SOLUBILITY DATA SERIES

Volume 50

CARBON DIOXIDE IN NON-AQUEOUS SOLVENTS AT PRESSURES LESS THAN 200 KPA
SOLUBILITY DATA SERIES

Editor-in-Chief
J. W. LORIMER
The University of Western Ontario
London, Ontario, Canada

H. L. Clever (USA)  C. L. Young (Australia)
Sub-editor  Sub-editor
Gas/Liquid Systems  Indexes

EDITORIAL BOARD

R. W. Cargill (UK)  M.-T. Saugier-Cohen Adad (France)
F. W. Getzen (USA)  P. Scharlin (Finland)
E. Gryzlova (USSR)  D. G. Shaw (USA)
W. Hayduk (Canada)  R. P. T. Tomkins (USA)
G. T. Hefter (Australia)  J. Vanderdeelen (Belgium)
A. E. Mather (Canada)  D. A. Wiesenber (USA)
R. Paterson (UK)  Yu P. Yampol'skii (USSR)
M. Salomon (USA)

Managing Editor
P. D. GUJRAL
IUPAC Secretariat, Oxford, UK

INTERNATIONAL UNION OF PURE AND APPLIED CHEMISTRY
IUPAC Secretariat: Bank Court Chambers, 2-3 Pound Way,
Templars Square, Cowley, Oxford OX4 3YF, UK

NOTICE TO READERS

If your library is not already a standing-order customer or subscriber to the Solubility Data Series,
may we recommend that you place a standing order or subscription order to receive immediately
upon publication all new volumes published in this valuable series. Should you find that these
volumes no longer serve your needs, your order can be cancelled at any time without notice.
A complete list of volumes published in the Solubility Data Series will be found on p. 484.
SOLUBILITY DATA SERIES

Volume 50

CARBON DIOXIDE IN NON-AQUEOUS SOLVENTS AT PRESSURES LESS THAN 200 KPA

Volume Editor
PETER G. T. FOGG
Polytechnic of North London, Holloway, London, UK

Contributors
H. LAWRENCE CLEVER
Emory University
Atlanta, Georgia, USA

ARDIS L. CRAMER
Emory University
(deceased)

M. ELIZABETH DERRICK
Valdosta State University
Valdosta, Georgia, USA

J. CHR. GJALDBAEK
Royal Danish School of Pharmacy
Copenhagen, Denmark

WALTER HAYDUK
University of Ottawa
Ottawa, Ontario, Canada

SUSAN A. JOHNSON
Emory University
Atlanta, Georgia, USA

TRINA D. KITTREDGE
Emory University
Atlanta, Georgia, USA

PATRICK L. LONG
Emory University
Atlanta, Georgia, USA

ARDIS L. CRAMER
Emory University
(deceased)

COLIN L. YOUNG
University of Melbourne
Parkville, Victoria, Australia

PERGAMON PRESS
OXFORD · NEW YORK · SEOUL · TOKYO
CONTENTS

Foreword vii
Preface ix
William Gerrard 1900-1990 x
The Solubility of Gases in Liquids xi

Carbon Dioxide in Non-aqueous Solvents at Pressures under 200 kPa.
   Alkanes and alkenes 1
   Aromatic hydrocarbons 90
   Alcohols 128
   Miscellaneous solvents containing carbon, hydrogen and oxygen 178
   Halogen compounds 255
   Nitrogen compounds 302
   Phosphorus, silicon and sulfur compounds 358
   Mixed solvents 384
   Mineral oils 417
   Animal and vegetable oils and fats 430
   Polymeric materials 448
   Liquid gases 457

System Index 464
Registry Number Index 473
Author Index 477
Titles in the Solubility Data Series 484
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 evaluation 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.
(ii) 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.

(iii) 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;
(ii) primary source of the data;
(iii) experimental variables;
(iv) 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;
(viii) source and purity of materials used;
(ix) 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 principle 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
This volume of The Solubility Data Series contains evaluated data for the solubility in non-aqueous solvents of carbon dioxide at a partial pressure not greater than 200 kPa. In some cases a compiler has extrapolated published data for higher pressures to obtain a value for a solubility at a pressure below 200 kPa. Two further volumes in the series will include data for aqueous systems at all pressures and data for non-aqueous systems at pressures above 200 kPa.

Measurements of the solubility of carbon dioxide have been carried out for over a hundred years. New techniques have been developed and old techniques modified during this time but some of the early measurements are in close agreement with recent measurements. Reliance may be placed on data when there is good agreement between the measurements of different groups of workers. Unfortunately there are sometimes inconsistencies between measurements by different groups. Judgements have then to be made of the relative reliability of different experimental methods. Difficulties in attaining equilibrium between the gas and liquid phase are an important cause of discrepancies.

In some cases it has been possible to recommend equations relating mole fraction solubility at a partial pressure of 101.3 kPa with temperature. These equations are based on the data which have been considered to be the most reliable. The use of these equations for extrapolation more than a few degrees outside the temperature range of the experimental measurements can lead to errors.

The editor is grateful for support, encouragement and help from fellow members of the IUPAC Commission on Solubility Data. He would like to acknowledge the help given by Dr Elena Gryzlova in obtaining copies of papers from the less accessible Russian journals. He would also like to thank Dr Sim-wan Annie Bligh for her assistance in translating Chinese and Japanese papers.

Peter Fogg
London

September 1991
WILLIAM GERRARD 1900–1990

Members of the Solubility Data Commission of the International Union of Pure and Applied Chemistry were saddened by the death of Dr William Gerrard on 5th February 1990, shortly before his ninetieth birthday. William Gerrard was the oldest and one of the longest serving members of the Commission.

William Gerrard was born in Tyldesley, Lancashire, U.K. on 24th February, 1900. He studied part-time at a local technical college and eventually graduated as an external student of the University of London with first class honours in chemistry. Later he gained a PhD after part-time research at Battersea Polytechnic in London under the direction of Dr Joseph Kenyon, FRS. This gave him a life long interest in the mechanisms and stereochemistry of reactions of esters of phosphorus and sulfur. William Gerrard joined the staff of the Northern Polytechnic (now Polytechnic of North London) in 1934 after holding earlier academic posts. He became Head of the Department of Chemistry, Mathematics, Botany, Zoology, Biology and Geology in 1948, a post which he held until he retired in 1965.

During the Second World War he had responsibilities for a section of the London University Air Squadron training at the Northern Polytechnic and held the rank of Flight Lieutenant.

It is as an experimental organic chemist that he made his most important contribution to chemistry. He established a flourishing research school covering a wide range of organic chemistry and published over 200 research papers. He was awarded the degree of DSc in 1947. His monograph The Organic Chemistry of Boron was published in 1961. He also contributed a chapter on boron chemistry to Mellor's Inorganic Chemistry and a chapter on the organic chemistry of phosphorous and thiophosphorous acids to the Kosolapoff and Maier series Organic Compounds of Phosphorus. For many years after his retirement he continued to direct the studies of part time and full time research students and to work at the bench himself. His interest in solubility phenomena arose from his observations of the behaviour of gases such as hydrogen chloride and sulfur dioxide during organic reactions in the liquid phase. As his many research students and collaborators can testify, once William Gerrard's enthusiasm was roused he had the ability to transmit his enthusiasm to others.

He and his co-workers published many papers containing solubility data for the hydrogen halides and other gases. His book entitled Solubility of Gases and Liquids was published in 1976. Gas Solubilities - Widespread Applications followed in 1980. At the time of his death he was co-operating with Peter Fogg in the preparation of Solubility of Gases in Liquids which was published later in the year.

Publications on the solubility of gases led to an invitation to assist in the Solubility Data Project shortly after its inception and continued to serve when Commission status was achieved in 1979. He contributed to several of the volumes on gas solubilities and was co-editor of Hydrogen Halides in Non-aqueous Solvents. He was always fearless in his determination to maintain high standards. Not one of his colleagues working in the Solubility Data Commission could escape his criticism if things did not meet his approval. Eventually failing hearing and eyesight and general frailty made it impossible for him to attend annual meetings of the Solubility Data Commission. Until the last he took a keen interest in the affairs of the Commission and continued to provide detailed comments.

He was awarded an OBE for services to chemistry in 1981.

William Gerrard had an infectious delight in many aspects of chemistry and former colleagues and students have been inspired by his unforgettable enthusiasms, scholarship and devotion to hard and careful work. It is a privilege to have worked with him.

Peter Fogg
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, \( x(g) \)**

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

\[
x(g) = \frac{n(g)}{n(g) + n(l)} = \frac{W(g)/M(g)}{[W(g)/M(g)] + [W(l)/M(l)]}
\]

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

\[
wt\% = 100 \frac{W(g)}{[W(g) + W(l)]}
\]
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

\[
x(g) = \frac{\text{wt}\% / M(g)}{\text{wt}\% / M(g) + [(100 - \text{wt}\%) / M(l)]}
\]

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

\[
x(g) \text{ (partial pressure 1 atm)} = \frac{C_w M(l)}{1 + C_w M(l)}
\]

where \( M(l) \) 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 quoted as moles of gas per unit volume of liquid mixture. This is related to the mole fraction solubility by

\[
x = \frac{n \nu^O(l)}{1 + n \nu^O(l)}
\]

where \( \nu^O(l) \) is the molar volume of the liquid component.

The Bunsen Coefficient, \( \alpha \)

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,

\[
\alpha = \frac{V(g) \text{ 273.15}}{V(l) \text{ 273.15}}
\]

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

\[
x(g, 1 \text{ atm}) = \frac{\alpha}{\alpha + \frac{273.15}{T} \nu^O(g) \nu^O(l)}
\]

where \( \nu^O(g) \) and \( \nu^O(l) \) are the molar volumes of gas and solvent at a pressure of one atmosphere. If the gas is ideal,

\[
x(g) = \frac{\alpha}{\alpha + \frac{273.15R}{\nu^O(l)}}
\]

Real gases do not follow the ideal gas law and it is important to establish the real gas law used for calculating \( \alpha \) 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.
The Ostwald Coefficient, L

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

$$ L = \frac{V(g)}{V(l)} $$

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

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

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

The Absorption Coefficient, $S$

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.

$$ S = a(1-P(l)) $$

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

The Henry's Law Constant

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

$$ P(g) = K_H x(g) $$

where $K_H$ is the Henry's Law constant and $x$ the mole fraction solubility. Other formulations are

$$ P(g) = K_2 C(l) $$

or

$$ C(g) = K_C C(l) $$

where $K_2$ and $K_C$ are constants, $C$ the concentration, and (l) and (g) refer to the liquid and gas phases. Unfortunately, $K_H$, $K_2$, and $K_C$ 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

$$ N = n(g)/n(l) $$

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.

\[
L = \alpha \left( \frac{T}{273.15} \right) \\
C_w = \frac{\alpha}{v_0 \rho} \\
K_H = \frac{17.033 \times 10^6 \rho_{\text{soln}}}{\alpha M(1)} + 760 \\
L = C_w v_{t,\text{gas}} \rho
\]

where \(v_0\) is the molal volume of the gas in cm\(^3\) mol\(^{-1}\) at 0°C, \(\rho\) the density of the solvent at the temperature of the measurement, \(\rho_{\text{soln}}\) the density of the solution at the temperature of the measurement, and \(v_{t,\text{gas}}\) the molal volume of the gas (cm\(^3\) mol\(^{-1}\)) at the temperature of the measurement.

REFERENCES


Revised: December 1984 (CLY)
# APPENDIX I. Conversion Factors k and $k^{-1}$

<table>
<thead>
<tr>
<th>Unit</th>
<th>Conversion Factor</th>
<th>SI Unit, m</th>
<th>SI Unit, m²</th>
<th>SI Unit, m³</th>
<th>SI Unit, kg</th>
<th>SI Unit, kg m⁻³</th>
<th>SI Unit, Pa (pascal, kg m⁻¹ s⁻²)</th>
<th>SI Unit, J (joule, kg m² s⁻²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Å (angstrom)</td>
<td>$1 \times 10^{-10}$ (*)</td>
<td>$1 \times 10^{-10}$ (*)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>cm (centimeter)</td>
<td>$1 \times 10^{-2}$ (*)</td>
<td>$1 \times 10^{-2}$ (*)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>in (inch)</td>
<td>$254 \times 10^{-4}$ (*)</td>
<td>$3 , 937 , 008 \times 10^{-5}$(*)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ft (foot)</td>
<td>$3 , 048 \times 10^{-4}$ (*)</td>
<td>$3 , 280 , 840 \times 10^{-6}$ (*)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>cm²</td>
<td>$1 \times 10^{-6}$ (*)</td>
<td></td>
<td></td>
<td>$1 \times 10^{-5}$ (*)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>in²</td>
<td>$64 , 516 \times 10^{-8}$ (*)</td>
<td></td>
<td></td>
<td>$1 , 550 , 003 \times 10^{-3}$ (*)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ft²</td>
<td>$9 , 290 , 304 \times 10^{-6}$ (*)</td>
<td></td>
<td></td>
<td>$1 , 076 , 391 \times 10^{-5}$ (*)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>cm³</td>
<td>$1 \times 10^{6}$ (*)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>in³</td>
<td>$16 , 387 , 064 \times 10^{-12}$ (*)</td>
<td></td>
<td></td>
<td>$6 , 102 , 374 \times 10^{-2}$ (*)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ft³</td>
<td>$2 , 831 , 685 \times 10^{-8}$ (*)</td>
<td></td>
<td></td>
<td>$3 , 531 , 467 \times 10^{-5}$ (*)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>l (litre)</td>
<td>$1 \times 10^{-3}$ (*)</td>
<td></td>
<td></td>
<td>$1 \times 10^{3}$ (*)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>UKgal (UK gallon)</td>
<td>$45 , 461 \times 10^{-7}$ (*)</td>
<td></td>
<td></td>
<td>$21 , 997 \times 10^{-2}$ (*)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>USgal (US gallon)</td>
<td>$37 , 854 \times 10^{-7}$ (*)</td>
<td></td>
<td></td>
<td>$26 , 417 \times 10^{-2}$ (*)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>g (gram)</td>
<td>$1 \times 10^{-3}$ (*)</td>
<td></td>
<td></td>
<td>$1 \times 10^{3}$ (*)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>t (tonne)</td>
<td>$1 \times 10^{3}$ (*)</td>
<td></td>
<td></td>
<td>$1 \times 10^{-3}$ (*)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>lb (pound)</td>
<td>$45 , 359 , 237 \times 10^{-8}$ (*)</td>
<td></td>
<td></td>
<td>$2 , 024 , 623 \times 10^{-6}$ (*)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>g cm⁻³</td>
<td>$1 \times 10^{3}$ (*)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>g l⁻¹</td>
<td>$1$ (*)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>lb in⁻³</td>
<td>$2 , 767 , 991 \times 10^{-2}$ (*)</td>
<td></td>
<td></td>
<td>$3 , 612 , 728 \times 10^{-11}$ (*)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>lb ft⁻³</td>
<td>$1 , 601 , 847 \times 10^{-5}$ (*)</td>
<td></td>
<td></td>
<td>$6 , 242 , 795 \times 10^{-8}$ (*)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>lb UKgal⁻¹</td>
<td>$99 , 776 \times 10^{-3}$ (*)</td>
<td></td>
<td></td>
<td>$100 , 224 \times 10^{-7}$ (*)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>lb USgal⁻¹</td>
<td>$1 , 198 , 264 \times 10^{-4}$ (*)</td>
<td></td>
<td></td>
<td>$8 , 345 , 406 \times 10^{-9}$ (*)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>dyn cm⁻²</td>
<td>$1 \times 10^{-1}$ (*)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>at (kgf cm⁻²)</td>
<td>$980 , 665 \times 10^{-1}$ (*)</td>
<td></td>
<td></td>
<td>$1 , 019 , 716 \times 10^{-11}$ (*)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>atm (atmosphere)</td>
<td>$101 , 325$ (*)</td>
<td></td>
<td></td>
<td>$9 , 869 , 233 \times 10^{-12}$ (*)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>bar</td>
<td>$1 \times 10^{5}$ (*)</td>
<td></td>
<td></td>
<td>$1 \times 10^{-5}$ (*)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>lbf in⁻² (p.s.i.)</td>
<td>$6 , 894 , 757 \times 10^{-4}$ (*)</td>
<td></td>
<td></td>
<td>$1 , 450 , 377 \times 10^{-10}$ (*)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>lbf ft⁻²</td>
<td>$47 , 880 \times 10^{-1}$ (*)</td>
<td></td>
<td></td>
<td>$20 , 886 \times 10^{-6}$ (*)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>inHg (inch of mercury)</td>
<td>$3 , 386 , 388 \times 10^{-3}$ (*)</td>
<td></td>
<td></td>
<td>$2 , 952 , 999 \times 10^{-10}$ (*)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>mmHg (millimeter of mercury, torr)</td>
<td>$1 , 333 , 224 \times 10^{-3}$ (*)</td>
<td></td>
<td></td>
<td>$7 , 500 , 617 \times 10^{-9}$ (*)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>erg</td>
<td>$1 \times 10^{-7}$ (*)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>cal IT (I.T. calorie)</td>
<td>$41 , 868 \times 10^{-6}$ (*)</td>
<td></td>
<td></td>
<td>$2 , 388 , 459 \times 10^{-7}$ (*)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>cal th (thermochemical calorie)</td>
<td>$4 , 184 \times 10^{-3}$ (*)</td>
<td></td>
<td></td>
<td>$2 , 390 , 057 \times 10^{-7}$ (*)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>kW h (kilowatt hour)</td>
<td>$3 , 6 \times 10^{5}$ (*)</td>
<td></td>
<td></td>
<td>$2 , 777 , 778 \times 10^{-13}$ (*)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>l atm</td>
<td>$101 , 325 \times 10^{-10}$ (*)</td>
<td></td>
<td></td>
<td>$9 , 869 , 233 \times 10^{-10}$ (*)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ft lbf</td>
<td>$1 , 355 , 818 \times 10^{-6}$ (*)</td>
<td></td>
<td></td>
<td>$7 , 375 , 622 \times 10^{-7}$ (*)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>hp h (horse power hour)</td>
<td>$2 , 684 , 519$ (*)</td>
<td></td>
<td></td>
<td>$3 , 725 , 062 \times 10^{-13}$ (*)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Btu (British thermal unit)</td>
<td>$1 , 055 , 056 \times 10^{-13}$ (*)</td>
<td></td>
<td></td>
<td>$9 , 478 , 172 \times 10^{-10}$ (*)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

An asterisk (*) denotes an exact relationship.
**COMPONENTS:**

1. Carbon dioxide; CO₂; [124-38-9]

2. Alkanes, Cyclic Alkanes and Alkenes

**CRITICAL EVALUATION:**

**EVALUATOR:**

Peter G.T. Fogg,
School of Applied Chemistry,
Polytechnic of North London,
Holloway Road, London, N7 8DB, U.K.

July 1991

Solubility of carbon dioxide in alkanes, cyclic alkanes and alkenes.

The solubility of solid carbon dioxide in methane, ethane, propane and butane was measured by Cheung and Zander (1) at temperatures between 87.4 K and 194.6 K. Solubility in methane at 126.4 K and 137.5 K was measured by Preston et al. (2). There is satisfactory agreement with Cheung's data. The concentration of carbon dioxide in solution in the presence of solid carbon dioxide increases with increase in temperature. The partial vapor pressure also increases with temperature and mole fraction solubilities corrected to the same partial vapor pressure show a decrease with increase in temperature in line with the behaviour of the gas in other solvents. Data indicate that there are insignificant differences between solubilities in methane, propane and butane under the conditions of the measurements but that solubility is greatest in ethane. (see table below)

<table>
<thead>
<tr>
<th>Alkane</th>
<th>T/K</th>
<th>Mole% of CO₂ in solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Methane</td>
<td>183.2</td>
<td>6.60</td>
</tr>
<tr>
<td>Ethane</td>
<td>180.3</td>
<td>7.54</td>
</tr>
<tr>
<td>Propane</td>
<td>180.2</td>
<td>5.7</td>
</tr>
<tr>
<td>Butane</td>
<td>180.3</td>
<td>5.6</td>
</tr>
</tbody>
</table>

Solubility of solid carbon dioxide in liquid ethane was also measured by Clark and Din (3) from 130 K to 180 K. Clark's measurements are close to those of Cheung at lower temperatures. Clark found a solubility of 0.9 mol% at 150 K and Cheung a value of 0.85 mol% at 149 K. The agreement at higher temperatures is poor. Clark's value for 180 K is 6.7 mol% and Cheung's value at 180.3 K is 7.54 mol%.

