330, E331, 334, E390, 434, E438, 449 110-01-0

| 110-02-1 | 72, E330, E331, 334, E390, 434, E438, 449 |
|--|---|
| 110-19-0 | E207, E208, 212 |
| 110-52-1 | E389, E390, 429 |
| 110-54-3 | E7-E11, 12-16, E383, E384, 393, 394, 400 |
| 110-63-4 | E138, E139, 144 |
| 110-82-7 111-25-1 111-27-3 111-29-5 111-43-3 | E41, E42, 44-46, E53, E54, 70 E241, 277, E389, E390, 428 E78, E79, E83, E84, E86, E87, E89, E92, 113, 116, 118, E385, E387, 413 E138, E139, 144 E21, E22, 24, E150, E152, E153, 158, 167 |
| 111-44-4 111-65-9 111-66-0 111-70-6 111-83-1 | E21, E22, 26, E154, 172, 187, 188 E1, 2-4, E7-E11, 12, 13, E383, E384, 396 71 E78, E79, E83, E84, E87, E89, E92, 117, 119,E385, E387, 414 E241, 278, 279, E387, E389, 425, E437, E438, 447 |
| 111-85-3 111-87-5 112-14-1 112-30-1 112-40-3 | E240, E241, 270, E388, E389, 425, E437, E438, 446 E78, E79, E83, E85-E87, E89, E92, 100, 110, 119-121, E385-E387, 414, 416, E438, 448 E207, E208, 212 E78, E79, E83, E87, E90, 117, 119, 123, E385, E387, 414 E7-E11, 13 |
| 112-52-7 | E240, E241, 271 |
| 112-53-8 | E78, E79, E83, E85, E87, E90, E92, 124, E385, E387, 415 |
| 112-58-3 | E150, E152, E153, 162 |
| 112-72-1 | E78, E85, E87, E90, E92, 125, E385, E387, 415 |
| 112-92-5 | E78, E85, E87, E90, E92, 125 |
| 115-20-8 | E127, 131, 132, E387, 419, 420 |
| 120-82-1 | E291, 307 |
| 121-73-3 | E314, 321 |
| 122-79-2 | E207, E208, 213 |
| 123-51-3 | E78, E79, E88, E90, E92, 115 |
| 123-86-4 | E207, E208, 212, 216 |
| 123-91-1 | E21, E22, 31, E153, E154, 171, 189 |
| 123-96-6 | E78, E79, E88, E91, E92, 122 |
| 124-18-5 | E7-E11, 19, E383, E384, 395, 396 |
| 124-63-0 | E330, E331, 332 |
| 126-33-0 | E330, E331, 333 |
| 126-71-6 | E352, 358 |
| 126-73-8 | E352, 358, 359 |
| 127-00-4 | E127, 130 |
| 127-18-4 | 72, E241, 286, 288 |
| 137-32-6 | E78, E79, E88, E90, E92, 99 |
| 139-66-2 | E330, E331, 334, E390, 434, E438, 449 |
| 140-11-4 | E207, E208, 213 |
| 141-78-6 | E207, E208, 211, 214, 215 |
| 142-62-1 | E196, 204, E388, 423, E438, 443 |
| 142-68-7 | E21, E22, 32 |
| 142-82-5 | E7-E11, 12, 17, 18, E21, E22, 23-40, 70, E383, E384, 395 |
| 142-96-1 | E150, E152, E153, 160, 168, 175 |
| 143-08-8 | E78, E79, E83, E87, E89, E92, 119, E385, E387, 414 |
| 150-46-9 | E342, 343 |
| 156-60-5 | E241, 284, 285 |
| 274-09-9 | E155, 191 |
| 340-54-5 | E437, E438, 444 |
| 352-93-2 | E21, E22, 33 |
| 462-06-6 | E21, E22, 40, E291, 294 |

488-23-3 72 E155, 192 E196, 198 493-09-4 503-74-2 E41, E42, 49 504-60-9 504-63-2 E138, E139, 143 E352, 358 512-56-1 E352, 358 513-08-6 513-42-8 E133, 136 E41, E42, 513-81-5 51 E138, E139, 144 513-85-9 E208, 222 515-84-4 526-73-8 71 527-53-7 72 535-15-9 E208, 222 E153, E154, 169 538-86-3 E21, E22, 40 E153, E154, 538-93-2 170 539-30-0 E208, E209, 233 539-92-4 540-51-2 E127, 129 E150-E153, 156 540-67-0 540-84-1 E7-E11, 12 E208, 221, 224 541 - 41 - 3E208, E209, 232 542-52-9 E208, 223 E154, 172 542-58-5 542-88-1 544-01-4 E1, 5, E150, E152, E153, 161, 168, 178, 179 E240, E241, 269 544-10-5 E330, E331, 334, E390, 434, E438, 449 E7-E11, 13, 20 544 - 40 - 1544-76-3 557-17-5 E150, E152, E153, 157 E153, E154, 169 578-58-5 583-59-5 E145, 146 E78, E79, E88, E91, E92, 99 584-02-1 E154, 170 588-67-0 E78, E79, E88, E91, E92, 100 589-55-9 E21, E22, 40, E291, 312, E390, 430 591-50-4 E208, 227 592-34-7 594-44-5 E330, E331, 332 E330, E331, 333 E330, E331, 333 595-50-6 598-03-8 E330, E331, 333 598-04-9 598-38-9 E387, 417 601-88-7 E314, 321 E208, 230 E342, 344, E391, 436 620-73-5 621-78-3 623-71-2 E208, 228 625-24-1 E208, 223 E21, E22, 37 625-58-1 625-80-9 E330, E331, 334, E390, 434, E438, 449 E133, 136 627-27-0 628-08-0 E209, 219 E150, E152, E153, 167, 173, 174 628-28-4 628-63-7 E207, 217 E150, E152, E153, 158 628-80-8 628-81-9 E150, E152, E153, 176, 177 E389, E390, 429 629-03-8 629-27-6 280, E388, E389, 425, E437, E438, 448 E150, E152, E153, 159 629-32-3 629-36-7 E154, 172 E150, E152, E153, 162 629-64-1

| 629-73-2 | E41, E42, 52 |
|---|---|
| 629-82-3 | E150, E152, E153, 163, E387, 421, E438, 441 |
| 644-97-3 | E342, 355 |
| 681-84-5 | E365, E367, 369 |
| 682-01-9 | E365, 371 |
| 688-74-4 | E342, 345 |
| 693-65-2 | E150, E152, E153, 160, 168 |
| 763-23-5 | E330, E331, 333 |
| 778-28-9 | E330, E331, 333 |
| 821-09-0 | E133, 136 |
| 824-72-6 | E342, 356 |
| 873-51-8 | E342, 349 |
| 927-74-2 | E133, 135 |
| 929-56-6 | E150, E152, E153, 160 |
| 998-30-1 | E365, 375, 376 |
| 1069-93-8 | E352, 364 |
| 1124-68-1 | E342, 346 |
| 1126-79-0 | E153, E154, 184 |
| 1128-16-1 | E315, 328 |
| 1321-27-3 | E145, 148 |
| 1330-20-7 | 77 |
| 1335-12-2 | E145, 149 |
| 1462-34-6 | E154, 172 |
| 1912-32-9 | E330, E331, 333 |
| 1929-82-4 | E315, 327 |
| 1932-93-0 | E209, Ż20 |
| 2028-63-9 | E133, 135 |
| 2050-95-5 | E208, E209, 234 |
| 2051-78-7 | E209, 220 |
| 2305-21-7 | E133, 137 |
| 2408-20-0 | E209, 220 |
| 2524-64-3 | E352, 363 |
| 2679-87-0 | E150, E152, E153, 158 |
| 3073-92-5 | E150, E152, E153, 159 |
| 3452-97-9 | E78, E79, E88, E91, 100 |
| 3488-87-7 | E342, 347 |
| 3497-00-5 | E352, 357 |
| 4377-37-1 | E315, 326 |
| 4747-07-3 | E150, E152, E153, 159 |