Nagahama et al. (4) studied phase equilibria between gaseous carbon dioxide and ethane, propane, butane or 2-methylpropane. Measurements were extended to high pressures over the whole concentration range. Approximate mole fraction solubilities for a partial pressure of 101.3 kPa show an increase with carbon number at constant temperature. These have been estimated by the evaluator from data for partial pressures of carbon dioxide from 71 to 214 kPa, assuming that mole fraction solubility is proportional to pressure, and are given below.

<table>
<thead>
<tr>
<th>Alkane</th>
<th>T/K</th>
<th>xCO₂</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ethane</td>
<td>252.95</td>
<td>0.026</td>
</tr>
<tr>
<td>Propane</td>
<td>252.95</td>
<td>0.029</td>
</tr>
<tr>
<td>Butane</td>
<td>273.15</td>
<td>0.019</td>
</tr>
<tr>
<td>2-Methylpropane</td>
<td>273.15</td>
<td>0.021</td>
</tr>
</tbody>
</table>

Makranczy et al. (5) measured the solubility of carbon dioxide in straight chain alkanes from pentane to hexadecane at 298.2 K and 313.2 K. These measurements show a decrease in mole fraction solubility with increase in chain length at a partial pressure of gas of 101.3 kPa. This is not in accord with measurements reported by other workers and the bulk of evidence indicates that mole fraction solubility increases with chain length.

Solubility in pentane has been reported by Makranczy et al. (5) and by Cheng et al. (6). Cheng's data indicate a mole fraction solubility of approximately 0.0138 at 298.2 K and a partial pressure of carbon dioxide of 101.3 kPa. The mole fraction solubility from Makranczy's measurements under these conditions is 0.0125. The following equation for mole
COMPONENTS:

1. Carbon dioxide; CO₂; [124-38-9]
2. Alkanes, Cyclic Alkanes and Alkenes

EVALUATOR:

Peter G.T. Fogg,
School of Applied Chemistry,
Polytechnic of North London,
Holloway Road, London, N7 8DB, U.K.
July 1991

CRITICAL EVALUATION:

Fraction solubility at a partial pressure of carbon dioxide of 101.3 kPa is based upon data from the two sources.

\[
\ln x_{CO₂} = 83.727 - 2635.9/(T/K) - 13.906\ln(T/K)
\]

temperature range = 252.7-313.2 K
standard deviation in \(x_{CO₂}\) = 0.00033

Solubility in 2,2-dimethylpropane (neopentane) was measured by Stead and Williams (7) at pressures below 516 kPa from 250 K to 300 K. The data are self-consistent. Mole fraction solubility at a partial pressure of 101.3 kPa estimated from these data fit the following equation

\[
\ln x_{CO₂} = 85.021 - 2788.0/(T/K) - 14.006\ln(T/K)
\]

temperature range = 250-300 K
standard deviation in \(x_{CO₂}\) = 0.00071

The mole fraction solubility at 298.2 K from this equation is 0.0161 compared with a value of 0.0130 from the equation for pentane.

Mole fraction solubilities of gas in hexane at a partial pressure of 101.3 kPa from work by various authors (5,8-13) show good agreement (Fig 1) and fit the equation

\[
\ln x_{CO₂} = 26.213 - 429.93/(T/K) - 5.1244\ln(T/K)
\]

temperature range 238.2-313.2 K
standard deviation in \(x_{CO₂}\) = 0.00018

Data published by Tong et al. (14) appear to be inconsistent with other data and have not been used to derive the above equation.

Solubility of solid carbon dioxide at 177-216 K was measured by Im and Kurata (13). The data are self-consistent and may be accepted as reliable. Mole fraction solubilities for a partial pressure of carbon dioxide of 101.3 kPa estimated from these data for low temperatures are higher than values estimated from the equation given above.

Most of the data from various sources (5,10,11,15,16) for solubilities in heptane show a similar consistency. The following equation fits values of mole fraction solubilities at a partial pressure of gas of 101.3 kPa.

\[
\ln x_{CO₂} = 18.584 - 61.706/(T/K) - 4.0034\ln(T/K)
\]

temperature range = 238.2-313.2 K
standard deviation in \(x_{CO₂}\) = 0.00035

Data published by Tong et al. (14) appear to be inconsistent with data published by other authors and have not been included in the evaluation of the constants in this equation.

Im and Kurata (13) also measured the solubility of solid carbon dioxide in heptane over the temperature range 182-216 K. Data for this system are self consistent. Mole fraction solubilities of solid carbon dioxide in heptane are lower than solubilities in hexane. The equation given above is not applicable to the solubility of solid carbon dioxide in heptane.

Data for the solubility of carbon dioxide in octane published by Wilcock et al. (17), Shenderei and Ivanovsky (11), King and Al-Najjar (10) are consistent with each other. Mole fraction solubilities at a partial
Fig. 1 Variation with temperature of the mole fraction solubility of carbon dioxide in hexane at a partial pressure of gas of 101.3 kPa.

Points based upon experimental measurements by various authors (5,8-13) have been superimposed on a curve corresponding to the equation

\[ \ln x_{\text{CO}_2} = 26.213 - \frac{429.93}{T/\text{K}} - 5.1244 \ln(T/\text{K}) \]

A reference line corresponding to values from the Raoult's law equation is also shown.
COMPONENTS:
1. Carbon dioxide; CO₂; [124-38-9]
2. Alkanes, Cyclic Alkanes and Alkenes

EVALUATOR:
Peter G.T. Fogg,
School of Applied Chemistry,
Polytechnic of North London,
Holloway Road, London, N7 8DB, U.K.
July 1991

CRITICAL EVALUATION:

Pressure of gas of 101.2 kPa from these three sets of data fit the equation

\[
\ln x_{CO_2} = -9.6225 + \frac{1063.4}{(T/K)} + 0.2883 \ln(T/K)
\]

Temperature range = 238.2-313.4 K
Standard deviation in \(x_{CO_2}\) = 6.2 \times 10^{-5}

The mole fraction solubility at 298.15 K published by Tong et al. (14) is close to the value from this equation (Tong 0.0119; eqn. 0.0121). Mole fraction solubilities at 298.15 and 313.15 K calculated from data given by Makranczy et al.(5), fall below values given by the equation.

Asano et al. (18) used a chromatographic method to measure K-values for dissolution of carbon dioxide in solutions of methane in octane. The K-values were defined as the ratio of mole fractions of CO₂ in the vapor and in the liquid phases and correspond to very low concentrations of carbon dioxide. The data are self-consistent but no other data on this system are available for comparison.

Hiraoka and Hildebrand (19) measured solubility in the non-linear 2,2,4-trimethylpentane. The mole fraction solubility at 298.15 and a partial pressure of 101.3 kPa estimated from these data is 0.0139 compared with a value for solubility in octane from the above equation of 0.0121. This difference may be compared with that between solubilities in pentane and 2,2-dimethylpropane which has been noted above.

Solubility in nonane was measured by Makranczy et al. (5). Measurements of solubilities of carbon dioxide in the higher alkanes by this group do not conform to the general trend indicated by other workers. A value for 298.15 K has also been published by Tong et al.(14). The data for nonane cannot be recommended until they are substantiated by other measurements on this system.

Solubility in decane has been measured by Wilcock et al.(17), King and Al-Najjar (10), Horvath et al.(20), Makranczy et al.(5), and Tong et al.(14). The following equation for mole fraction solubility at a partial pressure of 101.3 kPa is based upon data from the first three groups of workers.

\[
\ln x_{CO_2} = 14.481 - \frac{114.51}{(T/K)} - 3.2438 \ln(T/K)
\]

Temperature range = 283.2-313.5 K.
Standard deviation in \(x_{CO_2}\) = 0.00016

Data published by Makranczy and by Tong are not consistent with this equation.

Values of the solubility in undecane, tridecane and pentadecane reported by Makranczy et al. appear to be too low and cannot be recommended until the measurements have been repeated by other workers. The mole fraction solubility in undecane at 298.15 K has been published by Tong et al. In contrast this value appears to be too high in comparison with data for other alkanes.

Solubility in dodecane has been measured by Hayduk et al.(16), by King and Al-Najjar (10) and by Makranczy et al.(5). Measurements by Hayduk are consistent with those by King. Mole fraction solubilities at a partial pressure of 101.3 kPa from these two sources fit the equation

\[
\ln x_{CO_2} = 11.161 + \frac{66.063}{(T/K)} - 2.7623 \ln(T/K)
\]

Temperature range = 283.15-323.15 K
Standard deviation in \(x_{CO_2}\) = 0.00014
COMPONENTS:
1. Carbon dioxide; CO$_2$; [124-38-9]
2. Alkanes, Cyclic Alkanes and Alkenes

CRITICAL EVALUATION:

Solubilities measured by Macranczy et al. are about 14% lower than those reported by the other authors.

Mole fraction solubility in tetradecane at a partial pressure of 101.3 kPa from measurements by King and Al-Najjar (10) fit the equation

$$\ln x_{CO_2} = -49.650 + 2870.5/(T/K) + 6.2703\ln(T/K)$$

temperature range = 298.2-343.2 K
standard deviation in $x_{CO_2} = 1.2 \times 10^{-5}$

Measurements by Makranczy et al.(5) are about 20% lower and are less likely to be reliable.

Solubility in hexadecane has been measured by at least seven groups (5,10,16, 21-24). Measurements by Macranczy et al. appear to be too low and those by Lenoir et al.(21) to be too high. Values of mole fraction solubility from measurements by the other groups are mutually consistent and fit the equation

$$\ln x_{CO_2} = -26.045 + 1769.0/(T/K) + 2.7810\ln(T/K)$$

temperature range = 298.2-475.0 K
standard deviation in $x_{CO_2} = 0.00015$

The solubility in heptadecane at 313.2 K was measured by Lenoir et al.(21) using a chromatographic method to find the limiting value of Henry's constant. The corresponding value of the mole fraction solubility at 101.3 kPa is 0.0139. This may be compared with the value of 0.01210 for solubility in hexadecane at this temperature and pressure from the equation given above.

Henry's law constants for dissolution of carbon dioxide in eicosane (C$_{20}$H$_{42}$) were measured by Chai and Paulaitis (24), Gasem and Robinson (25) and by Huang et al. The sets of data are mutually consistent. The corresponding mole fraction solubilities for a partial pressure of 101.3 kPa fit the equation

$$\ln x_{CO_2} = -23.875 + 1622.2/(T/K) + 2.5006\ln(T/K)$$

temperature range = 313.2-573.4 K
standard deviation in $x_{CO_2} = 0.00044$

Solubility in octacosane (C$_{28}$H$_{58}$) was reported by Huang et al.,(26), Gasem and Robinson (25) and by Lin and Parcher (22) with good agreement between the sets of data. Mole fraction solubilities at a partial pressure of 101.3 kPa fit the equation

$$\ln x_{CO_2} = -25.506 + 1747.4/(T/K) + 2.7523\ln(T/K)$$

temperature range = 348.2-573.2
standard deviation in $x_{CO_2} = 4.2 \times 10^{-5}$

Solubilities in hexatriacontane (C$_{36}$H$_{74}$) have also been published by Gasem and Robinson (25) and by Lin and Parcher (22). There is again good agreement between sets of data. Mole fraction solubilities at a partial pressure of 101.3 kPa fit the equation

$$\ln x_{CO_2} = 5.2340 + 123.53/(T/K) - 1.6712\ln(T/K)$$

temperature range = 353.2-423.2 K
standard deviation in $x_{CO_2} = 0.00014$
Fig. 2  Selected values of the mole fraction solubility of carbon dioxide in straight chain alkanes at 298.15 K or 373.15 K and a partial pressure of gas of 101.3 kPa.

large crosses  298.15 K
small crosses  373.15 K
COMPONENTS:
1. Carbon dioxide; CO₂; [124-38-9]
2. Alkanes, Cyclic Alkanes and Alkenes

EVALUATOR:
Peter G.T. Fogg,
School of Applied Chemistry,
Polytechnic of North London,
Holloway Road, London, N7 8DB, U.K.
July 1991

CRITICAL EVALUATION:
Gasem and Robinson (25) measured solubility in tetratetracontane \((C_{44}H_{90})\) at 373.2 and 423.2 K. Mole fraction solubilities for a partial pressure of 101.3 kPa are in accord with the general trend of values with increase in chain length (see fig 2).

Chai and Paulaitis (24) have published Henry's constants at infinite dilution for the carbon dioxide - squalane \((C_{30}H_{62})\) system for 298.6-330.2 K. Mole fraction solubilities at a partial pressure of 101.3 kPa estimated from these constants fit the equation

\[
\ln x_{CO_2} = -16.170 + 1354.4/(T/K) + 1.3729\ln(T/K)
\]

temperature range = 298.6-330.2 K
standard deviation in \(x_{CO_2}\) = 0.00011

A plot of the mole fraction solubility at 101.3 kPa against temperature lies close to an extrapolation of a similar plot for hexatriacontane. Mole fraction solubilities are higher than extrapolated values for octacosane (Fig 3).

Phase equilibria between cyclopropane and carbon dioxide has been studied by Haselden and Snowden (27). They reported dew and bubble points from 179 K to 237 K. Data are self-consistent. The mole fraction solubility at 228.3 K and a partial pressure of carbon dioxide of approximately 99.51 kPa is 0.0489. This may be compared with the ideal solubility of 0.119 estimated from Raoult's law.

Mole fraction solubilities in cyclic alkanes are lower than in the corresponding straight chain compounds. Eckert and Sandler (28) studied equilibria between cyclopentane and carbon dioxide at 310.9 K to 333.2 K and pressures to 8263 kPa. The mole fraction solubility at 310.9 K and a partial pressure of carbon dioxide of 101.3 kPa from this work is 0.0065. The corresponding value for solubility in pentane from the smoothing equation given above is 0.0104. The ideal solubility from Raoult's law is 0.0118.

At least nine groups have measured solubility in cyclohexane (8,9,12,15, 29-33). Solubility at 293.2 K reported by Horsman-van den Dool and Warman (12) was measured by an unsatisfactory method and is not consistent with measurements by other workers. Mole fraction solubility at a partial pressure of 101.3 kPa from other sources fit the equation below.

\[
\ln x_{CO_2} = 0.11850 + 454.47/(T/K) - 1.1454\ln(T/K)
\]

temperature range = 283.2-313.2 K
standard deviation in \(x_{CO_2}\) = 0.00016

The mole fraction solubility at 298.15 from this equation is 0.00757. The corresponding smoothed value for solubility in hexane is 0.01196.

Field et al. (34) measured solubility in methylcyclohexane at 283.9-313.3 K. Horsman-van den Dool (12) also reported a value at 294.3 which is about 5% lower than the corresponding value from data published by Field et al. Field's value is the more reliable and can be recommended. The mole fraction solubility at 298.13 K and a partial pressure of 101.3 kPa from Field's work is 0.00928 compared with a smoothed value of 0.01188 for dissolution in heptane.
COMPONENTS:

1. Carbon dioxide; CO₂; [124-38-9]

2. Alkanes, Cyclic Alkanes and Alkenes

EVALUATOR:

Peter G.T. Fogg,
School of Applied Chemistry,
Polytechnic of North London,
Holloway Road, London, N7 8DB, U.K.
July 1991

CRITICAL EVALUATION:

Wilcock et al. (35) measured the solubility in cyclooctane at 289.1-313.5 K. No other data on this system are available for comparison but this work is likely to be reliable. The mole fraction solubility at a partial pressure of 101.3 kPa and 298.27 K is 0.006860 compared with a smoothed value of 0.01210 for dissolution in octane under these conditions.

Geller et al. (36) measured solubilities in various isomers of dimethylcyclohexane. The work is likely to be reliable but no other work on these systems is available for comparison. Mole fraction solubilities, corrected to 298.15 K and a partial pressure of 101.3 kPa are given below together with the smoothed value for octane.

<table>
<thead>
<tr>
<th>Isomer</th>
<th>Mole Fraction Solubility</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Z)-1,2-dimethylcyclohexane</td>
<td>0.00938</td>
</tr>
<tr>
<td>(E)-1,2-dimethylcyclohexane</td>
<td>0.01020</td>
</tr>
<tr>
<td>1,3-dimethylcyclohexane</td>
<td>0.01021</td>
</tr>
<tr>
<td>(59 mol% Z + 41 mol% E)</td>
<td></td>
</tr>
<tr>
<td>1,4-dimethylcyclohexane</td>
<td>0.01035</td>
</tr>
<tr>
<td>(70 mol% Z + 30 mol% E)</td>
<td></td>
</tr>
<tr>
<td>Octane</td>
<td>0.01211</td>
</tr>
</tbody>
</table>

There is a significant difference between solubilities in (Z)- and (E)-1,2-dimethylcyclohexane.

Tremper and Prausnitz (23) published Henry's constants in 1,1'-bicyclohexyl from 300 K to 475 K. Horsman-van den Dool reported an Ostwald coefficient at 295.2 K. This corresponds to a mole fraction solubility at a partial pressure of 101.3 kPa of 0.00854. Extrapolation of Tremper's measurements indicates a mole fraction solubility of 0.00820 at 295.2 K and 101.3 K. Horsman-van den Dool used very simple apparatus and Tremper's data are likely to be the more reliable.

Solubility in decahydronaphthalene (decalin) was measured by Luhring and Schumpe (33) and by Horsman-van den Dool and Warman (12). The former group used a mixture of isomers and the latter made separate measurements on the two isomers. Lenoir et al. (21) measured limiting values of Henry's constant for a mixture of isomers by gas-liquid chromatography. Mole fraction solubilities at a partial pressure of 101.3 kPa from the available data are as follows

<table>
<thead>
<tr>
<th>Isomer</th>
<th>Temperature</th>
<th>Mole Fraction Solubility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mixed isomers</td>
<td>293.2 K</td>
<td>0.00790</td>
</tr>
<tr>
<td></td>
<td>298.2 K</td>
<td>0.00909</td>
</tr>
<tr>
<td></td>
<td>323.2 K</td>
<td>0.00735</td>
</tr>
<tr>
<td>(Z)-decalin</td>
<td>296.6 K</td>
<td>0.00697</td>
</tr>
<tr>
<td>(E)-decalin</td>
<td>296.6 K</td>
<td>0.00816</td>
</tr>
</tbody>
</table>

Further measurements on this system need to be made before solubility data can be recommended.

Nagahama et al. (4) have studied phase equilibria between ethene and carbon dioxide to high pressures. At 252.95 K the mole fraction solubility in ethene at a partial pressure of carbon dioxide of 183 kPa is 0.071. This may be compared with their value of 0.055 for the mole fraction solubility in ethane at 252.95 K and a partial pressure of carbon dioxide of 214 KPa. Clark and Din (3) measured the solubility of solid carbon dioxide in liquid ethene and in various mixtures with ethane at 130-180 K. Under these conditions carbon dioxide was again more soluble in ethene than in ethane.

Haselden and Snowden (27) have reported dew points and bubble points for mixtures of carbon dioxide and propene at 116-225 K. Phase equilibria in
Fig. 3  Mole fraction solubility of carbon dioxide in various alkanes and cyclic alkanes at a partial pressure of gas of 101.3 kPa.

The curves showing the variation of solubility with temperature correspond to equations derived by the evaluator. The solubility of methylcyclohexane is from ref. (34).

A reference line corresponding to values from the Raoult's law equation is also shown.
COMPONENTS:

1. Carbon dioxide; CO₂; [124-38-9]
2. Alkanes, Cyclic Alkanes and Alkenes

CRITICAL EVALUATION:

EVALUATOR:
Peter G.T. Fogg,
School of Applied Chemistry,
Polytechnic of North London,
Holloway Road, London, N7 8DB, U.K.
July 1991

this system have also been studied to high pressure by Nagahama et al. (4)
Cheung and Zander (1) have measured solubilities of solid carbon dioxide
in propene. There is no obvious incompatibility between the three sets
of measurements. Nagahama's measurements indicate a mole fraction
solubility of 0.076 at 252.95 K and a partial pressure of carbon dioxide
of 184 kPa and a solubility of 0.014 at 273.15 and a partial pressure of
81 kPa. The corresponding ideal solubilities from Raoult's law are 0.094
and 0.023

Nagahama et al. (4) also studied phase equilibria between carbon dioxide
and 1-butene to high pressures. The mole fraction solubilities of carbon
dioxide given below are based upon their data and show an increase from
ethene to 1-butene.