| 4860-03-1 | E240, E241, 272, 273 |
| 5966-54-1 | E155, 194 |
| 6092-54-2 | E208, 229 |
| 6117-91-5 | E133, 135 |
| 6421-41-6 | E330, E331, 333 |
| 7041-22-7 | E315, 329 |
| 7216-18-4 7446-09-5 7550-45-0 7646-78-8 7647-01-0 | E155, 193 E330, E331, 340, E390, E391, 435 E379, 380, 382 E379, 380 E7-E11, 12-20, E21, E22, 23-40, E41, E42, 43-52, E53- E55, 56-77, E78-E93, 94-126, E127, 128-132, E133, E134, 135-137, E138, E139, 140-144, E145, 146-149, E150-E155, 156-195, E196, 197-206, E207-E209, 210-235, E236-E243, 244-290, E291-E293, 294-313, E314, E315, 316-329, E330, E331, 332-341, E342, 343-351, E352, 353-364, E365-E368, 369-378, E379, 380-382 |
| 7664-39-3 | E1, 2-6 |
| 7664-93-9 | E330, E331, 332 |
| 7719-09-7 | E330, E331, 337, 338 |
| 7719-12-2 | E352, 353 |
| 7727-15-3 | E383, E384, 399, 400 |

| 7783-06-4 7789-21-1 | 64, 65, 316 E330, E331, 339 E1, 6 E330, E331, 332, 335 E352, 354 |
|--|--|
| 10034-85-2 10035-10-6 10147-37-2 | E352, 377, 378 E437-E439, 440-453 E383-E391, 392-436 E330, E331, 332 E342, 350, 351, E438, 450 |
| 10544-63-5 10606-47-0 13929-83-4 14245-63-7 16339-30-3 | E133, 137 E342, 362 E330, E331, 333 |
| 19686-73-8 | E365, 374 E365, E366, 372, 373 E127, 130 E342, 360 E293, 297 |
| 36653-82-4 39161-19-8 50780-47-7 | E150, E152, E153, 161, 162 E78, E85-E87, E90, E92, 126, E385, E387, 415 E133, 136 E208, E209, 235 E293, 296, 297 |
| 72035-37-1 72035-38-2 72035-39-3 72035-40-6 72035-41-7 | E342, 347 E342, 347 E342, 346 |

AUTHOR INDEX

Page numbers preceded by E refer to evaluation texts. E236, E243, 263, 287 E21, E22, E53, E54, 74-76, E78, E79, E85, E87, E93, 120, E150, E152, E155, 180, E196, 202, 204, E240, Abdullaev, A.I. Ahmed, W. E241, E243, 279, 280, E293, 313, E315, 322, E330, E331, 335-337, 340, E342, 349-351, E352, 353-357, E365, E368, 377, E379, 381, 382, E383-E385, E387-E391, 395, 398, 404, 407, 409, 416, 417, 420-425, 430, 431, 435, E437-E439, 440-443, 446-448, 450 E236, E243, 263, 287 Allev, A.M. Avet'yan, M.G. E236, E240, E241, E243, 258 E291-E293, 302 Babkin, B.M. Bell, R.P. E7-E11, 13, E41, E42, 44, E53, E54, 57, E236, E238, E240, E241, E243, 245, 256, 274, 286, E291-E293, 298, 309 E53, E54, 66, E384-E390, E391, 401, 405, 432, 433 E383, E384, 394, 396, 397 Bobalek, E.G. Boedeker, E.R. Borissov, R.S. E352, 358 E7-E11, 17, E21, E22, 38-40, E41, E42, 47, 48, Brady, J.D. E53-E55, 67, 70-72 E7-E11, 17, E21, E22, 38-40, E41, E42, 47, 48, E53-E55, 67, 70-72, E384, E385, E391, 403, 406, 408, Brown, H.C. 410 E7-E11, 12, 15, 16 E291, E293, 294, 299, 310, 312 Bugaichuk, A.M. Byrne, J.B. E330, E331, 