<table>
<thead>
<tr>
<th>Hydrocarbon</th>
<th>T/K</th>
<th>P/kPa</th>
<th>x_CO₂</th>
</tr>
</thead>
<tbody>
<tr>
<td>ethene</td>
<td>252.95</td>
<td>183</td>
<td>0.071</td>
</tr>
<tr>
<td>propene</td>
<td>252.95</td>
<td>184</td>
<td>0.076</td>
</tr>
<tr>
<td></td>
<td>273.15</td>
<td>219</td>
<td>0.050</td>
</tr>
<tr>
<td>1-butene</td>
<td>273.15</td>
<td>193</td>
<td>0.059</td>
</tr>
</tbody>
</table>

Luhring and Schumpe (33) have published Henry's constant for dissolution
in 1-tetradecene at 293.2 K. This corresponds to a mole fraction
solubility of 0.001654 at a partial pressure of 101.3 kPa. The
 corresponding value for dissolution in tetradecane is 0.01442.

Solubility in tetrahydronaphthalene has been measured by Luhring and
Schumpe (33), by Horvath et al. (20), by Krauss and Gestrich (32) and by
Bratzler et al. (37). The seven data points for mole fraction solubility
at a partial pressure of 101.3 kPa fit the equation below.

\[
\ln x_{CO_2} = 22.419 - 306.70/(T/K) - 4.6125\ln(T/K)
\]

temperature range = 283.15-313.15 K.
standard deviation in values of \(x_{CO_2}\) = 0.00031

The mole fraction solubility at 293.15 K from this equation is
0.00799 ±0.00034. The value for 296.6 K is 0.00766 ±0.00034. These may
be compared with solubility data for decahydropahthalene given above.
Further measurements are needed to determine the relative solubilities in
the two solvents.

Just (38) measured solubility in 1-methyl-4-(1-methylethenyl)cyclohexene
(\(d\)-limonene, carvene). No other measurements on this compound are
available for comparison.

Selected values of mole fraction solubilities in non-aromatic hydrocarbons
are shown in Table 1 and Fig 3.

REFERENCES

34-43.

2345-2352.

COMPONENTS:
1. Carbon dioxide; CO₂; [124-38-9]
2. Alkanes, Cyclic Alkanes and Alkenes

EVALUATOR:
Peter G.T. Fogg,
School of Applied Chemistry,
Polytechnic of North London,
Holloway Road, London, N7 8DB, U.K.
July 1991

CRITICAL EVALUATION:
<table>
<thead>
<tr>
<th>COMPONENTS:</th>
<th>EVALUATOR:</th>
</tr>
</thead>
</table>
| 1. Carbon dioxide; CO₂; [124-38-9]                                        | Peter G.T. Fogg, School of Applied Chemistry,
|                                                                          | Polytechnic of North London, Holloway Road, London, N7 8DB, U.K. |
| 2. Alkanes, Cyclic Alkanes and Alkenes                                    | July 1991                                    |

CRITICAL EVALUATION:

**Table 1.**
Mole fraction solubilities of carbon dioxide at a partial pressure of 101.3 kPa in alkanes and alkenes.

<table>
<thead>
<tr>
<th>Solvent</th>
<th>$T/K$</th>
<th>$x_{CO2}$</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Propane</td>
<td>273.15</td>
<td>0.019</td>
<td>4</td>
</tr>
<tr>
<td>Butane</td>
<td>273.15</td>
<td>0.021</td>
<td>4</td>
</tr>
<tr>
<td>2-Methylpropane</td>
<td>273.15</td>
<td>0.019</td>
<td>4</td>
</tr>
<tr>
<td>Pentane</td>
<td>273.15</td>
<td>0.01953 ±0.00033</td>
<td>*</td>
</tr>
<tr>
<td></td>
<td>298.15</td>
<td>0.01298 ±0.00033</td>
<td>*</td>
</tr>
<tr>
<td>2,2-Dimethylpropane</td>
<td>298.15</td>
<td>0.01607 ±0.00071</td>
<td>*</td>
</tr>
<tr>
<td>Hexane</td>
<td>298.15</td>
<td>0.01197 ±0.00018</td>
<td>*</td>
</tr>
<tr>
<td>Heptane</td>
<td>298.15</td>
<td>0.01188 ±0.00035</td>
<td>*</td>
</tr>
<tr>
<td>Octane</td>
<td>298.15</td>
<td>0.01212 ±0.00006</td>
<td>*</td>
</tr>
<tr>
<td>2,2,4-Trimethylpentane</td>
<td>298.15</td>
<td>0.01307</td>
<td>19</td>
</tr>
<tr>
<td>Decane</td>
<td>298.15</td>
<td>0.01246 ±0.00016</td>
<td>*</td>
</tr>
<tr>
<td>Dodecane</td>
<td>298.15</td>
<td>0.01283 ±0.00014</td>
<td>*</td>
</tr>
<tr>
<td>Tetradecane</td>
<td>298.15</td>
<td>0.01361 ±0.00001</td>
<td>*</td>
</tr>
<tr>
<td>Hexadecane</td>
<td>298.15</td>
<td>0.01403 ±0.00015</td>
<td>*</td>
</tr>
<tr>
<td></td>
<td>373.15</td>
<td>0.00794 ±0.00005</td>
<td>*</td>
</tr>
<tr>
<td>Eicosane</td>
<td>373.15</td>
<td>0.00892 ±0.00044</td>
<td>*</td>
</tr>
<tr>
<td>2,6,10,15,19,23-Hexamethyltetracontane (squalane)</td>
<td>298.15</td>
<td>0.002205</td>
<td>24</td>
</tr>
<tr>
<td></td>
<td>330.2</td>
<td>0.01655</td>
<td>24</td>
</tr>
<tr>
<td></td>
<td>348.2</td>
<td>0.01434</td>
<td>24 †</td>
</tr>
<tr>
<td>Octacosane</td>
<td>348.15</td>
<td>0.01254 ±0.00004</td>
<td>*</td>
</tr>
<tr>
<td></td>
<td>373.15</td>
<td>0.01084 ±0.00004</td>
<td>*</td>
</tr>
<tr>
<td>Hexatriacontane</td>
<td>373.15</td>
<td>0.01314 ±0.00014</td>
<td>*</td>
</tr>
<tr>
<td>Tetracontane</td>
<td>373.15</td>
<td>0.01444</td>
<td>25</td>
</tr>
<tr>
<td>Cyclohexane</td>
<td>298.15</td>
<td>0.00757 ±0.00016</td>
<td>*</td>
</tr>
<tr>
<td>Methylcyclohexane</td>
<td>298.13</td>
<td>0.00928</td>
<td>34</td>
</tr>
<tr>
<td>(Z)-1,2-Dimethylcyclohexane</td>
<td>297.88</td>
<td>0.009408</td>
<td>36</td>
</tr>
<tr>
<td>(E)-1,2-Dimethylcyclohexane</td>
<td>298.19</td>
<td>0.010197</td>
<td>36</td>
</tr>
<tr>
<td>Cycloctane</td>
<td>298.27</td>
<td>0.006860</td>
<td>35</td>
</tr>
<tr>
<td>1,1'-Bicyclohexyl</td>
<td>298.15</td>
<td>0.007979</td>
<td>23 ‡</td>
</tr>
<tr>
<td>1-Tetradecene</td>
<td>293.15</td>
<td>0.00165</td>
<td>33</td>
</tr>
<tr>
<td>Tetrahydronaphthalene</td>
<td>298.15</td>
<td>0.00752 ±0.00031</td>
<td>*</td>
</tr>
<tr>
<td>1-Methyl-4-(methyleneyl)cyclohexene (d-limonene)</td>
<td>298.15</td>
<td>0.0118</td>
<td>38</td>
</tr>
</tbody>
</table>

* interpolated; † extrapolated
* from the equation given by the evaluator on a previous page
COMPONENTS:
1. Carbon dioxide; CO$_2$; [124-38-9]
2. Methane; CH$_4$; [74-82-8]
   Ethane; C$_2$H$_6$; [74-84-0]
   Propane; C$_3$H$_8$; [74-98-6]
   Propene; C$_3$H$_6$; [115-07-1]
   Butane; C$_4$H$_{10}$; [106-97-8]

VARIABLES:
$T/K = 87.4-194.6$
$P_{CO_2}/kPa = 0-100$

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>Solvent</th>
<th>$T/K$</th>
<th>$P_{CO_2}/kPa$</th>
<th>Mole% of carbon dioxide</th>
</tr>
</thead>
<tbody>
<tr>
<td>Methane</td>
<td>110.70</td>
<td>0.00043</td>
<td>0.03</td>
</tr>
<tr>
<td></td>
<td>124.90</td>
<td>0.0119</td>
<td>0.08</td>
</tr>
<tr>
<td></td>
<td>125.20</td>
<td>0.0127</td>
<td>0.08</td>
</tr>
<tr>
<td></td>
<td>138.70</td>
<td>0.154</td>
<td>0.29</td>
</tr>
<tr>
<td></td>
<td>151.40</td>
<td>1.04</td>
<td>0.99 (0.99; 0.90)*</td>
</tr>
<tr>
<td></td>
<td>167.20</td>
<td>7.31</td>
<td>3.14</td>
</tr>
<tr>
<td></td>
<td>183.20</td>
<td>37.3</td>
<td>6.60</td>
</tr>
<tr>
<td></td>
<td>194.60</td>
<td>100.7</td>
<td>12.6 (12.6; 12.6)*</td>
</tr>
</tbody>
</table>

* mole% of CO$_2$ measured by mass spectrometry and chromatography respectively.

† calculated by the compiler from equations given in ref.(1) for $T/K = 87-150$ and ref.(2) for $T/K = 150-194$.

Auxiliary Information

METHOD/APPARATUS/PROCEDURE:
Mixtures of carbon dioxide and the hydrocarbon gas under test flowed through a cell held in a cryostat. The carbon dioxide was in excess so that a solution of carbon dioxide and solid carbon dioxide condensed in the cell. Samples of the solution were withdrawn into a sample bulb through a fritted disc of fine porosity so that particles of solid were held back. The samples were then vaporized and analysed by gas chromatography. Some samples were also analysed by mass spectrometry. The authors claim good agreement between the two methods of analysis. Typical values given by the authors are within about 2% except at low concentration. Most of the measurements on solvents other than methane were made at a pressure less than 101.3 kPa using glass apparatus. Stainless steel apparatus was used for higher pressures.

SOURCE AND PURITY OF MATERIALS:
No information

ESTIMATED ERROR:
$\delta$(mole% CO$_2$) = ±2%

REFERENCES:
COMPONENTS:

1. Carbon dioxide; CO₂; [124-38-9]
2. Methane; CH₄; [74-82-8]
   Ethane; C₂H₆; [74-84-0]
   Propane; C₃H₈; [74-98-6]
   Propene; C₃H₆; [115-07-1]
   Butane; C₄H₁₀; [106-97-8]

EXPERIMENTAL VALUES:

Compositions of solutions of carbon dioxide in liquid hydrocarbons in equilibrium with solid carbon dioxide at various temperatures.

<table>
<thead>
<tr>
<th>Solvent</th>
<th>T/K</th>
<th>Pₒ₂[kPa]</th>
<th>Mole% of carbon dioxide</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ethane</td>
<td>137.80</td>
<td>0.132</td>
<td>0.40</td>
</tr>
<tr>
<td></td>
<td>149.00</td>
<td>0.750</td>
<td>0.85</td>
</tr>
<tr>
<td></td>
<td>161.20</td>
<td>3.65</td>
<td>2.06</td>
</tr>
<tr>
<td></td>
<td>164.20</td>
<td>5.20</td>
<td>2.50 (2.50; 2.48)*</td>
</tr>
<tr>
<td></td>
<td>167.30</td>
<td>7.39</td>
<td>3.33 (3.33; 3.36)*</td>
</tr>
<tr>
<td></td>
<td>172.90</td>
<td>13.5</td>
<td>4.88 (4.88; 5.07)*</td>
</tr>
<tr>
<td></td>
<td>175.40</td>
<td>17.5</td>
<td>5.62</td>
</tr>
<tr>
<td></td>
<td>180.30</td>
<td>28.4</td>
<td>7.54 (7.54; 7.60)*</td>
</tr>
<tr>
<td>Propane</td>
<td>87.40</td>
<td>0.0000002</td>
<td>&lt;0.00001</td>
</tr>
<tr>
<td></td>
<td>105.00</td>
<td>0.0009</td>
<td>0.009</td>
</tr>
<tr>
<td></td>
<td>106.70</td>
<td>0.0014</td>
<td>0.010</td>
</tr>
<tr>
<td></td>
<td>123.30</td>
<td>0.0085</td>
<td>0.07</td>
</tr>
<tr>
<td></td>
<td>149.70</td>
<td>0.829</td>
<td>0.80</td>
</tr>
<tr>
<td></td>
<td>180.10</td>
<td>27.8</td>
<td>5.8</td>
</tr>
<tr>
<td></td>
<td>180.20</td>
<td>28.1</td>
<td>5.7</td>
</tr>
<tr>
<td>Butane</td>
<td>139.80</td>
<td>0.184</td>
<td>0.35</td>
</tr>
<tr>
<td></td>
<td>150.20</td>
<td>0.880</td>
<td>0.66</td>
</tr>
<tr>
<td></td>
<td>160.00</td>
<td>3.15</td>
<td>1.71</td>
</tr>
<tr>
<td></td>
<td>160.20</td>
<td>3.23</td>
<td>1.58</td>
</tr>
<tr>
<td></td>
<td>180.20</td>
<td>28.1</td>
<td>6.1</td>
</tr>
<tr>
<td></td>
<td>180.30</td>
<td>28.4</td>
<td>5.6</td>
</tr>
<tr>
<td>Propene</td>
<td>120.40</td>
<td>0.0045</td>
<td>0.68</td>
</tr>
<tr>
<td></td>
<td>140.00</td>
<td>0.190</td>
<td>2.4</td>
</tr>
<tr>
<td></td>
<td>140.00</td>
<td>0.190</td>
<td>2.1</td>
</tr>
</tbody>
</table>

* mole% of CO₂ measured by mass spectrometry and chromatography respectively.

† calculated by the compiler from equations given in ref.(1) for T/K = 87-150 and ref.(2) for T/K = 150-194.
COMPONENTS:
1. Carbon dioxide; CO₂; [124-38-9]
2. Ethane; C₂H₆; [74-84-0]
   Propane; C₃H₈; [74-98-6]
   Butane; C₄H₁₀; [106-97-8]
   2-Methylpropane; C₅H₁₀; [75-28-5]

VARIABLES:
T/K = 252.95-273.15
P_CO₂ = 71-214 kPa

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>Solvent</th>
<th>T/K</th>
<th>P_{total} /atm</th>
<th>x_CO₂</th>
<th>y_CO₂</th>
<th>P_CO₂/atm</th>
<th>P_CO₂/kPa</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ethane</td>
<td>252.95</td>
<td>15.9</td>
<td>0.055</td>
<td>0.133</td>
<td>2.11</td>
<td>214</td>
</tr>
<tr>
<td>Propane</td>
<td>273.15</td>
<td>5.5</td>
<td>0.013</td>
<td>0.127</td>
<td>0.70</td>
<td>71</td>
</tr>
<tr>
<td>Butane</td>
<td>273.15</td>
<td>3.3</td>
<td>0.030</td>
<td>0.313</td>
<td>1.03</td>
<td>105</td>
</tr>
<tr>
<td>2-Methylpropane</td>
<td>273.15</td>
<td>2.4</td>
<td>0.030</td>
<td>0.588</td>
<td>1.41</td>
<td>143</td>
</tr>
<tr>
<td></td>
<td>273.15</td>
<td>3.5</td>
<td>0.037</td>
<td>0.541</td>
<td>1.89</td>
<td>192</td>
</tr>
</tbody>
</table>

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
The data given above were obtained during studies of the systems to higher pressures over the whole of each composition range. The apparatus has been described previously (1). The components were charged into a glass-windowed equilibrium cell. A magnetic piston pump recirculated vapor, removed it from the top of the liquid and reintroduced it into the bottom of the liquid. After equilibrium was reached (c. 0.5 h) samples of the gas phase and of the liquid phase were analysed by gas chromatography.

SOURCE AND PURITY OF MATERIALS:
1. Purity at least 99.8%
2. Ethane; purity at least 99.0%
   Propane; purity at least 99.05%
   Butane; purity at least 99.35%
   2-Methylpropane; purity at least 99.2%

EXPERIMENTAL ERROR:
\(\delta T/K = \pm 0.05\) (authors)

REFERENCES:
COMPONENTS:
(1) Carbon dioxide; \( \text{CO}_2; \) [124-38-9]
(2) Pentane; \( \text{C}_5\text{H}_{12}; \) [109-66-0]

ORIGINAL MEASUREMENTS:
Makranczy, J.; Megery-Balog, K.; Rusz, L.; Patyi, L.


VARIABLES:
\( T/K = 298.15, 313.15 \)
\( p/kPa = 101.325 \) (1 atm)

PREPARED BY:
S. A. Johnson
H. L. Clever

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>( T/K )</th>
<th>Mol Fraction</th>
<th>Bunsen Coefficient ( \times 10^2 ) a/cm(^3) (STP)cm(^{-3})atm(^{-1} )</th>
<th>Ostwald Coefficient ( L/cm^3cm^{-3} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>298.15</td>
<td>1.258</td>
<td>2.460</td>
<td>2.685</td>
</tr>
<tr>
<td>313.15</td>
<td>0.999</td>
<td>1.897</td>
<td>2.175</td>
</tr>
</tbody>
</table>

The Bunsen coefficient and mole fraction values were calculated by the compiler assuming that the gas is ideal and that Henry's law is obeyed.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
Volumetric method. The apparatus described by Bodor, Bor, Mohai and Sipos was used (1).

SOURCE AND PURITY OF MATERIALS:
Both the gas and the liquid were analytical grade reagents of Hungarian or foreign origin. No further information

ESTIMATED ERROR:
\( \delta L/L = \pm 0.03 \)

REFERENCES:
1. Bodor, E.; Bor, Gy.; Mohai, B.; Sipos, G.
Chem. Abstr. 1961, 55, 3175h.
COMPONENTS:
1. Carbon dioxide; CO\textsubscript{2}; [124-38-9]
2. Pentane; C\textsubscript{5}H\textsubscript{12}; [109-66-0]

ORIGINAAL MEASUREMENTS:
Cheng, H.; Fernandez, M.E.P.; Zollweg, J.A.; Streett, W.B.

VARIABLES:
\( T/K = 252-458 \)
\( P/\text{MPa} = 0.16-9.62 \)

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>( T/K )</th>
<th>( P_{\text{total}}/\text{MPa} )</th>
<th>( x_{CO_2} )</th>
<th>( y_{CO_2} )</th>
<th>( P_{CO_2}/\text{kPa}^* )</th>
</tr>
</thead>
<tbody>
<tr>
<td>252.67</td>
<td>0.159</td>
<td>0.0388</td>
<td>0.9375</td>
<td>149</td>
</tr>
<tr>
<td>273.41</td>
<td>0.269</td>
<td>0.0451</td>
<td>0.8798</td>
<td>237</td>
</tr>
<tr>
<td>294.09</td>
<td>0.172</td>
<td>0.0165</td>
<td>0.6769</td>
<td>116</td>
</tr>
</tbody>
</table>

(other measurements extend to higher pressures)
* calculated by the compiler on the assumption that \( P_{CO_2} = P_{\text{total}} \times y_{CO_2} \)

A vapor-recirculating equilibrium apparatus described in ref. (1) was used. Gas and liquid phases were analysed by gas chromatography.