332, 333 Charalambous, J. E41, E42, 43, E53, E54, 58, E78, E79, E84, E85, E87, E88, E93, 96, E152, E155, 165, E207, E209, 214, E236, Chesterman, D.R. E243, 246, E330, E331, 341 E78, E79, E84, E87, E93, 107, E133, 134-137, E207, E208, 219, 220, E241, E243, 290, E352, 360 Cook, T.M. E196, 199 E236, E241, E243, 253, 288, 289 Cupr, V. Curda, M. E240, E241, E243, 259, 260, 282-285 Danov, S.M. Dement'seva, G.M. E41, E42, 49, 50 E53, E54, 62, 68, 77 Despande, A.B. Domeniconi, M. E330, E331, 338 Dorofeeva, N.G. E385, E391, 411 E53, E54, 63, E291-E293, 295-297, 304, 305, 307, Dzhagatspanyan, R.V. E315, 320, 321, 326-329 E53, E54, 69, 73, E152, E155, 166 Dzhuraev, Kh.Sh. Echte, A. Evans, W.H. E7-E11, 18, E21, E22, 23-37 451, 452 E196, 200 Ewart, R.H. E78, E79, E84-E88, E93, 114, 118, 121-126, E240, E243, 271, 272, 271, 272, E386, E391, 413-415 Fernandes, J.B. E236, E240, E241, E243, 258 Flid, R.M. 451, 452 Fonseca, I.M. E383, E384, E391, 392, 393, 399, 400 E21, E22, E330, E331, 332-334, E390, E391, 434, E438, Fontana, C.M. Frazer, M.J. E439, 449 E78, E79, E81, E93, 101 Fritz, J.J. E196, 201 Gehlawat, J.K.

| Gerrard, W. Gill, W.N. Golubev, Yu.D. Gorshkov, A.S. | E1, E7, E10, E11, 19, E21, E22, E53, E54, 74-76, E78-E80, E82, E84, E85, E87, E88, E93, 97-100, 108-112, 115, 117, 120, E127, 128-132, E138, E139, 142-144, E145, 146-149, E150, E152-E155, 167-172, 180, 190-195, E196, 197, 198, 202, 204-206, E207-E209, 210-213, 217, 218, 221-235, E240, E241, E243, 268-270, 276-280, E291-E293, 301, 308, 311, E315, 322, E330, E331, 332-334, E342, 343-348, 351, E352, 353, 359, 361-364, E365-E368, E379, 381, 382, E387-E391, 395, 398, 404, 407, 409, 416-425, 430, 431, 434, 436, E437-E439, 440-443, 446-449 E41, E42, 52, E240, E243, 273 E240, E241, E243, 259, 260, 282-285 E365, E368, E375, 376 |
|---|---|
| Haccuria, M. | E236, E241, E243, 262, 281 |
| Hannaert, M. | E236, E241, E243, 262, 281 |
| Hartman, B.F. | E1, 6 |
| Hamai, S. | E236, E240, E241, E243, 250, 257, 264, 265, 267, 275 |
| Henderson, C. | 451, 452 |
| Herold, R.J. | E383, E384, E391, 392, 393, 399, 400 |
| Hinshelwood, C.N. | E53, E54, 56 |
| Holas, J. | E236, E241, E243, 253, 288, 289 |
| Howald, R.A. | E379, 380 |
| Howland, J.J. | E236, E238, E243, 247, 251, E388, E391, 426, 427 |
| Ionin, M.V. | E78, E79, E84, E85, E87, E93, 113, 119, E152, E155, 175, E207, E209, 215, 216, E352, 358 |
| Jaffe, I. | 451, 452 |
| Jelınek, R.V. | E41, E42, 52 |
| Jones, W.J. | E78-E82, E86, E93, 105 |