REFERENCES:
1. Pozo, M.E.; Streett, W.B.
COMPONENTS:
1. Carbon dioxide; CO\textsubscript{2}; [124-38-9]
2. 2,2-Dimethylpropane, (neopentane); C\textsubscript{5}H\textsubscript{12}; [463-82-1]

VARIABLES:
T/K = 250-300
P/kPa = 43-516

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>Total Pressure/kPa</th>
<th>(x_{CO_2})</th>
<th>(y_{CO_2})</th>
<th>(P_{CO_2}/kPa^*)</th>
</tr>
</thead>
<tbody>
<tr>
<td>250</td>
<td>154.0</td>
<td>0.039</td>
<td>0.822</td>
<td>126.59</td>
</tr>
<tr>
<td>201.6</td>
<td>0.055</td>
<td>0.865</td>
<td>174.38</td>
<td></td>
</tr>
<tr>
<td>378.6</td>
<td>0.120</td>
<td>0.930</td>
<td>352.10</td>
<td></td>
</tr>
<tr>
<td>260</td>
<td>42.8</td>
<td>0.000</td>
<td>0.000</td>
<td>0.00</td>
</tr>
<tr>
<td>54.2</td>
<td>0.003</td>
<td>0.213</td>
<td>11.54</td>
<td></td>
</tr>
<tr>
<td>63.6</td>
<td>0.006</td>
<td>0.330</td>
<td>21.05</td>
<td></td>
</tr>
<tr>
<td>86.8</td>
<td>0.012</td>
<td>0.516</td>
<td>44.79</td>
<td></td>
</tr>
<tr>
<td>159.0</td>
<td>0.032</td>
<td>0.735</td>
<td>116.87</td>
<td></td>
</tr>
<tr>
<td>275.2</td>
<td>0.064</td>
<td>0.842</td>
<td>231.72</td>
<td></td>
</tr>
<tr>
<td>270</td>
<td>64.4</td>
<td>0.000</td>
<td>0.000</td>
<td>0.00</td>
</tr>
<tr>
<td>78.2</td>
<td>0.003</td>
<td>0.186</td>
<td>14.55</td>
<td></td>
</tr>
<tr>
<td>93.2</td>
<td>0.007</td>
<td>0.308</td>
<td>28.71</td>
<td></td>
</tr>
<tr>
<td>122.2</td>
<td>0.014</td>
<td>0.478</td>
<td>56.41</td>
<td></td>
</tr>
<tr>
<td>218.4</td>
<td>0.036</td>
<td>0.697</td>
<td>152.22</td>
<td></td>
</tr>
<tr>
<td>374.6</td>
<td>0.074</td>
<td>0.820</td>
<td>307.17</td>
<td></td>
</tr>
<tr>
<td>280</td>
<td>93.6</td>
<td>0.000</td>
<td>0.000</td>
<td>0.00</td>
</tr>
<tr>
<td>112.2</td>
<td>0.004</td>
<td>0.171</td>
<td>19.19</td>
<td></td>
</tr>
<tr>
<td>132.8</td>
<td>0.008</td>
<td>0.289</td>
<td>38.38</td>
<td></td>
</tr>
<tr>
<td>172.6</td>
<td>0.016</td>
<td>0.454</td>
<td>78.36</td>
<td></td>
</tr>
<tr>
<td>293.0</td>
<td>0.039</td>
<td>0.667</td>
<td>195.96</td>
<td></td>
</tr>
<tr>
<td>290</td>
<td>132.8</td>
<td>0.000</td>
<td>0.000</td>
<td>0.00</td>
</tr>
<tr>
<td>156.2</td>
<td>0.005</td>
<td>0.150</td>
<td>23.43</td>
<td></td>
</tr>
<tr>
<td>181.6</td>
<td>0.010</td>
<td>0.262</td>
<td>47.58</td>
<td></td>
</tr>
<tr>
<td>234.2</td>
<td>0.019</td>
<td>0.422</td>
<td>98.83</td>
<td></td>
</tr>
<tr>
<td>388.4</td>
<td>0.045</td>
<td>0.643</td>
<td>249.74</td>
<td></td>
</tr>
<tr>
<td>300</td>
<td>184.0</td>
<td>0.000</td>
<td>0.000</td>
<td>0.00</td>
</tr>
<tr>
<td>218.2</td>
<td>0.005</td>
<td>0.155</td>
<td>33.82</td>
<td></td>
</tr>
<tr>
<td>248.6</td>
<td>0.011</td>
<td>0.252</td>
<td>62.65</td>
<td></td>
</tr>
<tr>
<td>231.5</td>
<td>0.019</td>
<td>0.407</td>
<td>128.61</td>
<td></td>
</tr>
<tr>
<td>516.0</td>
<td>0.050</td>
<td>0.634</td>
<td>327.14</td>
<td></td>
</tr>
</tbody>
</table>

\(x_{CO_2}\) is the mole fraction of CO\textsubscript{2} in the liquid phase.
\(y_{CO_2}\) is the mole fraction of CO\textsubscript{2} in the gas phase
* calculated by the compiler and taken to be \(y_{CO_2} \times \text{total pressure}\)

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
A mixture of carbon dioxide and 2,2-dimethylpropane was circulated through a thermostatted equilibrium cell. The rest of the apparatus was at a higher temperature so that condensation occurred only in the cell. Samples of liquid in the cell and vapor circulating through the system were analysed by gas chromatography.

SOURCE AND PURITY OF MATERIALS:
1. Supplied by The Distillers Company; purity stated to be better than British Standard 4105 (1967).
2. Supplied by Fisons Scientific Apparatus Ltd; purity at least 99%.

ESTIMATED ERROR:
\(\delta P/kPa = \pm 1.4\); \(\delta T/K = \pm 0.008 (T/K < 273)\); \(\delta T/K = \pm 0.010 (T/K > 273)\)
\(\delta (\text{mole fraction}) = \pm 0.01\) at mole fractions close to 0.5
\(\delta (\text{mole fraction}) = \pm 0.003\) at mole fractions close to 0.01 or 0.99
COMPONENTS:
1. Carbon dioxide; CO₂; [124-38-9]
2. Hexane; C₆H₁₄; [110-54-3]
   Heptane; C₇H₁₆; [142-82-5]
   Octane; C₈H₁₈; [111-65-9]

VARIABLES:
T/K = 238.15
P/kPa = 202-1013

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>Solvent</th>
<th>T/K</th>
<th>P/atm</th>
<th>P/kPa</th>
<th>(x_{CO₂})</th>
<th>Henry's constant /kPa</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hexane</td>
<td>238.15</td>
<td>2</td>
<td>202.65</td>
<td>0.0580</td>
<td>4039*</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1</td>
<td>101.32</td>
<td>0.0263</td>
<td></td>
</tr>
<tr>
<td>Heptane</td>
<td>238.15</td>
<td>2</td>
<td>202.65</td>
<td>0.0600</td>
<td>3819*</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1</td>
<td>101.32</td>
<td>0.0277</td>
<td></td>
</tr>
<tr>
<td>Octane</td>
<td>238.15</td>
<td>2</td>
<td>202.65</td>
<td>0.0600</td>
<td>3797*</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1</td>
<td>101.32</td>
<td>0.0279</td>
<td></td>
</tr>
</tbody>
</table>

* Estimated by the compiler by use of a Krichevsky-Il'inskaya equation from the solubility data for 2-10 atm given in the paper.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
Details of method given in ref. (1). A static method was used. A glass (low pressure) section of the apparatus was connected to a high pressure section made of metal. Carbon dioxide in the low pressure section was allowed to condense in a cooled metal bulb in the high pressure section. The quantity of gas collected was found from pressure changes in the glass section. The valve connecting the two sections was then closed and the condensed gas allowed to evaporate to generate the required pressure and to come in contact with the solvent under test which was held in an absorption cell in a thermostat bath. The cell was stirred magnetically. The quantity of unabsorbed gas when equilibrium was reached was calculated from the final pressure and volume of the gas in the high pressure section.

SOURCE AND PURITY OF MATERIALS:
No information

ESTIMATED ERROR

\(δ{x_{CO₂}} = ±5\%\) (compiler)

REFERENCES:
**COMPONENTS:**

1. Carbon dioxide; CO₂; [124-38-9]
2. Hexane; C₆H₁₄; [110-54-3]

**ORIGINAL MEASUREMENTS:**

Im, U.K.; Kurata, F.


**VARIABLES:**

\( T/K = 177.2-215.7 \)

\( P_{CO₂}/kPa = 34-474 \)

**EXPERIMENTAL VALUES:**

<table>
<thead>
<tr>
<th>T/K</th>
<th>( P_{total}/atm )</th>
<th>( P_{total}/kPa )</th>
<th>( P_{CO₂}/kPa^* )</th>
<th>( x_{CO₂} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>215.7</td>
<td>4.73</td>
<td>479</td>
<td>476.9</td>
<td>0.9723</td>
</tr>
<tr>
<td>215.2</td>
<td>4.63</td>
<td>469</td>
<td>461.3</td>
<td>0.9526</td>
</tr>
<tr>
<td>215.0</td>
<td>4.49</td>
<td>455</td>
<td>452.2</td>
<td>0.9514</td>
</tr>
<tr>
<td>214.7</td>
<td>4.32</td>
<td>438</td>
<td>431.5</td>
<td>0.6510</td>
</tr>
<tr>
<td>214.2</td>
<td>4.02</td>
<td>407</td>
<td>403.3</td>
<td>0.5722</td>
</tr>
<tr>
<td>213.2</td>
<td>3.78</td>
<td>383</td>
<td>364.0</td>
<td>0.4627</td>
</tr>
<tr>
<td>212.0</td>
<td>3.46</td>
<td>351</td>
<td>328.1</td>
<td>0.3593</td>
</tr>
<tr>
<td>207.7</td>
<td>2.66</td>
<td>290</td>
<td>274.9</td>
<td>0.2662</td>
</tr>
<tr>
<td>204.2</td>
<td>2.18</td>
<td>221</td>
<td>213.0</td>
<td>0.1990</td>
</tr>
<tr>
<td>200.2</td>
<td>1.16</td>
<td>118</td>
<td>157.3</td>
<td>0.1544</td>
</tr>
<tr>
<td>195.2</td>
<td>1.11</td>
<td>112</td>
<td>105.8</td>
<td>0.1177</td>
</tr>
<tr>
<td>190.2</td>
<td>0.74</td>
<td>75</td>
<td>69.6</td>
<td>0.0905</td>
</tr>
<tr>
<td>186.2</td>
<td>0.48</td>
<td>49</td>
<td>49.0</td>
<td>0.0681</td>
</tr>
<tr>
<td>183.2</td>
<td>0.37</td>
<td>37</td>
<td>37.3</td>
<td>0.0569</td>
</tr>
<tr>
<td>180.2</td>
<td>0.28</td>
<td>28</td>
<td>28.1</td>
<td>0.0457</td>
</tr>
<tr>
<td>178.2</td>
<td>0.23</td>
<td>23</td>
<td>23.1</td>
<td>0.0409</td>
</tr>
<tr>
<td>177.2</td>
<td>0.21</td>
<td>21</td>
<td>21.0</td>
<td>0.0382</td>
</tr>
</tbody>
</table>

* vapor pressure of solid CO₂ from ref. (1).

**AUXILIARY INFORMATION**

**METHOD/APPARATUS/PROCEDURE:**

The solubility of solid carbon dioxide was measured as described earlier (2). The components were introduced into the glass cell and 1 to 2 hr allowed for equilibrium to be reached. Samples of liquid were withdrawn at various temperatures from the glass equilibrium cell for analysis by gas chromatography. Alternatively the equilibrium temperature of mixtures of known composition were measured. Temperatures were controlled by an air bath cooled by liquid nitrogen and measured by a calibrated platinum resistance thermometer. Pressures were measured by a calibrated Heise gage.

**SOURCE AND PURITY OF MATERIALS:**

1. Coleman Instrument grade obtained from Matheson Gas Products. Analysis showed that the purity was better than 99.9%
2. Supplied by Phillips Petroleum Co. Analysis showed that the purity was better than 99.9%

**ESTIMATED ERROR:**

\( \delta T/K = \pm 0.2 \)

\( \delta P/atm = \pm 0.03 \)

**REFERENCES:**

**COMPONENTS:**
(1) Carbon dioxide; CO₂; [124-38-9]
(2) Hexane; C₆H₁₄; [110-54-3]

**ORIGINAL MEASUREMENTS:**
Makranczy, J.; Megyery-Balog, K.; Rusz, L.; Patyi, L.

**VARIABLES:**

<table>
<thead>
<tr>
<th>T/K</th>
<th>p/kPa: 101.325 (1 atm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>298.15</td>
<td>313.15</td>
</tr>
</tbody>
</table>

**EXPERIMENTAL VALUES:**

<table>
<thead>
<tr>
<th>T/K</th>
<th>Mol Fraction</th>
<th>Bunsen Coefficient (a/cm^3(STP)cm^{-3}atm^{-1})</th>
<th>Ostwald Coefficient (E/cm^3cm^{-3})</th>
</tr>
</thead>
<tbody>
<tr>
<td>298.15</td>
<td>1.207</td>
<td>2.080</td>
<td>2.270</td>
</tr>
<tr>
<td>313.15</td>
<td>0.963</td>
<td>1.621</td>
<td>1.858</td>
</tr>
</tbody>
</table>

The Bunsen coefficient and mole fraction values were calculated by the compiler assuming that the gas is ideal and that Henry’s law is obeyed.

**AUXILIARY INFORMATION**

**METHOD/APPARATUS/PROCEDURE:**
Volumetric method. The apparatus described by Bodor, Bor, Mohai and Sipos was used (1).

**SOURCE AND PURITY OF MATERIALS:**
Both the gas and the liquid were analytical grade reagents of Hungarian or foreign origin. No further information.

**ESTIMATED ERROR:**
\[ \delta L/L = \pm 0.03 \]

**REFERENCES:**
1. Bodor, E.; Bor, Gy.; Mohai, B.; Sipos, G.
   *Chem. Abstr.* 1961, 55, 3175h.
### COMPONENTS:

1. Carbon dioxide; \( \text{CO}_2 \); [124-38-9]
2. Hexane; \( \text{C}_6\text{H}_{14} \); [110-54-3]

### ORIGINAL MEASUREMENTS:

King, M. B.; Al-Najjar, H.
1977, 32, 1241-1246.

### VARIABLES:

<table>
<thead>
<tr>
<th>Temperature</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

### EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>( T/K )</th>
<th>Mole fraction* of carbon dioxide at a partial pressure of 101.3 kPa</th>
</tr>
</thead>
<tbody>
<tr>
<td>293.2</td>
<td>0.0126</td>
</tr>
<tr>
<td>298.2</td>
<td>0.0119</td>
</tr>
<tr>
<td>303.2</td>
<td>0.0113</td>
</tr>
</tbody>
</table>

* allowance was made for the non-ideal gas behaviour of carbon dioxide.

### AUXILIARY INFORMATION

**METHOD/APPARATUS/PROCEDURE:**

Solvent degassed by spraying into a continuously evacuated chamber. Solvent flows in a thin film down a glass spiral into a buret system containing the gas to be dissolved. Flow rates may be varied over a wide range without affecting the solubility. Similar to the apparatus of Morrison and Billett.

**SOURCE AND PURITY OF MATERIALS:**

No details given.

**ESTIMATED ERROR:**

\( \delta T/K = \pm 0.1 \); \( \delta x_{\text{CO}_2} = \pm 2\% \)

(estimated by compiler).

**REFERENCES:**

1. Morrison, T. J.; Billett, F.
   1952, 3819.
## COMPONENTS:
1. Carbon dioxide; CO₂; [124-38-9]
2. Hexane; C₆H₁₄; [110-54-3]

## ORIGINAL MEASUREMENTS:
Patyi, L.; Furmer, I. E.; Makranczy, J.; Sadilenko, A. S.; Stepanova, Z. G.; Berengarten, M. G.

## VARIABLES:

### EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>a⁺</th>
<th>Mole fraction of carbon dioxide at a partial pressure of 101.325 kPa</th>
<th>x̂_{CO₂}</th>
</tr>
</thead>
<tbody>
<tr>
<td>298.15</td>
<td>2.08</td>
<td>volume of gas (measured at 101.325 kPa and 273.15 K) dissolved by one volume of hexane.</td>
<td></td>
</tr>
</tbody>
</table>

## AUXILIARY INFORMATION

### METHOD/APPARATUS/PROCEDURE:
Volumetric method. Pressure measured when known amounts of gas were added, in increments, to a known amount of liquid in a vessel of known dimensions. Corrections were made for the partial pressure of solvent. Details in ref. (1).

### SOURCE AND PURITY OF MATERIALS:
Purity better than 99 mole per cent as determined by gas chromatography.

### ESTIMATED ERROR:
δT/K = ±0.1;  δa = ±4% or less.

### REFERENCES:
1. Bodor, E.; Bor, G. J.; Mohai, B.; Sipos, G.
COMPONENTS:
(1) Carbon dioxide; CO₂; [124-38-9]
(2) Hexane; C₆H₁₄; [110-54-3]

ORIGINAL MEASUREMENTS:
Horsman-van den Dool, L. E. W.;
Warman, J. W.
Interuniversity Reactor Institute
(IRI)-Report 134-81-01

VARIABLES:
T/K = 291.1
P₁/kPa = not given

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>Temperature (°C)</th>
<th>Temperature (K)</th>
<th>Ostwald Coefficient (L/cm³ cm⁻³)</th>
<th>Number of Runs</th>
</tr>
</thead>
<tbody>
<tr>
<td>17.9</td>
<td>291.1</td>
<td>2.46</td>
<td>1</td>
</tr>
</tbody>
</table>

PREPARED BY:
H. L. Clever

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
A cylindrical glass container of approximately 15 cm³ volume is partly filled with solvent and closed with a half-hole septum. An amount of the gaseous solute is added to the container. The closed container is shaken for 30 minutes. Samples of both the vapor and liquid phases are taken in a calibrated syringes. The samples are injected into a gas chromatograph. The Ostwald coefficient is calculated from the known sample size and the measured peak areas.

The chromatograph is a Hewlett-Packard model 5750 equipped with a thermal conductivity cell detector. The carrier gas is helium. A 200 cm Porapak Q column is used for the separation.

SOURCE AND PURITY OF MATERIALS:

(2) Hexane. Merck, Uvasol Spektroskopie grade. Impurities which give the same retention time as the gas are removed before the experiment by adsorption or distillation.

ESTIMATED ERROR:
δ L/L = ± 0.05

REFERENCES:
COMPONENTS:
1. Carbon dioxide; CO₂; [124-38-9]
2. Hexane, C₆H₁₄; [110-54-3]

ORIGINAL MEASUREMENTS:
Kaminishi, G-I.; Yokoyama, C.; Takahashi, S.

VARIABLES:

\[ \frac{T}{K} = 273.15 - 303.15 \]
\[ \frac{P}{MPa} = 1.066 - 6.109 \]

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>( \frac{T}{K} )</th>
<th>( \frac{H}{MPa} )</th>
<th>( \frac{H}{kPa} )</th>
<th>Mole fraction ( x_{CO_2} ) at ( P_{CO_2} = 101.3kPa )*</th>
</tr>
</thead>
<tbody>
<tr>
<td>273.15</td>
<td>6.22</td>
<td>6220</td>
<td>0.01629</td>
</tr>
<tr>
<td>283.15</td>
<td>7.12</td>
<td>7120</td>
<td>0.01423</td>
</tr>
<tr>
<td>298.15</td>
<td>8.42</td>
<td>8420</td>
<td>0.01203</td>
</tr>
<tr>
<td>303.15</td>
<td>8.86</td>
<td>8860</td>
<td>0.01144</td>
</tr>
</tbody>
</table>

\[ H = \left[ \frac{f_1}{x_1} \right] \]
\[ x_1 = x_{CO_2}; \quad f_1 = \text{fugacity of CO}_2 \]

* taken by the compiler to be given approximately by \( P_{CO_2}/H \)

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
Apparatus able to withstand pressures to 20 MPa was used to
determine phase equilibria by the
bubble point method. Henry's
constants at zero pressure were
obtained from the experimental data
by using the method described by
Prausnitz and Chueh (1)

SOURCE AND PURITY OF MATERIALS:
1. Supplied by Showa Tansan
   Industry Co., Ltd; purity better
   than 99.9%
2. Supplied by Dojin Yakugaku
   Research Institute;
purity better than 99.8%

ESTIMATED ERROR:
\[ \delta T/K = \pm 0.01 \text{ (authors)} \]
\[ \delta P/kPa = \pm 0.1 \]

REFERENCES:
1. Prausnitz, J.M.; Chueh, P.L.
   Computer Calculations for High
   Pressure Vapor-Liquid Equilibria,
   Prentice-Hall, Englewood Cliffs,
   USA, 1968.
COMPONENTS:
1. Carbon dioxide; CO$_2$; [124-38-9]
2. Alkanes

ORIGINAL MEASUREMENTS:
Tong Jingshan; Gao Guanghua; Wang Xiagong

VARIABLES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>P$_{CO_2}$/kPa</th>
</tr>
</thead>
<tbody>
<tr>
<td>298.15</td>
<td>101</td>
</tr>
</tbody>
</table>

PREPARED BY:
P.G.T. Fogg

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>Solvent</th>
<th>P/kPa</th>
<th>T/K</th>
<th>x$_{CO_2}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hexane; C$<em>6$H$</em>{14}$; [110-54-3]</td>
<td>101</td>
<td>298.15</td>
<td>0.0089104</td>
</tr>
<tr>
<td>Heptane; C$<em>7$H$</em>{16}$; [142-82-5]</td>
<td>101</td>
<td>298.15</td>
<td>0.011382</td>
</tr>
<tr>
<td>Octane; C$<em>8$H$</em>{18}$; [111-65-9]</td>
<td>101</td>
<td>298.15</td>
<td>0.011900</td>
</tr>
<tr>
<td>Nonane; C$<em>9$H$</em>{20}$; [111-84-2]</td>
<td>101</td>
<td>298.15</td>
<td>0.013888</td>
</tr>
<tr>
<td>Decane; C$<em>{10}$H$</em>{22}$; [124-18-5]</td>
<td>101</td>
<td>298.15</td>
<td>0.017645</td>
</tr>
<tr>
<td>Undecane; C$<em>{11}$H$</em>{24}$; [1120-21-4]</td>
<td>101</td>
<td>298.15</td>
<td>0.019997</td>
</tr>
</tbody>
</table>

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
Gas circulated through the solvent with provision to sample the gas and liquid phases.