| Kaminski, M. Kapoor, K.P. Kapova, Z.K. Kapustinskii, A.F. Kenny, C.L. Ketov, A.N. Khodeeva, S.M. King, C.V. Kitvinenko, V.I. Klinedinst, K. Knight, R.W. Kohn, G. Kolesnikov, I.M. Kondratenko, V.I. | E291-E293, 338 E21, E22, E150, E152, E155, 156-163, 173,174, 176, 177 E196, 203 E384, E391, 402 E7, E8, E10, E11, 14, E21, E22, E41, E42, E53, E54, 60, E138, E139, 140, E315, 317, 323, 324 E7-E11, 12, 15, 16 E236, E243, 255 E153-E155, 183-185, E315, 325 E196, 203 E330, E331, 338 E53, E54, 56 E78, E79, E84, E87, E88, E93, 95, 106, 115, 122 E314, E315, 320, 321 E236, E238, E240, E243, 244, 249, 254 |
| Kororotov, V.I. | E53, E54, 63, E291-E293, 295-297, 304, 305, 307, E315, 326-329 |
| Kshirsagar, S.N. | E53, E54, 62, 68, 77 |
| Kumar, S. | E196, 201 |
| Kurina, N.V. | E78, E79, E84, E85, E87, E93, 113, 119 |
| Lapworth, A. | E78-E82, E86, E93, 105 |
| Lavrova, E.M. | E291, E293, 306 |
| Lewis, D.G. | 451, 452 |
| Levine, S. | 451, 452 |
| Lingford, H.M. | E78-E82, E86, E93, 105 |
| Lobry de Bruyn, C.A | E78, E79, E84, E87, E93, 94, 104 |
| Lobo, L.Q. | 451, 452 |
| Luckcock, R.G. | E21, E22, E150, E152, E155, 156-163, 173,174, 176, 177 |
| Lynch, C.C. | E383, E391, 394, 396, 397 |
| Macklen, E.D. | E1, E21, E22, E78, E79, E84, E85, E87, E88, E93, 97-100, 116 117 E127 129-131 E138 E139 142-144 E145 146-149, E150, E152-E155, 167-172, 195, E196, 198, 205, 206, E207-E209, 210-213, 217, 218, 221-223, 226, 228 |

E21, E22, E53, E54, 74-76, E78, E79, E85, E87, E93, Maladkar, V.K. 120, E150, E152, E155, 180, E196, 202, 204, E240, E241, E243, 270, 279, 280, E315, 322, E342, 351, E352, 353, E365, E368, 377, E379, 381, 382, E387-E391, 395, 398, 404, 407, 409, 416, 417, 420-425, 428-431, E437-E439, 440-448 E384, E391, 402 Mal'tsev, B.A. E330, E331, 338 E236, E243, 263, 287 Marincic, N. Mamedov, M.B. E78, E79, E81-E83, E93, 102, 103 E236, E241, E243, 262, 281 Maschka, A. Mathieu, M.P. E1, 5, E138, E139, 141, E152, E154, E155, 179, 186, Matuszak, M.P. 189 E236, E238, E243, 247, 251 E7, E10, E11, 19, E78-E80, E82, E84, E85, E87, E88, E93, 108-112, E127, 128, 132, E155, 190-194, E208, Miller, D.R. Mincer A.M.A. E209, 224, 225, 227, 229-235, E240, E241, E243, 208, 269, 276-278, E291-E293, 301, 308, 311, E342, 343-348, E352, 359, 361-364, E365, E368, 369-374, E387, E391, 418, 419, 436 E53, E54, 69, 73, E152, E155, 166 E293, 295-297 Mirsaidov, U. Motsarev, G.I. E7, E8, E10, E11, 14, E21, E22, E41, E42, E53, E54, 60, 61, 66, E138, E139, 140, E152-E155, 181-185, 187, 188, E291-E293, 294, 299, 300, 310, 312, E315, O'Brien, S.J. 317-319, 323-325, E384, E390, E391, 