SOURCE AND PURITY OF MATERIALS:
1. No information
2. Purity of nonane and decane > 99%

ESTIMATED ERROR:
$\delta T$/K = ±0.1 (authors)

REFERENCES:
COMPONENTS:
(1) Carbon dioxide; CO₂; [124-38-9]
(2) Heptane; C₇H₁₆; [142-82-5]

ORIGINAL MEASUREMENTS:
Gjaldbaek, J. C.

VARIABLES:

\[ T/K = 293.65 \text{ - } 307.65 \]
\[ p_f/kPa = 101.325 \text{ (1 atm)} \]

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>Carbon Dioxide Pressure ( p_f/mmHg )</th>
<th>Mol Fraction ( 10^2 x_f )</th>
<th>Bunsen Coefficient ( a/cm^3(\text{STP})cm^{-1} \text{ atm}^{-1} )</th>
<th>Ostwald Coefficient ( L/cm^3 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>293.65</td>
<td>718.6</td>
<td>1.33</td>
<td>1.98</td>
<td>2.13</td>
</tr>
<tr>
<td>298.25</td>
<td>712.4</td>
<td>1.21</td>
<td>1.84</td>
<td>2.01</td>
</tr>
<tr>
<td>298.25</td>
<td>710.3</td>
<td>1.22</td>
<td>1.85</td>
<td>2.02</td>
</tr>
<tr>
<td>307.65</td>
<td>727.7</td>
<td>1.08</td>
<td>1.62</td>
<td>1.82</td>
</tr>
</tbody>
</table>

\( ^1 \) Mole fraction solubility values adjusted to a gas partial pressure of 101.325 kPa (1 atm) by the compiler.

Smoothed Data: For use between 293.65 and 307.65 K.

\[ \ln x_f = -8.7743 + 13.0435/(T/100 \text{ K}) \]

The standard error about the regression line is \( 1.78 \times 10^{-4} \).

<table>
<thead>
<tr>
<th>T/K</th>
<th>Mol Fraction ( 10^2 x_f )</th>
</tr>
</thead>
<tbody>
<tr>
<td>293.15</td>
<td>1.32</td>
</tr>
<tr>
<td>298.15</td>
<td>1.23</td>
</tr>
<tr>
<td>303.15</td>
<td>1.14</td>
</tr>
<tr>
<td>308.15</td>
<td>1.07</td>
</tr>
</tbody>
</table>

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

A calibrated all-glass combined manometer and bulb was enclosed in an air thermostat and shaken until equilibrium. Mercury was used for calibration and as confining liquid. The solvent was degassed in the apparatus.

The absorbed volume of gas is calculated from the initial and final amounts, both saturated with solvent vapor. The amount of solvent is determined by the weight of displaced mercury.

The mol fraction solubility values are at 1 atm assuming Henry's law is obeyed.

Details of the apparatus and procedure are given in ref. 1 and 2.

SOURCE AND PURITY OF MATERIALS:

(1) Carbon dioxide. Prepared from potassium bicarbonate (analytical reagent) and concentrated sulfuric acid. 99.9 per cent CO₂.

(2) Heptane. Phillips Petroleum Co. Pure grade. B.p. (760 mmHg)/°C = 98.3 - 98.4. \( n_D(25 \degree \text{C}) = 1.3855 \).

ESTIMATED ERROR:

\[ \delta T/K = \pm 0.05 \]
\[ \delta x_f/x_f = \pm 0.015 \]

REFERENCES:

1. Lannung, A.

2. Gjaldbaek, J. C.
COMPONENTS:

1. Carbon dioxide; CO₂; [124-38-9]
2. Heptane; C₇H₁₆; [142-82-5]

ORIGINAL MEASUREMENTS:

Im, U.K.; Kurata, F.

VARIABLES:

\[ T/K = 182.2-215.6 \]
\[ P_{\text{CO}_2}/\text{kPa} = 34-474 \]

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>( P_{\text{total}}/\text{atm} )</th>
<th>( P_{\text{total}}/\text{kPa} )</th>
<th>( P_{\text{CO}_2}/\text{kPa}^* )</th>
<th>( x_{\text{CO}_2} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>215.6</td>
<td>4.70</td>
<td>476</td>
<td>461.3</td>
<td>0.6801</td>
</tr>
<tr>
<td>215.2</td>
<td>4.32</td>
<td>438</td>
<td>431.5</td>
<td>0.5810</td>
</tr>
<tr>
<td>214.2</td>
<td>3.78</td>
<td>383</td>
<td>364.0</td>
<td>0.4440</td>
</tr>
<tr>
<td>211.7</td>
<td>3.33</td>
<td>337</td>
<td>328.1</td>
<td>0.2908</td>
</tr>
<tr>
<td>207.2</td>
<td>2.65</td>
<td>269</td>
<td>265.2</td>
<td>0.1544</td>
</tr>
<tr>
<td>204.2</td>
<td>2.14</td>
<td>217</td>
<td>213.0</td>
<td>0.1108</td>
</tr>
<tr>
<td>200.2</td>
<td>1.57</td>
<td>159</td>
<td>157.3</td>
<td>0.0798</td>
</tr>
<tr>
<td>195.2</td>
<td>1.11</td>
<td>112</td>
<td>105.8</td>
<td>0.0608</td>
</tr>
<tr>
<td>190.2</td>
<td>0.72</td>
<td>73</td>
<td>69.6</td>
<td>0.0550</td>
</tr>
<tr>
<td>185.2</td>
<td>0.41</td>
<td>42</td>
<td>37.3</td>
<td>0.0519</td>
</tr>
<tr>
<td>183.2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>182.2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* vapor pressure of solid CO₂ from ref. (1).

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The solubility of solid carbon dioxide was measured as described earlier (2). The components were introduced into the glass cell and 1 to 2 hr allowed for equilibrium to be reached. Samples of liquid were withdrawn at various temperatures from the glass equilibrium cell for analysis by gas chromatography. Alternatively the equilibrium temperatures of mixtures of known composition were measured. Temperatures were controlled by an air bath cooled by liquid nitrogen and measured by a calibrated platinum resistance thermometer. Pressures were measured by a calibrated Heise gage.

SOURCE AND PURITY OF MATERIALS:

1. Coleman Instrument grade obtained from Matheson Gas Products. Analysis showed that the purity was better than 99.9%
2. Supplied by Phillips Petroleum Co. Analysis showed that the purity was better than 99.9%

ESTIMATED ERROR:

\[ \delta T/K = \pm 0.2 \]
\[ \delta P/\text{atm} = \pm 0.03 \]

REFERENCES:

COMPONENTS:
1. Carbon dioxide; CO$_2$; [124-38-9]
2. Alkanes

ORIGINAL MEASUREMENTS:
Hayduk, W.; Walter, E.B.; Simpson, P.

VARIBALES:
\[ \frac{P}{kPa} = 101.3 \]
\[ T/K = 293.15-323.15 \]

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>Solvent</th>
<th>( T/K )</th>
<th>Ostwald coeff. ( L )</th>
<th>( x_{CO_2} ) at ( P_{CO_2} = 101.3 \text{ kPa} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heptane; C$<em>7$H$</em>{16}$; [142-82-5]</td>
<td>283.15</td>
<td>2.24</td>
<td>0.01390</td>
</tr>
<tr>
<td></td>
<td>298.15</td>
<td>1.95</td>
<td>0.01170</td>
</tr>
<tr>
<td></td>
<td>313.15</td>
<td>1.71</td>
<td>0.00995</td>
</tr>
<tr>
<td>Dodecane; C$<em>{12}$H$</em>{26}$; [112-40-3]</td>
<td>283.15</td>
<td>1.55</td>
<td>0.01490</td>
</tr>
<tr>
<td></td>
<td>298.15</td>
<td>1.37</td>
<td>0.01270</td>
</tr>
<tr>
<td></td>
<td>313.15</td>
<td>1.22</td>
<td>0.01090</td>
</tr>
<tr>
<td>Hexadecane; C$<em>{16}$H$</em>{34}$; [544-76-3]</td>
<td>298.15</td>
<td>1.16</td>
<td>0.01380</td>
</tr>
<tr>
<td></td>
<td>313.15</td>
<td>1.05</td>
<td>0.01210</td>
</tr>
<tr>
<td></td>
<td>323.15</td>
<td>1.00</td>
<td>0.01130</td>
</tr>
</tbody>
</table>

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
The apparatus was described in an earlier paper (1). Deaerated solvent slowly flowed down a spiral tube in contact with the gas under test. The gas was maintained at constant pressure close to barometric. The rate of absorption of gas was measured by the rate of decrease of volume of gas. The concentration of gas in the liquid could then be calculated from the rate of flow of liquid.

SOURCE AND PURITY OF MATERIALS:
1. Coleman Instrument Grade; minimum purity 99.99%.
2. Supplied by Canadian Laboratory Supplies; minimum purity 99.0 mol%.

ESTIMATED ERROR:
\( \delta T/K = \pm 0.05 \) (authors)

REFERENCES:
COMPONENTS:
(1) Carbon dioxide; CO₂; [124-38-9]
(2) Heptane; C₇H₁₆; [142-82-5]

ORIGINAL MEASUREMENTS:
Makranczy, J.; Megery-Balog, K.; Rusz, L.; Patyi, L.

VARIABLES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>p/kPa (1 atm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>298.15</td>
<td>101.325</td>
</tr>
<tr>
<td>313.15</td>
<td>101.325</td>
</tr>
</tbody>
</table>

PREPARED BY:

S. A. Johnson
H. L. Clever

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>Mol Fraction</th>
<th>Bunsen Coefficient</th>
<th>Ostwald Coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>10²x_j</td>
<td>a/cm³(STP)cm⁻³atm⁻¹</td>
<td>L/cm³cm⁻³</td>
</tr>
<tr>
<td>298.15</td>
<td>1.177</td>
<td>1.810</td>
<td>1.976</td>
</tr>
<tr>
<td>313.15</td>
<td>0.978</td>
<td>1.397</td>
<td>1.602</td>
</tr>
</tbody>
</table>

The Bunsen coefficient and mole fraction values were calculated by the compiler assuming that the gas is ideal and that Henry's law is obeyed.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Volumetric method. The apparatus described by Bodor, Bor, Mohai and Sipos was used (1).

SOURCE AND PURITY OF MATERIALS:

Both the gas and the liquid were analytical grade reagents of Hungarian or foreign origin. No further information.

ESTIMATED ERROR:

δL/L = ± 0.03

REFERENCES:

1. Bodor, E.; Bor, Gy.; Mohai, B.; Sipos, G.
Chem. Abstr. 1961, 55, 3175h.
COMPONENTS:
1. Carbon dioxide; \( \text{CO}_2 \); [124-38-9]
2. Heptane; \( \text{C}_7\text{H}_{16} \); [142-82-5]

ORIGINAL MEASUREMENTS:
King, M. B.; Al-Najjar, H.
1977, 32, 1241-1246.

VARIABLES:
Temperature

PREPARED BY:
C. L. Young

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>( T/K )</th>
<th>Mole fraction* of carbon dioxide at a partial pressure of 101.3 kPa</th>
</tr>
</thead>
<tbody>
<tr>
<td>293.2</td>
<td>0.0126</td>
</tr>
<tr>
<td>298.2</td>
<td>0.0119</td>
</tr>
<tr>
<td>303.2</td>
<td>0.0113</td>
</tr>
</tbody>
</table>

* allowance was made for the non-ideal gas behaviour of carbon dioxide.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
Solvent degassed by spraying into a continuously evacuated chamber. Solvent flows in a thin film down a glass spiral into a buret system containing the gas to be dissolved. Flow rates may be varied over a wide range without affecting the solubility. Similar to the apparatus of Morrison and Billett.

SOURCE AND PURITY OF MATERIALS:
No details given.

ESTIMATED ERROR:
\( \delta T/K = \pm 0.1 \); \( \delta x_{\text{CO}_2} = \pm 2\% \) (estimated by compiler).

REFERENCES:
1. Morrison, T. J.; Billett, F.
   1952, 3819.
COMPONENTS:
(1) Carbon dioxide; CO₂; [124-38-9]
(2) Octane; C₈H₁₈; [111-65-9]

ORIGINAL MEASUREMENTS:
Makranczy, J.; Megery-Balog, K.; Rusz, L.; Patyi, L.

VARIABLES:
T/K: 298.15, 313.15
p/kPa: 101.325 (1 atm)

PREPARED BY:
S. A. Johnson
H. L. Clever

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>Mol Fraction 10²x₁</th>
<th>Bunsen Coefficient a/cm³(STP)cm⁻³atm⁻¹</th>
<th>Ostwald Coefficient L/cm³cm⁻³</th>
</tr>
</thead>
<tbody>
<tr>
<td>298.15</td>
<td>1.153</td>
<td>1.600</td>
<td>1.746</td>
</tr>
<tr>
<td>313.15</td>
<td>0.911</td>
<td>1.239</td>
<td>1.420</td>
</tr>
</tbody>
</table>

The Bunsen coefficient and mole fraction values were calculated by the compiler assuming that the gas is ideal and that Henry's law is obeyed.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
Volumetric method. The apparatus described by Bodor, Bor, Mohai and Sipos was used (1).

SOURCE AND PURITY OF MATERIALS:
Both the gas and the liquid were analytical grade reagents of Hungarian or foreign origin. No further information.

ESTIMATED ERROR:

δL/L = ± 0.03

REFERENCES:
1. Bodor, E.; Bor, Gy.; Mohai, B.; Sipos, G.
Chem. Abstr. 1961, 55, 3175h.
**COMPONENTS:**
1. Carbon dioxide; CO₂; [124-38-9]
2. Octane; C₈H₁₈; [111-65-9]

**VARIABLES:**

\[ \frac{T}{K} = 293.2 \text{ - } 303.2 \]
\[ \frac{P}{kPa} = 101.3 \]

**EXPERIMENTAL VALUES:**

<table>
<thead>
<tr>
<th>( \frac{T}{K} )</th>
<th>Mole fraction* of carbon dioxide at a partial pressure of 101.3 kPa</th>
</tr>
</thead>
<tbody>
<tr>
<td>293.2</td>
<td>0.0128</td>
</tr>
<tr>
<td>298.2</td>
<td>0.0121</td>
</tr>
<tr>
<td>303.2</td>
<td>0.0115</td>
</tr>
</tbody>
</table>

* allowance was made for the non-ideal gas behaviour of carbon dioxide.

**AUXILIARY INFORMATION**

**METHOD/APPARATUS/PROCEDURE:**
Solvent degassed by spraying into a continuously evacuated chamber.
Solvent flows in a thin film down a glass spiral into a buret system containing the gas to be dissolved.
Flow rates may be varied over a wide range without affecting the solution.
Similar to the apparatus of Morrison and Billett.

**SOURCE AND PURITY OF MATERIALS:**
No details given.

**ESTIMATED ERROR:**
\( \delta \frac{T}{K} = \pm 0.1; \delta x_{CO₂} = \pm 2\% \)
(estimated by compiler).

**REFERENCES:**
1. Morrison, T. J.; Billett, F.
   1952, 3819.
COMPONENTS:
(1) Carbon dioxide; CO₂; [124-38-9]
(2) Octane; C₈H₁₈; [111-65-9]

ORIGINAL MEASUREMENTS:
Wilcock, R. J.; Battino, R.; Danforth, W. F.; Wilhelm, E.

VARIABLES:
T/K: 283.44 - 313.43
p/kPa: 101.325 (1 atm)

PREPARED BY:
H. L. Clever

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>Mol Fraction 10¹x₁</th>
<th>Bunsen Coefficient a/cm³(STP) cm⁻³ atm⁻¹</th>
<th>Ostwald Coefficient L/cm³ cm⁻¹</th>
</tr>
</thead>
<tbody>
<tr>
<td>283.44</td>
<td>14.44</td>
<td>2.031</td>
<td>2.108</td>
</tr>
<tr>
<td>298.27</td>
<td>11.98</td>
<td>1.654</td>
<td>1.806</td>
</tr>
<tr>
<td>313.43</td>
<td>10.38</td>
<td>1.407</td>
<td>1.614</td>
</tr>
</tbody>
</table>

The Bunsen coefficients were calculated by the compiler.
It is assumed that the gas is ideal and that Henry's law is obeyed.

Smoothed Data: For use between 283.15 and 313.15 K

\[ \ln x₁ = -7.6969 + 9.7909/(T/100K) \]

The standard error about the regression line is \(1.51 \times 10^{-4}\).

<table>
<thead>
<tr>
<th>T/K</th>
<th>Mol Fraction 10¹x₁</th>
</tr>
</thead>
<tbody>
<tr>
<td>283.15</td>
<td>14.42</td>
</tr>
<tr>
<td>293.15</td>
<td>12.82</td>
</tr>
<tr>
<td>298.15</td>
<td>12.12</td>
</tr>
<tr>
<td>303.15</td>
<td>11.48</td>
</tr>
<tr>
<td>313.15</td>
<td>10.35</td>
</tr>
</tbody>
</table>

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
The solubility apparatus is based on the design of Morrison and Billett (1) and the version used is described by Battino, Evans, and Danforth (2). The degassing apparatus is that described by Battino, Banzhof, Bogan, and Wilhelm (3).

Degassing. Up to 500 cm³ of solvent is placed in a flask of such size that the liquid is about 4 cm deep. The liquid is rapidly stirred, and vacuum is intermittently applied through a liquid N₂ trap until the permanent gas residual pressure drops to 5 microns.

Solubility Determination. The degassed solvent is passed in a thin film down a glass helical tube containing solute gas plus the solvent vapor at a total pressure of one atm. The volume of gas absorbed is found by difference between the initial and final volumes in the buret system. The solvent is collected in a tared flask and weighed.

SOURCE AND PURITY OF MATERIALS:
(1) Carbon dioxide. Air Products and Chemicals, Inc. Minimum mole per cent purity stated to be 99.8.
(2) Octane. Phillips Petroleum Co. 99 mole per cent, distilled, density at 298.15 K, \(\rho/cm³ = 0.6988\).

ESTIMATED ERROR:

\[ \delta T/K = 0.02 \]
\[ \delta P/mmHg = 0.5 \]
\[ \delta x₁/x₁ = 0.01 \]

REFERENCES:
COMPONENTS:
1. Carbon dioxide; CO₂; [124-38-9]
2. Octane; C₈H₁₈; [111-65-9]
3. Methane; CH₄; [74-82-8]

VARIABLES:
T/K = 233-293
P(CH₄)/kPa = 138-1034 kPa

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>P(CH₄)/psia</th>
<th>P(CH₄)/kPa</th>
<th>CH₄ mole fraction in liquid phase*</th>
<th>K-value for CO₂ Exptl. Smoothed†</th>
</tr>
</thead>
<tbody>
<tr>
<td>233.15</td>
<td>20</td>
<td>138</td>
<td>0.0104</td>
<td>16.5</td>
</tr>
<tr>
<td>100</td>
<td>689</td>
<td>0.0515</td>
<td>3.78</td>
<td>3.80</td>
</tr>
<tr>
<td>200</td>
<td>1379</td>
<td>0.1000</td>
<td>2.06</td>
<td>2.11</td>
</tr>
<tr>
<td>400</td>
<td>2758</td>
<td>0.1923</td>
<td>1.16</td>
<td>1.20</td>
</tr>
<tr>
<td>600</td>
<td>4137</td>
<td>0.2725</td>
<td>0.88</td>
<td>0.88</td>
</tr>
<tr>
<td>800</td>
<td>5516</td>
<td>0.3509</td>
<td>0.79</td>
<td>0.80</td>
</tr>
<tr>
<td>1000</td>
<td>6895</td>
<td>0.4167</td>
<td>0.74</td>
<td>0.74</td>
</tr>
<tr>
<td>1250</td>
<td>8618</td>
<td>0.4902</td>
<td>0.73</td>
<td>0.71</td>
</tr>
<tr>
<td>1500</td>
<td>10342</td>
<td>0.5525</td>
<td>0.81</td>
<td>0.80</td>
</tr>
</tbody>
</table>

The K-value for CO₂ was defined as:
mole fraction of CO₂ in the vapor phase/mole fraction in the liquid phase

These K-values correspond to essentially infinite dilution.

* calculated by the compiler from K-values for methane in octane from ref. (1).

† given by the authors

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
Retention volumes for small samples of carbon dioxide were measured by gas chromatography with octane as the stationary phase and methane as the carrier gas. Temperatures were maintained to ±0.1 K and the pressure of methane measured to ±0.2%. Experimental details are given in refs (2)-(4).

SOURCE AND PURITY OF MATERIALS:
1. At least 99.6% pure.
2. 99.88% pure.
3. 99.99% pure.

ESTIMATED ERROR:
δT/K = ±0.1; δP(CH₄) = ±2% (authors)

REFERENCES:
1. Kohn, J.P.; Bradish, W.F.
2. van Horn, L.D.; Kobayashi, R.
3. Masukawa, S.; Kobayashi, R.
J. Gas Chromatography 1968, 6, 257.
4. Koonce, K.T.; Kobayashi, R.
COMPONENTS:

1. Carbon dioxide; CO₂; [124-38-9]
2. Octane; C₈H₁₈; [111-65-9]
3. Methane; CH₄; [74-82-8]

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>P₂CH₄/psia</th>
<th>PCH₄/kPa</th>
<th>Mole fraction of CH₄ in liquid phase</th>
<th>K-value for CO₂ Exptl. Smoothed†</th>
</tr>
</thead>
<tbody>
<tr>
<td>253.15</td>
<td>20</td>
<td>138</td>
<td>0.0090</td>
<td>28.1</td>
</tr>
<tr>
<td></td>
<td>100</td>
<td>689</td>
<td>0.0429</td>
<td>6.17</td>
</tr>
<tr>
<td></td>
<td>200</td>
<td>1379</td>
<td>0.5556</td>
<td>3.11</td>
</tr>
<tr>
<td></td>
<td>400</td>
<td>2758</td>
<td>0.1639</td>
<td>1.77</td>
</tr>
<tr>
<td></td>
<td>600</td>
<td>4137</td>
<td>0.2336</td>
<td>1.33</td>
</tr>
<tr>
<td></td>
<td>800</td>
<td>5516</td>
<td>0.2985</td>
<td>1.11</td>
</tr>
<tr>
<td></td>
<td>1000</td>
<td>6895</td>
<td>0.3546</td>
<td>0.99</td>
</tr>
<tr>
<td></td>
<td>1250</td>
<td>8618</td>
<td>0.4149</td>
<td>0.95</td>
</tr>
<tr>
<td></td>
<td>1500</td>
<td>10342</td>
<td>0.4695</td>
<td>0.95</td>
</tr>
<tr>
<td>273.15</td>
<td>20</td>
<td>138</td>
<td>0.0078</td>
<td>37.2</td>
</tr>
<tr>
<td></td>
<td>100</td>
<td>689</td>
<td>0.0376</td>
<td>8.45</td>
</tr>
<tr>
<td></td>
<td>200</td>
<td>1379</td>
<td>0.0746</td>
<td>4.46</td>
</tr>
<tr>
<td></td>
<td>400</td>
<td>2758</td>
<td>0.1429</td>
<td>2.41</td>
</tr>
<tr>
<td></td>
<td>600</td>
<td>4137</td>
<td>0.2075</td>
<td>1.80</td>
</tr>
<tr>
<td></td>
<td>800</td>
<td>5516</td>
<td>0.2667</td>
<td>1.46</td>
</tr>
<tr>
<td></td>
<td>1000</td>
<td>6895</td>
<td>0.3226</td>
<td>1.31</td>
</tr>
<tr>
<td></td>
<td>1250</td>
<td>8618</td>
<td>0.3774</td>
<td>1.19</td>
</tr>
<tr>
<td></td>
<td>1500</td>
<td>10342</td>
<td>0.4310</td>
<td>1.13</td>
</tr>
<tr>
<td>293.15</td>
<td>20</td>
<td>138</td>
<td>0.0070</td>
<td>57.7</td>
</tr>
<tr>
<td></td>
<td>100</td>
<td>689</td>
<td>0.0336</td>
<td>12.3</td>
</tr>
<tr>
<td></td>
<td>200</td>
<td>1379</td>
<td>0.0658</td>
<td>6.19</td>
</tr>
<tr>
<td></td>
<td>400</td>
<td>2758</td>
<td>0.1282</td>
<td>3.35</td>
</tr>
<tr>
<td></td>
<td>600</td>
<td>4137</td>
<td>0.1869</td>
<td>2.34</td>
</tr>
<tr>
<td></td>
<td>800</td>
<td>5516</td>
<td>0.2410</td>
<td>1.88</td>
</tr>
<tr>
<td></td>
<td>1000</td>
<td>6895</td>
<td>0.2882</td>
<td>1.62</td>
</tr>
<tr>
<td></td>
<td>1250</td>
<td>8618</td>
<td>0.3367</td>
<td>1.51</td>
</tr>
<tr>
<td></td>
<td>1500</td>
<td>10342</td>
<td>0.3774</td>
<td>1.41</td>
</tr>
</tbody>
</table>

The K-value for CO₂ was defined as:

mole fraction of CO₂ in the vapor phase/mole fraction in the liquid phase

These K-values correspond to essentially infinite dilution.

* calculated by the compiler from K-values for methane in octane from ref. (1).

† given by the authors
COMPONENTS:
(1) Carbon dioxide; CO₂; [124-38-9]
(2) 2,2,4-Trimethylpentane or isooctane; C₈H₁₈; [540-84-1]

ORIGINAL MEASUREMENTS:
Hiraoka, H.; Hildebrand, J. H.

VARIABLES:
T/K = 277.63 - 308.20
pᵢ/kPa = 101.325 (1 atm)

PREPARED BY:
M. E. Derrick
H. L. Clever

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>Temperature (°C)</th>
<th>Mol Fraction</th>
<th>Bunsen Coefficient a/cm³(STP)cm⁻³atm⁻¹</th>
<th>Ostwald Coefficient L/cm²cm⁻¹</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.48</td>
<td>1.838</td>
<td>2.59</td>
<td>2.63</td>
</tr>
<tr>
<td>15.12</td>
<td>1.575</td>
<td>2.18</td>
<td>2.30</td>
</tr>
<tr>
<td>24.97</td>
<td>1.385</td>
<td>1.90</td>
<td>2.07</td>
</tr>
<tr>
<td>35.05</td>
<td>1.228</td>
<td>1.66</td>
<td>1.87</td>
</tr>
</tbody>
</table>

The Bunsen and Ostwald coefficients were calculated by the compiler assuming ideal gas behavior.

Smoothed Data: For use between 277.63 and 308.20 K.

\[
\ln x_1 = -8.0643 + 11.2899/(T/100 K)
\]

The standard error about the regression line is 4.34 x 10⁻⁵.

<table>
<thead>
<tr>
<th>T/K</th>
<th>Mol Fraction</th>
<th>10²x₁</th>
</tr>
</thead>
<tbody>
<tr>
<td>278.15</td>
<td>1.820</td>
<td></td>
</tr>
<tr>
<td>288.15</td>
<td>1.581</td>
<td></td>
</tr>
<tr>
<td>298.15</td>
<td>1.387</td>
<td></td>
</tr>
<tr>
<td>308.15</td>
<td>1.226</td>
<td></td>
</tr>
</tbody>
</table>

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
The apparatus consists of a gas measuring buret, an absorption pipet, and a reservoir for the solvent. The buret is thermostated at 25°C, the pipet at any temperature from 5 to 30°C. The pipet contains an iron bar in glass for magnetic stirring. The pure solvent is degassed by freezing with liquid nitrogen, evacuating, then boiling with a heat lamp. The degassing process is repeated three times. The solvent is flowed into the pipet where it is again boiled for final degassing. Manipulation of the apparatus is such that the solvent never comes in contact with stopcock grease. The liquid in the pipet is sealed off by mercury. Gas is admitted into the pipet. Its exact amount is determined by P-V measurements in the buret before and after introduction of the gas into the pipet. The stirrer is set in motion. Equilibrium is attained within 24 hours.

SOURCE AND PURITY OF MATERIALS:
(1) Carbon dioxide. Western Gas Inc. Gas passed through a cold trap.
(2) Isooctane. Source not given. Distilled, purity checked by ultraviolet absorbance.

ESTIMATED ERROR:
\[
\delta T/K = 0.02 \\
\delta x_1/x_1 = 0.003
\]

REFERENCES:
1. Kobatake, Y.; Hildebrand, J. H.
COMPONENTS:
(1) Carbon dioxide; CO₂; [124-38-9]
(2) Nonane; C₉H₂₀; [111-84-2]

ORIGINAL MEASUREMENTS:
Makranczy, J.; Megery-Balog, K.; Rusz, L.; Patyi, L.

VARIABLES:
T/K: 298.15, 313.15
p/kPa: 101.325 (1 atm)

PREPARED BY:
S. A. Johnson
H. L. Clever

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>Mol Fraction</th>
<th>Bunsen Coefficient</th>
<th>Ostwald Coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>10²x₁</td>
<td>a/cm³(STP)cm⁻³atm⁻¹</td>
<td>L/cm³cm⁻³</td>
</tr>
<tr>
<td>298.15</td>
<td>1.126</td>
<td>1.420</td>
<td>1.550</td>
</tr>
<tr>
<td>313.15</td>
<td>0.898</td>
<td>1.112</td>
<td>1.275</td>
</tr>
</tbody>
</table>

The Bunsen coefficient and mole fraction values were calculated by the compiler assuming that the gas is ideal and that Henry's law is obeyed.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
Volumetric method. The apparatus described by Bodor, Bor, Mohai and Sipos was used (1).

SOURCE AND PURITY OF MATERIALS:
Both the gas and the liquid were analytical grade reagents of Hungarian or foreign origin. No further information.

ESTIMATED ERROR:
δL/L = ± 0.03

REFERENCES:
1. Bodor, E.; Bor, Gy.; Mohai, B.; Sipos, G.
Veszpremi Vegyi. Eg. Kozl. 1957, 1, 55.
Chem. Abstr. 1961, 55, 3175h.
**COMPONENTS:**
(1) Carbon dioxide; CO₂; [124-38-9]
(2) Decane; C₁₀H₂₂; [124-18-5]

**ORIGINAL MEASUREMENTS:**
Makranczy, J.; Megery-Balog, K.; Rusz, L.; Patyi, L.

**VARIABLES:**
| T/K   | p/kPa: | 101.325 (1 atm) |

**PREPARED BY:**
S. A. Johnson
H. L. Clever

**EXPERIMENTAL VALUES:**

<table>
<thead>
<tr>
<th>T/K</th>
<th>Mol Fraction</th>
<th>Bunsen Coefficient</th>
<th>Ostwald Coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>10²x₁</td>
<td>a/cm³(STP)cm⁻³atm⁻¹</td>
<td>L/cm³cm⁻¹</td>
</tr>
<tr>
<td>298.15</td>
<td>1.106</td>
<td>1.280</td>
<td>1.397</td>
</tr>
<tr>
<td>313.15</td>
<td>0.884</td>
<td>1.004</td>
<td>1.151</td>
</tr>
</tbody>
</table>

The Bunsen coefficient and mole fraction values were calculated by the compiler assuming that the gas is ideal and that Henry's law is obeyed.

**AUXILIARY INFORMATION**

**METHOD/APPROATUS/PROCEDURE:**
Volumetric method. The apparatus described by Bodor, Bor, Mohai and Sipos was used (1).

**SOURCE AND PURITY OF MATERIALS:**
Both the gas and the liquid were analytical grade reagents of Hungarian or foreign origin. No further information.

**ESTIMATED ERROR:**
\[ \delta L/L = \pm 0.03 \]

**REFERENCES:**
1. Bodor, E.; Bor, Gy.; Mohai, B.; Sipos, G.
   1957, 1, 55.
   *Chem. Abstr.* 1961, 55, 3175h.
COMPONENTS:
1. Carbon dioxide; CO₂; [124-38-9]
2. Decane; C₁₀H₂₂; [124-18-5]

ORIGINAL MEASUREMENTS:
King, M. B.; Al-Najjar, H.
1977, 32, 1241-1246.

VARIABLES:
T/K = 293.2 - 323.2
P/kPa = 101.3

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>Mole fraction* of carbon dioxide at a partial pressure of 101.3 kPa</th>
</tr>
</thead>
<tbody>
<tr>
<td>293.2</td>
<td>0.0133</td>
</tr>
<tr>
<td>298.2</td>
<td>0.0125</td>
</tr>
<tr>
<td>303.2</td>
<td>0.0119</td>
</tr>
<tr>
<td>323.2</td>
<td>0.0099</td>
</tr>
</tbody>
</table>

* allowance was made for the non-ideal gas behaviour of carbon dioxide.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
Solvent degassed by spraying into a continuously evacuated chamber.
Solvent flows in a thin film down a glass spiral into a buret system containing the gas to be dissolved.
Flow rates may be varied over a wide range without affecting the solubility.
Similar to the apparatus of Morrison and Billett.

SOURCE AND PURITY OF MATERIALS:
No details given.

ESTIMATED ERROR:
δT/K = ±0.1;  δx_CO₂ = ±2%
(estimated by compiler).

REFERENCES:
1. Morrison, T. J.; Billett, F.
1952, 3819.
COMPONENTS:
(1) Carbon dioxide; \( \text{CO}_2 \); [124-38-9]
(2) Decane; \( \text{C}_{10}\text{H}_{22} \); [124-18-5]

ORIGINAL MEASUREMENTS:
Wilcock, R. J.; Battino, R.; Danforth, W. F.; Wilhelm, E.

VARIABLES:
\( T/\text{K} \): 283.16 - 313.50
\( p/\text{kPa} \): 101.325 (1 atm)

PREPARED BY:
H. L. Clever

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>( T/\text{K} )</th>
<th>( 10^3 x_j )</th>
<th>Bunsen Coefficient ( \alpha/\text{cm}^3(\text{STP}) \cdot \text{cm}^{-1} \cdot \text{atm}^{-1} )</th>
<th>Ostwald Coefficient ( L/\text{cm}^3 \cdot \text{cm}^3 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>283.16</td>
<td>14.39</td>
<td>1.686</td>
<td>1.748</td>
</tr>
<tr>
<td>298.10</td>
<td>12.58</td>
<td>1.451</td>
<td>1.583</td>
</tr>
<tr>
<td>313.50</td>
<td>10.83</td>
<td>1.228</td>
<td>1.409</td>
</tr>
</tbody>
</table>

The Bunsen coefficients were calculated by the compiler.

It is assumed that the gas is ideal and that Henry's law is obeyed.

Smoothed Data: For use between 283.15 to 313.15 K

\[
\ln x_j = -7.1707 + 8.3068/(T/100K)
\]

The standard error about the regression line is \( 1.31 \times 10^{-4} \).

<table>
<thead>
<tr>
<th>( T/\text{K} )</th>
<th>( 10^3 x_j )</th>
</tr>
</thead>
<tbody>
<tr>
<td>283.15</td>
<td>14.45</td>
</tr>
<tr>
<td>293.15</td>
<td>13.07</td>
</tr>
<tr>
<td>298.15</td>
<td>12.47</td>
</tr>
<tr>
<td>303.15</td>
<td>11.91</td>
</tr>
<tr>
<td>313.15</td>
<td>10.91</td>
</tr>
</tbody>
</table>

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
The solubility apparatus is based on the design of Morrison and Billett (1) and the version used is described by Battino, Evans, and Danforth (2). The degassing apparatus is that described by Battino, Banzhof, Bogan, and Wilhelm (3).

Degassing. Up to 500 cm³ of solvent is placed in a flask of such size that the liquid is about 4 cm deep. The liquid is rapidly stirred, and vacuum is intermittently applied through a liquid \( \text{N}_2 \) trap until the permanent gas residual pressure drops to 5 microns.

Solubility Determination. The degassed solvent is passed in a thin film down a glass helical tube containing solute gas plus the solvent vapor at a total pressure of one atm. The volume of gas absorbed is found by difference between the initial and final volumes in the buret system. The solvent is collected in a tared flask and weighed.

SOURCE AND PURITY OF MATERIALS:
(1) Carbon dioxide. Air Products and Chemicals, Inc. Minimum mole per cent purity stated to be 99.8.
(2) Decane. Phillips Petroleum Co. 99 mol %, distilled, density at 298.15 K, \( \rho/g \text{ cm}^{-3} \) = 0.7264.

ESTIMATED ERROR:
\( \delta T/\text{K} = 0.02 \)
\( \delta p/\text{mmHg} = 0.5 \)
\( \delta x_j/x_j = 0.01 \)

REFERENCES:
COMPONENTS:
1. Carbon dioxide; CO₂; [124-38-9]
2. Decane; C₁₀H₂₂; [124-18-5]

ORIGINAL MEASUREMENTS:
Horvath, M. J.; Sebastian, H. M.; Chao, K.-C.

VARIABLES:

T/K = 300
P/kPa = 101.3

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>Henry’s constant /atm</th>
<th>Mole fraction of carbon dioxide in liquid, ( x_{CO₂} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>300</td>
<td>83.4</td>
<td>0.0119</td>
</tr>
</tbody>
</table>

† at a partial pressure of carbon dioxide of 1 atmosphere calculated by compiler assuming \( \phi = 0.995 \).

METHOD/APPARATUS/PROCEDURE:
Gas chromatographic analysis of a saturated solution at barometric pressure. Henry’s constants determined from formula

\[ H = (p - p_o)\phi(m + 1)/m \]

where \( p \) is the total pressure, \( p_o \) the vapor pressure of the solvent and \( \phi \) is the fugacity coefficient of the gas. The mole ratio, \( m \), is defined by

\[ m = \frac{\text{Moles of carbon dioxide in gas phase}}{\text{Moles of carbon dioxide in liquid phase}} \]

SOURCE AND PURITY OF MATERIALS:
1. No details given.
2. Purity 99.56 mole per cent.

ESTIMATED ERROR:
\( \delta T/K = \pm 0.25; \delta H/\text{atm} = \pm 3\% \)
(estimated by compiler).

REFERENCES:
COMPONENTS:
(1) Carbon dioxide; CO₂; [124-38-9]
(2) Undecane; C₁₁H₂₄; [1120-21-4]

ORIGINAL MEASUREMENTS:
Makranczy, J.; Megery-Balog, K.; Rusz, L.; Patyi, L. 

VARIABLES:
T/K: 298.15, 313.15
p/kPa: 101.325 (1 atm)

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>Mol Fraction</th>
<th>Bunsen Coefficient ( \alpha/cm^3(STP)cm^-3atm^-1 )</th>
<th>Ostwald Coefficient ( L/cm^3cm^-3 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>298.15</td>
<td>1.053</td>
<td>1.124</td>
<td>1.227</td>
</tr>
<tr>
<td>313.15</td>
<td>0.874</td>
<td>0.917</td>
<td>1.051</td>
</tr>
</tbody>
</table>

The Bunsen coefficient and mole fraction values were calculated by the compiler assuming that the gas is ideal and that Henry's law is obeyed.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
Volumetric method. The apparatus described by Bodor, Bor, Mohai and Sipos was used (1).