401, 405, 432, 433 E53, E54, 62, 68, 77 E152, E155, 178 Parande, M.G. Perkin, W.H. E7, E9-E11, 20, E41, E42 Prausnitz, J.M. E236, E240, E241, 243, 258 Pimenov, I.F. Quam, G.N. E330, E331, 339 Rajalo, G. E41, E42, 49, 50, 51 E365, E368, 378 E365, E368, E375, 376 E196, 200 Rau, H. Reibakh, M.S. Rodebush, W.H. Rossini, F.D. 451, 452 Rothrock, H.S. E387, E391, 412 E236, E243, 255 Rozovskii, M.B. Rupert, F.F. Ryabov, V.G. E78, E79, E93 E7-E11, 12, 15, 16 E21, E22, E150, E152, E155, 156-163, 173,174, 176, 177 Sandbach, J.A. E41, E42, 49, 50 E53, E54, 59, 65 Savich, T.O. Saylor, J.H. Scher, M. E41, E42, 52, E240, E243, 273 E330, E331, 338 Schlaikjer, C. E152, E155, 164 Schunke, J. E78, E79, E81-E83, E93, 102, 103 E53, E54, 69, 73, E152, E155, 166 Schmid, M. Semenenko, K.N. E78, E79, E85-E88, E93, 124-126, E240, E243, 271, 272 Sharma, M.M. E152, E155, 175, E207, E209, 215, 216 Shverina, V.G. E1, 2-4 Simons, J.H. E78, E79, E81-E83, E93, 102, 103 E7-E11, 12, 15, 16 Sofer, H. Solomonov, A.B. E330, E331, 338 Staniewicz, R. E291-E293, 302 Strepikheev, Yu.A. E7-E11, 18, E21, E22, 23-37 E53, E54, 63, E291-E293, 295-297, 304, 305, 307, E315, Strohmeir, W. Stul, B.Ya. 326-329 E78, E79, E84, E85, E87, E93, 113, 119 Sudoplatova, A.E. E41, E42, 46 Svetlova, G.M. E330, E331, 338 Swette, L. E291-E293, 303 Szfranski, M. E236, E240, E241, E243, 258 Treger, Yu.A. E7, E9-E11, 20, E41, E42 Tremper, K.L. Tsiklis, D.S. E41, E42, 46

| Tsırlin, A.M. Tudorovskaya, G.L. | E365, E368, E375, 376 E291, E293, 306 |
|--|--|
| Ushakov, S.S. | E293, 295-297 |
| Vdovichenko, V.T. Volens, T. | E236, E238, E240, E243, 244, 249, 254 51 |
| Wallace, W.J. Washburn, E.W. Weast, R.C. Whitmore, F.C. Wiegner, F. Wilkinson, J.A. Willard, J.E. Wynne-Jones, W.F.K. | 451, 452 E384, E385, E391, 403, 406, 408, 410 451, 452 451, 452 E387, E391, 412 E41, E42, 45 E330, E331, 339 E236, E238, E243, 247, 251, E379, 380, E338, E391, 426, 427 E53, E54, 64, E315, 316 wicz, D. E291-293, 303 E7, E10, E11, 19, E78-E80, E82, E84, E85, E87, E88, E93, 108-112, E127, 128, 132, E155, 190-194, E208, E209, 224, 225, 227, 229-235, E240, E241, E243, 268, 269, 276-278, E291-E293, 301, 308, 311, E342, 343-348, E352, 359, 361-364, E365-E368, 369-374, E387, E391, 418, 419, 436 |
| Zakhorov, E.V. Zetkın, V.I. | E315, 320, 321 E53, E54, 63, E291-E293, 304, 305, 307, E314, E315, 320, 321 |
| Zeurcher, R.A. Zielinski, A.Z. | E53, E54, 60, E138, E139, 140, E315, 317 E236, E238, E240, E243, 248, 252, 261, 266 |

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