SOURCE AND PURITY OF MATERIALS:
Both the gas and the liquid were analytical grade reagents of Hungarian or foreign origin. No further information.

ESTIMATED ERROR:
\[ \delta L/L = \pm 0.03 \]

REFERENCES:
1. Bodor, E.; Bor, Gy.; Mohai, B.; Sipos, G. 
Chem. Abstr. 1961, 55, 3175h.
COMPONENTS:
(1) Carbon dioxide; CO₂; [124-38-9]
(2) Dodecane; C₁₂H₂₆; [112-40-3]

ORIGINAL MEASUREMENTS:
Makranczy, J.; Meggyery-Balog, K.; Rusz, L.; Patyi, L.

VARIABLES:
T/K: 298.15, 313.15
p/kPa: 101.325 (1 atm)

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>Mol Fraction 10²x₁</th>
<th>Bunsen Coefficient a/cm³(STP)cm⁻³atm⁻¹</th>
<th>Ostwald Coefficient L/cm³cm⁻³</th>
</tr>
</thead>
<tbody>
<tr>
<td>298.15</td>
<td>1.089</td>
<td>1.080</td>
<td>1.179</td>
</tr>
<tr>
<td>313.15</td>
<td>0.867</td>
<td>0.845</td>
<td>0.969</td>
</tr>
</tbody>
</table>

The Bunsen coefficient and mole fraction values were calculated by the compiler assuming that the gas is ideal and that Henry's law is obeyed.

Smoothed Data: \( \ln x₁ = -9.2793 + 14.1901/(T/100 \text{ K}) \)

The equation should be used with caution since it is based on only two experimental points.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
Volumetric method. The apparatus described by Bodor, Bor, Mohai and Sipos was used (1).

SOURCE AND PURITY OF MATERIALS:
Both the gas and the liquid were analytical grade reagents of Hungarian or foreign origin. No further information.

ESTIMATED ERROR:
\( \delta L/L = ± 0.03 \)

REFERENCES:
1. Bodor, E.; Bor, Gy.; Mohai, B.; Sipos, G.
Chem. Abstr. 1961, 55, 3175h.
COMPONENTS:
1. Carbon dioxide; CO₂; [124-38-9]
2. Dodecane; C₁₂H₂₆; [112-40-3]

ORIGINAL MEASUREMENTS:
King, M. B.; Al-Najjar, H.

VARIABLES:
\[ T/K = 293.2 - 323.2 \]
\[ P/kPa = 101.3 \]

PREPARED BY:
C. L. Young

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>Mole fraction* of carbon dioxide at a partial pressure of 101.3 kPa</th>
</tr>
</thead>
<tbody>
<tr>
<td>293.2</td>
<td>0.0137</td>
</tr>
<tr>
<td>298.2</td>
<td>0.0129</td>
</tr>
<tr>
<td>303.2</td>
<td>0.0122</td>
</tr>
<tr>
<td>323.2</td>
<td>0.0102</td>
</tr>
</tbody>
</table>

* allowance was made for the non-ideal gas behaviour of carbon dioxide.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
Solvent degassed by spraying into a continuously evacuated chamber.
Solvent flows in a thin film down a glass spiral into a buret system containing the gas to be dissolved.
Flow rates may be varied over a wide range without affecting the solubility.
Similar to the apparatus of Morrison and Billett.

SOURCE AND PURITY OF MATERIALS:
No details given.

ESTIMATED ERROR:
\[ \delta T/K = \pm 0.1; \quad \delta x_{CO_2} = \pm 2\% \]
(estimated by compiler).

REFERENCES:
1. Morrison, T. J.; Billett, F.
COMPONENTS:
(1) Carbon dioxide; \( \text{CO}_2 \); [124-38-9]
(2) Tridecane; \( \text{C}_{13}\text{H}_{28} \); [629-50-5]

ORIGINAL MEASUREMENTS:
Makranczy, J.; Megyery-Balog, K.; Rusz, L.; Patyi, L.

VARIABLES:
\( T/K: \) 298.15, 313.15
\( p/\text{kPa}: \) 101.325 (1 atm)

PREPARED BY:
S. A. Johnson
H. L. Clever

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>( T/K )</th>
<th>Mol Fraction ( 10^2x_f )</th>
<th>Bunsen Coefficient ( \alpha/\text{cm}^3\text{(STP)}\text{cm}^{-3}\text{atm}^{-1} )</th>
<th>Ostwald Coefficient ( L/\text{cm}^3\text{cm}^{-3} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>298.15</td>
<td>1.080</td>
<td>1.000</td>
<td>1.091</td>
</tr>
<tr>
<td>313.15</td>
<td>0.855</td>
<td>0.778</td>
<td>0.892</td>
</tr>
</tbody>
</table>

The Bunsen coefficient and mole fraction values were calculated by the compiler assuming that the gas is ideal and that Henry's law is obeyed.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
Volumetric method. The apparatus described by Bodor, Bor, Mohai and Sipos was used (1).

SOURCE AND PURITY OF MATERIALS:
Both the gas and the liquid were analytical grade reagents of Hungarian or foreign origin. No further information.

ESTIMATED ERROR:
\( \delta L/L = \pm 0.03 \)

REFERENCES:
1. Bodor, E.; Bor, Gy.; Mohai, B.; Sipos, G.
Chem. Abstr. 1961, 55, 3175h.
COMPONENTS:
(1) Carbon dioxide; \( \text{CO}_2 \); [124-38-9]
(2) Tetradecane; \( \text{C}_{14}\text{H}_{30} \); [629-59-4]

ORIGINAL MEASUREMENTS:
Makranczy, J.; Megery-Balog, K.; Rusz, L.; Patyi, L.

VARIABLES:
\( T/K: \) 298.15, 313.15
\( p/kPa: \) 101.325 (1 atm)

PREPARED BY:
S. A. Johnson
H. L. Clever

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>( T/K )</th>
<th>( T/K )</th>
<th>( \text{Mol Fraction} \times 10^2 )</th>
<th>( \text{Bunsen Coefficient} \ a/cm^3 \text{(STP)cm}^{-3} \text{atm}^{-1} )</th>
<th>( \text{Ostwald Coefficient} \ L/cm^3 \text{cm}^{-3} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>298.15</td>
<td>1.073</td>
<td>0.930</td>
<td>1.015</td>
<td></td>
</tr>
<tr>
<td>313.15</td>
<td>0.854</td>
<td>0.728</td>
<td>0.835</td>
<td></td>
</tr>
</tbody>
</table>

The Bunsen coefficient and mole fraction values were calculated by the compiler assuming that the gas is ideal and that Henry's law is obeyed.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
Volumetric method. The apparatus described by Bodor, Bor, Mohai and Sipos was used (1).

SOURCE AND PURITY OF MATERIALS:
Both the gas and the liquid were analytical grade reagents of Hungarian or foreign origin. No further information.

ESTIMATED ERROR:
\[ \delta L/L = \pm 0.03 \]

REFERENCES:
Chem. Abstr. 1961, 56, 3175h.
COMPONENTS:
1. Carbon dioxide; CO₂; [124-38-9]
2. Tetradecane; C₁₄H₃₀; [629-59-4]

ORIGINAL MEASUREMENTS:
King, M. B.; Al-Najjar, H.
1977, 32, 1241-1246.

VARIABLES:
\( T/K = 298.2-343.2 \)
\( P/kPa = 101.3 \)

PREPARED BY:
C. L. Young

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>( T/K )</th>
<th>Mole fraction* of carbon dioxide at a partial pressure of 101.3 kPa</th>
</tr>
</thead>
<tbody>
<tr>
<td>298.2</td>
<td>0.0136</td>
</tr>
<tr>
<td>303.2</td>
<td>0.0129</td>
</tr>
<tr>
<td>323.2</td>
<td>0.0107</td>
</tr>
<tr>
<td>343.2</td>
<td>0.0093</td>
</tr>
</tbody>
</table>

* allowance was made for the non-ideal gas behaviour of carbon dioxide.

AUXILIARY INFORMATION

METHOD/APPROATUS/PROCEDURE:
Solvent degassed by spraying into a continuously evacuated chamber.
Solvent flows in a thin film down a glass spiral into a buret system containing the gas to be dissolved.
Flow rates may be varied over a wide range without affecting the solubility.
Similar to the apparatus of Morrison and Billett.

SOURCE AND PURITY OF MATERIALS:
No details given.

ESTIMATED ERROR:
\( \delta T/K = \pm 0.1; \quad \delta X_{CO₂} = \pm 2\% \)
(estimated by compiler).

REFERENCES:
1. Morrison, T. J.; Billett, F.
   1952, 3819.
COMPONENTS:
(1) Carbon dioxide; CO₂; [124-38-9]
(2) Pentadecane; C₁₅H₃₂; [629-62-9]

ORIGINAL MEASUREMENTS:
Makranczy, J.; Megery-Balog, K.; Rusz, L.; Patyi, L.

VARIABLES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>p/kPa: 101.325 (1 atm)</th>
</tr>
</thead>
</table>

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>Mol Fraction</th>
<th>Bunsen Coefficient</th>
<th>Ostwald Coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>298.15</td>
<td>1.067</td>
<td>0.870</td>
<td>0.950</td>
</tr>
<tr>
<td>313.15</td>
<td>0.850</td>
<td>0.682</td>
<td>0.782</td>
</tr>
</tbody>
</table>

The Bunsen coefficient and mole fraction values were calculated by the compiler assuming that the gas is ideal and that Henry's law is obeyed.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
Volumetric method. The apparatus described by Bodor, Bor, Mohai and Sipos was used (1).

SOURCE AND PURITY OF MATERIALS:
Both the gas and the liquid were analytical grade reagents of Hungarian or foreign origin. No further information.

ESTIMATED ERROR:

δL/L = ± 0.03

REFERENCES:
1. Bodor, E.; Bor, Gy.; Mohai, B.; Sipos, G.
   Chem. Abstr. 1961, 58, 3175h.
COMPONENTS: ORIGINAL MEASUREMENTS:

1. Carbon dioxide; \( \text{CO}_2; \) [124-38-9]
   Lenoir, J-Y.; Renault, P.; Renon, H.

2. Hexadecane; \( \text{C}_{16}\text{H}_{34}; \) [544-76-3]
   or Heptadecane; \( \text{C}_{17}\text{H}_{36}; \) [629-78-7]

VARIABLES:

\[ T/K = 298.2 \text{ or } 323.2 \]

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>( T/K )</th>
<th>( P_{\text{CO}_2}/\text{atm} )</th>
<th>( x_{\text{CO}_2} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>298.2</td>
<td>62.5</td>
<td>0.0160</td>
</tr>
<tr>
<td>323.2</td>
<td>72.2</td>
<td>0.0139</td>
</tr>
</tbody>
</table>

* Calculated by compiler assuming a linear function of \( P_{\text{CO}_2} \) vs \( x_{\text{CO}_2} \), i.e., \( x_{\text{CO}_2} (1 \text{ atm}) = 1/H_{\text{CO}_2} \).

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

A conventional gas-liquid chromatographic unit fitted with a thermal conductivity detector was used. The carrier gas was helium. The value of Henry's law constant was calculated from the retention time. The value applies to very low partial pressures of gas and there may be a substantial difference from that measured at 1 atm. pressure. There is also considerable uncertainty in the value of Henry's constant since surface adsorption was not allowed for although its possible existence was noted.

SOURCE AND PURITY OF MATERIALS:

1. L'Air Liquide sample, minimum purity 99.9 mole per cent.
2. Touzart and Matignon or Serlabo sample, purity 99 mole per cent.

ESTIMATED ERROR:

\[ \delta T/K = \pm 0.1; \delta H/\text{atm} = \pm 6\% \]

(estimated by compiler).

REFERENCES:
**COMPONENTS:**
(1) Carbon dioxide; CO$_2$; [124-38-9]
(2) Hexadecane; C$_{16}$H$_{34}$; [544-76-3]

**ORIGINAL MEASUREMENTS:**
Makranczy, J.; Megery-Balog, K.; Rusz, L.; Patyi, L.

**VARIABLES:**
T/K: 298.15, 313.15
p/kPa: 101.325 (1 atm)

**PREPARED BY:**
S. A. Johnson
H. L. Clever

**EXPERIMENTAL VALUES:**

<table>
<thead>
<tr>
<th>T/K</th>
<th>Mol Fraction $10^2 z_i$</th>
<th>Bunsen Coefficient a/cm$^3$(STP)cm$^{-3}$atm$^{-1}$</th>
<th>Ostwald Coefficient L/cm$^3$cm$^{-3}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>298.15</td>
<td>1.064</td>
<td>0.820</td>
<td>0.895</td>
</tr>
<tr>
<td>313.15</td>
<td>0.843</td>
<td>0.639</td>
<td>0.733</td>
</tr>
</tbody>
</table>

The Bunsen coefficient and mole fraction values were calculated by the compiler assuming that the gas is ideal and that Henry's law is obeyed.

**AUXILIARY INFORMATION**

**METHOD/APPARATUS/PROCEDURE:**
Volumetric method. The apparatus described by Bodor, Bor, Mohai and Sipos was used (1).

**SOURCE AND PURITY OF MATERIALS:**
Both the gas and the liquid were analytical grade reagents of Hungarian or foreign origin. No further information.

**ESTIMATED ERROR:**

$$ \delta L/L = \pm 0.03 $$

**REFERENCES:**
1. Bodor, E.; Bor, Gy.; Mohai, B.; Sipos, G.
   *Chem. Abstr.* 1961, 55, 3175h.
### COMPONENTS:
1. Carbon dioxide; \( \text{CO}_2 \); [124-38-9]
2. Hexadecane; \( \text{C}_{16}\text{H}_{34} \); [544-76-3]

### ORIGINAL MEASUREMENTS:
Tremper, K.K.; Prausnitz, J.M.

### VARIABLES:
\( T/K = 300 - 475 \)

### EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>( T/K )</th>
<th>Henry's Constant(^a) /atm.</th>
<th>Mole fraction(^b) of ( \text{x}_{\text{CO}_2} ) carbon dioxide at 1 atm partial pressure, ( \text{CO}_2 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>300</td>
<td>74.3</td>
<td>0.0135</td>
</tr>
<tr>
<td>325</td>
<td>93.2</td>
<td>0.0107</td>
</tr>
<tr>
<td>350</td>
<td>112.0</td>
<td>0.00893</td>
</tr>
<tr>
<td>375</td>
<td>129.0</td>
<td>0.00775</td>
</tr>
<tr>
<td>400</td>
<td>144.0</td>
<td>0.00694</td>
</tr>
<tr>
<td>425</td>
<td>157.0</td>
<td>0.00637</td>
</tr>
<tr>
<td>450</td>
<td>168.0</td>
<td>0.00595</td>
</tr>
<tr>
<td>475</td>
<td>176.0</td>
<td>0.00568</td>
</tr>
</tbody>
</table>

\( ^a \) Authors stated measurements were made at several pressures and values of solubility used were all within the Henry's-Law region.

\( ^b \) Calculated by compiler assuming linear relationship between mole fraction and pressure.

### AUXILIARY INFORMATION

**METHOD/APPARATUS/PROCEDURE**
Volumetric apparatus similar to that described by Dymond and Hildebrand (1). Pressure measured with a null detector and precision gauge. Details in ref. (2).

**SOURCE AND PURITY OF MATERIALS:**
Solvent degassed, no other details given.

**ESTIMATED ERROR:**
\[ \delta T/K = \pm 0.1; \delta x_{\text{CO}_2} = \pm 1\% \]

**REFERENCES:**
1. Dymond, J.; Hildebrand, J.H.
2. Cukor, P.M.; Prausnitz, J.M.
COMPONENTS:
1. Carbon dioxide; CO₂; [124-38-9]
2. Hexadecane; C₁₆H₃₄; [544-76-3]

VARIABLES:
- T/K = 298.2-343.2
- P/kPa = 101.3

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>Mole fraction* of carbon dioxide at a partial pressure of 101.3 kPa</th>
</tr>
</thead>
<tbody>
<tr>
<td>298.2</td>
<td>0.0142</td>
</tr>
<tr>
<td>303.2</td>
<td>0.0135</td>
</tr>
<tr>
<td>323.2</td>
<td>0.0113</td>
</tr>
<tr>
<td>343.2</td>
<td>0.0097</td>
</tr>
</tbody>
</table>

* allowance was made for the non-ideal gas behaviour of carbon dioxide.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
Solvent degassed by spraying into a continuously evacuated chamber. Solvent flows in a thin film down a glass spiral into a buret system containing the gas to be dissolved. Flow rates may be varied over a wide range without affecting the solubility. Similar to the apparatus of Morrison and Billett.

SOURCE AND PURITY OF MATERIALS:
No details given.

ESTIMATED ERROR:
- δT/K = ±0.1;
- δx_CO₂ = ±2%
(estimated by compiler).

REFERENCES:
COMPONENTS:
1. Carbon dioxide; CO₂; [124-38-9]
2. Hexadecane; C₁₆H₃₄; [544-76-3]

VARIABLES:
T/K = 298.6 - 330.2

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>Henry's constant /atm</th>
<th>Mole fraction of a carbon dioxide</th>
</tr>
</thead>
<tbody>
<tr>
<td>298.6</td>
<td>71.42</td>
<td>0.01400</td>
</tr>
<tr>
<td>298.6</td>
<td>71.92</td>
<td>0.01390</td>
</tr>
<tr>
<td>304.3</td>
<td>75.78</td>
<td>0.01320</td>
</tr>
<tr>
<td>304.3</td>
<td>75.98</td>
<td>0.01316</td>
</tr>
<tr>
<td>311.0</td>
<td>80.77</td>
<td>0.01238</td>
</tr>
<tr>
<td>311.0</td>
<td>81.40</td>
<td>0.01229</td>
</tr>
<tr>
<td>316.2</td>
<td>84.57</td>
<td>0.01182</td>
</tr>
<tr>
<td>316.2</td>
<td>85.66</td>
<td>0.01167</td>
</tr>
<tr>
<td>323.6</td>
<td>89.46</td>
<td>0.01118</td>
</tr>
<tr>
<td>323.6</td>
<td>91.13</td>
<td>0.01097</td>
</tr>
<tr>
<td>330.2</td>
<td>95.11</td>
<td>0.01051</td>
</tr>
<tr>
<td>330.2</td>
<td>95.47</td>
<td>0.01047</td>
</tr>
</tbody>
</table>

a Calculated by compiler for a partial pressure of 1 atm.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
Volumetric apparatus similar to that described in ref.(1). Known amount of carbon dioxide brought into contact with known amount of solvent. Reduction in pressure measured.

SOURCE AND PURITY OF MATERIALS:
1. Linde "bone dry" grade.
2. Fisher certified grade.

REFERENCES:
**COMPONENTS:**
1. Carbon dioxide; CO₂; [124-38-9]  
2. Alkanes

**ORIGINAL MEASUREMENTS:**
Lin, P. J.; Parcher, J. F.  
*J. Chromatogr. Sci.*  

**VARIABLES:**

\[ \frac{T}{K} = 298.2 - 413.2 \]

**EXPERIMENTAL VALUES:**

<table>
<thead>
<tr>
<th>( \frac{T}{K} )</th>
<th>Henry's law constant, ( \frac{H}{\text{atm}} )</th>
<th>Mole fraction at a partial pressure of 1 atmosphere ( x_{\text{CO}_2} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>298.2</td>
<td>72.8</td>
<td>0.0138</td>
</tr>
<tr>
<td>313.2</td>
<td>82.7</td>
<td>0.0121</td>
</tr>
<tr>
<td>328.2</td>
<td>91.6</td>
<td>0.0109</td>
</tr>
<tr>
<td>353.2</td>
<td>82.0</td>
<td>0.0122</td>
</tr>
<tr>
<td>373.2</td>
<td>92.4</td>
<td>0.0108</td>
</tr>
<tr>
<td>393.2</td>
<td>101</td>
<td>0.00990</td>
</tr>
<tr>
<td>413.2</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**AUXILIARY INFORMATION**

**METHOD/APPARATUS/PROCEDURE:**

Henry's law constant determined from retention volume of gas on a chromatographic column. Helium was used as a carrier gas and a mass spectrometer was used as a detector. The measured Henry's law constants were independent of sample size, flow rate and composition of injected sample. The dead volume was determined by two independent methods and the values agreed within experimental error.

**SOURCE AND PURITY OF MATERIALS:**
No details given.

**ESTIMATED ERROR:**
\[ \delta \frac{T}{K} = \pm 0.1; \quad \delta x_{\text{CO}_2} = \pm 5\% \]
(estimated by compiler).

**REFERENCES:**
COMPONENTS:
1. Carbon dioxide; CO₂; [124-38-9]
2. Eicosane; C₂₀H₄₂; [112-95-8]

ORIGINAL MEASUREMENTS:

VARIABLES:
T/K = 314.3-330.2

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>Henry's constant /atm</th>
<th>Mole fraction of carbon dioxide</th>
</tr>
</thead>
<tbody>
<tr>
<td>314.3</td>
<td>75.58</td>
<td>0.01323</td>
</tr>
<tr>
<td>321.0</td>
<td>80.62</td>
<td>0.01240</td>
</tr>
<tr>
<td>321.0</td>
<td>80.24</td>
<td>0.01246</td>
</tr>
<tr>
<td>325.3</td>
<td>83.03</td>
<td>0.01204</td>
</tr>
<tr>
<td>325.3</td>
<td>82.75</td>
<td>0.01208</td>
</tr>
<tr>
<td>330.2</td>
<td>86.20</td>
<td>0.01160</td>
</tr>
<tr>
<td>330.2</td>
<td>86.21</td>
<td>0.01160</td>
</tr>
</tbody>
</table>

a Calculated by compiler for a partial pressure of 1 atm.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
Volumetric apparatus similar to that described in ref.(1). Known amount of carbon dioxide brought into contact with known amount of solvent. Reduction in pressure measured.

SOURCE AND PURITY OF MATERIALS:
1. Linde "bone dry" grade.
2. Fisher certified grade.

ESTIMATED ERROR:

REFERENCES:
COMPONENTS:
1. Carbon dioxide; CO₂;  [124-38-9]
2. Eicosane; C₂₀H₄₂;  [112-95-8]

VARIABLES:
\[ T/K = 323.2-573.2 \]
\[ P/kPa = 992-5063 \]

EXPERIMENTAL VALUES:

| T/K  | Henry's law constant /atm | Henry's law constant*/kPa | Mole fraction solubility at 101.3 kPa*
|------|---------------------------|---------------------------|-------------------------------------------------
| 323.3 | (75)†                     | 7646                      | 0.0131                                           |
| 373.5 | 114                       | 11551                     | 0.0088                                           |
| 473.2 | 160                       | 16212                     | 0.0063                                           |
| 573.4 | 171                       | 17327                     | 0.0058                                           |

The Henry's law constant, \( H \), is here defined as

\[ H = \frac{f}{x} \]

where

- \( x \) = mole fraction solubility of carbon dioxide
- \( f \) = fugacity of carbon dioxide
- \( P \) = pressure of carbon dioxide

† estimated by the compiler from data given in the paper.

* calculated by the compiler.

AUXILIARY INFORMATION

METHOD APPARATUS/PROCEDURE:
The solubility of carbon dioxide in eicosane was measured at four temperatures at pressures from 992 to 5063 kPa. Apparatus and procedure are described in an earlier paper (1). Gas was passed through the liquid in a thermostatted cell until saturation was achieved. Samples of solution were then withdrawn. The volume of the gas evolved when the pressure was reduced was measured and the eicosane weighed when it had cooled and solidified. The fugacity, \( f \), of the carbon dioxide at various pressures was estimated by the method described by Lee and Kesler (2). The variation of \( \ln(f/x) \) with pressure was linear to within a deviation of less than 0.8%. The value of \( f/x \) at zero pressure was taken to be the limiting value of the Henry's law constant.

SOURCE AND PURITY OF MATERIALS:
1. Supplied by Matheson Gas Products. Minimum purity 99.8%
2. Supplied by Alfa Products, Morton Thiokol Inc. Minimum purity 99%. Gas chromatographic analysis showed no thermal degradation after the solubility measurements were carried out.

ESTIMATED ERROR:

\[ \delta H = \pm 3\% \] (authors)

REFERENCES:
COMPONENTS:
1. Carbon dioxide; CO₂; \([124-38-9]\)
2. Octacosane; \(C_{28}H_{56}\); \([630-02-4]\)

ORIGINAL MEASUREMENTS:
Huang, S.H.; Lin, H.M.; Chao, K.C.

VARIABLES:
\[T/K = 373.2-573.2\]
\[P/kPa = 1013-5066\]

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>(T/K)</th>
<th>Henry's law constant /atm</th>
<th>Henry's law constant */kPa</th>
<th>Mole fraction solubility at 101.3 kPa*</th>
</tr>
</thead>
<tbody>
<tr>
<td>373.2</td>
<td>94 ± 2</td>
<td>9530 ± 200</td>
<td>0.0106</td>
</tr>
<tr>
<td>473.2</td>
<td>137 ± 1</td>
<td>13880 ± 100</td>
<td>0.0073</td>
</tr>
<tr>
<td>573.2</td>
<td>156 ± 2</td>
<td>15810 ± 200</td>
<td>0.0064</td>
</tr>
</tbody>
</table>

The Henry's law constant, \(H\), is here defined as

\[H = \lim_{P \to 0} \left( \frac{f}{x} \right)\]

where \(x\) = mole fraction solubility of carbon dioxide
\(f\) = fugacity of carbon dioxide
\(P\) = pressure of carbon dioxide

* calculated by the compiler.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
The solubility of carbon dioxide in octacosane was measured at three temperatures at pressures from 1013 to 5066 kPa. Apparatus and procedure are described in an earlier paper (1). Gas was passed through the liquid in a thermostatted cell until saturation was achieved. Samples of solution were then withdrawn. The volume of the gas evolved when the pressure was reduced was measured and the octacosane weighed when it had cooled and solidified. The fugacity, \(f\), of the carbon dioxide at various pressures was estimated by the method described by Lee and Kesler (2). The variation of \(\ln(f/x)\) with pressure was linear to within a deviation of less than 0.8%. The value of \(f/x\) at zero pressure was taken to be the limiting value of the Henry's law constant.

SOURCE AND PURITY OF MATERIALS:
1. Supplied by Matheson Gas Products. Minimum purity 99.8%
2. Supplied by Alfa Products, Morton Thiokol Inc. Minimum purity 99%. Gas chromatographic analysis showed no thermal degradation after the solubility measurements were carried out.

ESTIMATED ERROR:
\(\delta H = ±2\%\) (authors)

REFERENCES:
### COMPONENTS:

1. Carbon dioxide; $CO_2$; [124-38-9]
2. Alkanes

### VARIABLES:

<table>
<thead>
<tr>
<th>$P/kPa$</th>
<th>$T/K$</th>
<th>$\bar{V}_{CO_2}$</th>
<th>$x_{CO_2}$ at $P_{CO_2} = 101.3kPa^*$</th>
</tr>
</thead>
<tbody>
<tr>
<td>524-8632</td>
<td>313.2-423.2</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>Solvent</th>
<th>$T/K$</th>
<th>Henry's constant /kPa</th>
<th>$\bar{V}_{CO_2}$ /cm$^3$mol$^{-1}$</th>
<th>$x_{CO_2}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eicosane; $C_{20}H_{42}$; [112-95-8]</td>
<td>323.2</td>
<td>8230±30</td>
<td>48±3</td>
<td>0.0123</td>
</tr>
<tr>
<td></td>
<td>373.2</td>
<td>11290±30</td>
<td>79±1</td>
<td>0.0090</td>
</tr>
<tr>
<td>Octacosane; $C_{28}H_{56}$; [630-02-4]</td>
<td>348.2</td>
<td>8120±120</td>
<td>131±8</td>
<td>0.0125</td>
</tr>
<tr>
<td></td>
<td>373.2</td>
<td>9380±90</td>
<td>139±6</td>
<td>0.0108</td>
</tr>
<tr>
<td></td>
<td>423.2</td>
<td>11560±170</td>
<td>151±11</td>
<td>0.0088</td>
</tr>
<tr>
<td>Hexatriacontane; $C_{36}H_{74}$; [630-06-8]</td>
<td>373.2</td>
<td>7740±30</td>
<td>170±4</td>
<td>0.0131</td>
</tr>
<tr>
<td></td>
<td>423.2</td>
<td>9850±70</td>
<td>189±5</td>
<td>0.0103</td>
</tr>
<tr>
<td>Tetrametacontane; $C_{44}H_{90}$; [7098-22-8]</td>
<td>373.2</td>
<td>7060±80</td>
<td>211±11</td>
<td>0.0144</td>
</tr>
<tr>
<td></td>
<td>423.2</td>
<td>8520±80</td>
<td>226±8</td>
<td>0.0119</td>
</tr>
</tbody>
</table>

The authors found that, at mole fractions of carbon dioxide less than 0.45, the variation in mole fraction solubilities with variation in pressure could be represented by the Krichevsky-Kasarnovsky equation (1) in the form:

$$\ln(f_{CO_2}/x_{CO_2}) = \ln H + (\bar{V}_{CO_2}^\infty /RT)(P_b - P_{hc})$$

where $f_{CO_2}$ = fugacity of $CO_2$ in the mixture

- $H$ = Henry's constant
- $\bar{V}_{CO_2}^\infty$ = partial molar volume at infinite dilution of $CO_2$ in the liquid phase
- $P_b$ = bubble point pressure
- $P_{hc}$ = hydrocarbon vapor pressure

The authors found values of $H$ by plotting $\ln(f_{CO_2}/x_{CO_2})$ against $P_b$ and extrapolating to zero pressure. Values of $\bar{V}_{CO_2}^\infty$ were found from the slope of the line.

* calculated by the compiler from values of $H$ and of $\bar{V}_{CO_2}^\infty$ given in the paper

### AUXILIARY INFORMATION

**METHOD/APPARATUS/PROCEDURE:**

The authors used a static equilibrium cell capable of handling solvents which were solid at room temperature. Bubble point pressures for various quantities of $CO_2$ were found by decreasing the volume of the mixture and observing the break in the volume-pressure curve as the system changed from two phase to one phase. Mole fraction solubilities of $CO_2$ for various pressures are given in the paper.

**SOURCE AND PURITY OF MATERIALS:**

1. Supplied by Linde Speciality Gases; purity stated to be 99.99 mol%
2. Supplied by Alfa Products; purity stated to be 99 mol%

**ESTIMATED ERROR:**

See above.

**REFERENCES:**

1. Krichevsky, I.R.; Kasarnovsky, J.S.
**COMPONENTS:**

1. Carbon dioxide; CO₂; [124-38-9]
2. Tetracosane, 2,6,10,15,19,23-hexamethyl-, (squalane); C₃₀H₆₂; [111-01-3]

**ORIGINAL MEASUREMENTS:**


**VARIABLES:**

\[ T/K = 298.6-330.2 \]

**PREPARED BY:**

C. L. Young

**EXPERIMENTAL VALUES:**

<table>
<thead>
<tr>
<th>( T/K )</th>
<th>Henry's constant/atm</th>
<th>Mole fraction of (^a) carbon dioxide</th>
</tr>
</thead>
<tbody>
<tr>
<td>298.6</td>
<td>45.35</td>
<td>0.02205</td>
</tr>
<tr>
<td>298.6</td>
<td>44.92</td>
<td>0.02226</td>
</tr>
<tr>
<td>304.3</td>
<td>48.16</td>
<td>0.02076</td>
</tr>
<tr>
<td>304.3</td>
<td>47.75</td>
<td>0.02094</td>
</tr>
<tr>
<td>311.0</td>
<td>51.33</td>
<td>0.01948</td>
</tr>
<tr>
<td>311.0</td>
<td>50.94</td>
<td>0.01963</td>
</tr>
<tr>
<td>316.2</td>
<td>53.92</td>
<td>0.01855</td>
</tr>
<tr>
<td>316.2</td>
<td>53.22</td>
<td>0.01879</td>
</tr>
<tr>
<td>323.6</td>
<td>57.85</td>
<td>0.01729</td>
</tr>
<tr>
<td>323.6</td>
<td>57.56</td>
<td>0.01737</td>
</tr>
<tr>
<td>330.2</td>
<td>60.43</td>
<td>0.01655</td>
</tr>
</tbody>
</table>

\(^a\) Calculated by compiler for a partial pressure of 1 atm.

**AUXILIARY INFORMATION**

**METHOD/APPARATUS/PROCEDURE:**

Volumetric apparatus similar to that described in ref.(1). Known amount of carbon dioxide brought into contact with known amount of solvent. Reduction in pressure measured.

**SOURCE AND PURITY OF MATERIALS:**

1. Linde "bone dry" grade.
2. Fisher certified grade.

**ESTIMATED ERROR:**

**REFERENCES:**

## COMPONENTS:
1. Carbon dioxide; CO₂; [124-38-9]
2. Cyclopropane; C₃H₆; [75-19-4]

## VARIABLES:
\( T/K = 178.8 - 236.8 \)
\( P_{total}/kPa = 27 - 210 \)

## ORIGINAL MEASUREMENTS:
Haselden, G.G.; Snowden, P.

## PREPARED BY:
P.G.T. Fogg

## EXPERIMENTAL VALUES:

### Measurement of dew points

<table>
<thead>
<tr>
<th>( y_{CO_2} )</th>
<th>Total ( P/\text{atm} )</th>
<th>Total ( P/kPa* )</th>
<th>( T/K )</th>
<th>( y_{CO_2} )</th>
<th>Total ( P/\text{atm} )</th>
<th>Total ( P/kPa* )</th>
<th>( T/K )</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.2255</td>
<td>0.2862</td>
<td>29.00</td>
<td>208.7</td>
<td>1.4602</td>
<td>147.95</td>
<td>226.6</td>
<td></td>
</tr>
<tr>
<td>0.4484</td>
<td>45.43</td>
<td>219.0</td>
<td>0.8454</td>
<td>0.2182</td>
<td>22.11</td>
<td>184.3</td>
<td></td>
</tr>
<tr>
<td>1.0191</td>
<td>103.26</td>
<td>234.2</td>
<td>0.4794</td>
<td>48.58</td>
<td>192.7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.4535</td>
<td>147.28</td>
<td>242.6</td>
<td>0.9695</td>
<td>98.23</td>
<td>203.1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.9195</td>
<td>194.49</td>
<td>249.8</td>
<td>1.4890</td>
<td>150.87</td>
<td>210.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.4008</td>
<td>0.2506</td>
<td>25.39</td>
<td>203.8</td>
<td>1.9354</td>
<td>196.10</td>
<td>215.8</td>
<td></td>
</tr>
<tr>
<td>0.5606</td>
<td>56.00</td>
<td>216.8</td>
<td>0.9066</td>
<td>22.73</td>
<td>173.9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.8776</td>
<td>88.92</td>
<td>225.2</td>
<td>0.5025</td>
<td>50.92</td>
<td>184.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.4396</td>
<td>145.87</td>
<td>236.4</td>
<td>0.9663</td>
<td>97.91</td>
<td>194.9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.8298</td>
<td>185.40</td>
<td>242.4</td>
<td>1.5050</td>
<td>152.49</td>
<td>203.7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.6200</td>
<td>0.2191</td>
<td>22.20</td>
<td>193.7</td>
<td>1.8988</td>
<td>192.40</td>
<td>207.1</td>
<td></td>
</tr>
<tr>
<td>0.4497</td>
<td>45.57</td>
<td>205.5</td>
<td>2.0741</td>
<td>147.95</td>
<td>207.1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.9789</td>
<td>99.19</td>
<td>219.0</td>
<td>1.6100</td>
<td>119.12</td>
<td>186.6</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Measurement of bubble points

<table>
<thead>
<tr>
<th>( x_{CO_2} )</th>
<th>Total ( P/\text{atm} )</th>
<th>Total ( P/kPa* )</th>
<th>( T/K )</th>
<th>( x_{CO_2} )</th>
<th>Total ( P/\text{atm} )</th>
<th>Total ( P/kPa* )</th>
<th>( T/K )</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.048</td>
<td>2.0741</td>
<td>210.16</td>
<td>236.8</td>
<td>0.5480</td>
<td>55.53</td>
<td>192.7</td>
<td></td>
</tr>
<tr>
<td>1.6788</td>
<td>170.10</td>
<td>230.1</td>
<td>0.4066</td>
<td>41.20</td>
<td>186.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.4995</td>
<td>151.94</td>
<td>226.6</td>
<td>0.3258</td>
<td>33.01</td>
<td>182.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.2410</td>
<td>125.74</td>
<td>221.0</td>
<td>0.2694</td>
<td>27.30</td>
<td>178.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.0856</td>
<td>110.00</td>
<td>217.6</td>
<td>0.195</td>
<td>188.46</td>
<td>208.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.9723</td>
<td>98.52</td>
<td>214.4</td>
<td>1.8600</td>
<td>188.46</td>
<td>208.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.7835</td>
<td>79.39</td>
<td>208.4</td>
<td>1.6749</td>
<td>186.91</td>
<td>206.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.6354</td>
<td>64.38</td>
<td>203.0</td>
<td>1.4083</td>
<td>142.70</td>
<td>202.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.4937</td>
<td>50.02</td>
<td>196.6</td>
<td>1.1559</td>
<td>117.12</td>
<td>197.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.3533</td>
<td>39.80</td>
<td>188.6</td>
<td>0.9007</td>
<td>91.26</td>
<td>192.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.2649</td>
<td>26.84</td>
<td>182.1</td>
<td>0.7187</td>
<td>72.82</td>
<td>187.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.087</td>
<td>1.9017</td>
<td>192.69</td>
<td>223.8</td>
<td>0.299</td>
<td>208.50</td>
<td>205.3</td>
<td></td>
</tr>
<tr>
<td>1.6101</td>
<td>163.14</td>
<td>219.2</td>
<td>1.7874</td>
<td>181.11</td>
<td>202.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.2413</td>
<td>125.77</td>
<td>212.1</td>
<td>1.3730</td>
<td>139.12</td>
<td>195.9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.9555</td>
<td>96.82</td>
<td>205.2</td>
<td>0.391</td>
<td>206.52</td>
<td>202.7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.8946</td>
<td>90.65</td>
<td>203.7</td>
<td>1.8213</td>
<td>184.54</td>
<td>200.1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.5721</td>
<td>57.97</td>
<td>198.1</td>
<td>0.3587</td>
<td>205.3</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\( x_{CO_2} \) = mole fraction of carbon dioxide in the liquid phase
\( y_{CO_2} \) = mole fraction of carbon dioxide in the gas phase
* calculated by the compiler

## AUXILIARY INFORMATION

### METHOD/APPARATUS/PROCEDURE:
Dew points and bubble points of various mixtures of carbon dioxide and cyclopropane were measured. The dew and bubble point cells were immersed in a cryostat. Full details of the apparatus are described in the paper.

### SOURCE AND PURITY OF MATERIALS:
No information

### ESTIMATED ERROR:
\( \Delta T/K = \pm 0.02 \) (authors)

### REFERENCES:

---

---
COMPONENTS:

1. Carbon dioxide; CO₂; [124-38-9]
2. Cyclopentane; C₅H₁₀; [287-92-3]

ORIGINAL MEASUREMENTS:

Eckert, C.J.; Sandler, S.I.


VARIABLES:

\[
\begin{align*}
T/K & = 310.9-333.2 \\
P/kPa & = 175-8263
\end{align*}
\]

PREPARED BY:

P.G.T. Fogg

EXPERIMENTAL VALUES:

\[
\begin{array}{cccc}
T/K & P_{\text{total}}/kPa & x_{\text{CO}_2} & y_{\text{CO}_2} & P_{\text{CO}_2}/kPa^* \\
310.86 & 175 & 0.0067 & 0.600 & 105 \\
\end{array}
\]

*calculated by the compiler and taken to be \( y_{\text{CO}_2} \times P_{\text{total}} \)

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Measurements on the vapor-liquid equilibria for the carbon dioxide-cyclopentane system were made at 310.9 K, 318.2 K and 333.2 K and total pressures to a maximum of 8263 kPa. The measurements reported above were the only ones at a pressure below 200 kPa. The apparatus and procedure were similar to that used previously by one of the authors (1). Mixtures were analysed by gas chromatography.

SOURCE AND PURITY OF MATERIALS:

1. Research grade (99.99%) supplied by the Linde Division of Union Carbide.
2. Supplied by Aldrich; purified by distillation under nitrogen with only the middle 50% cut used.

ESTIMATED ERROR:

REFERENCES:

1. Behrens, P.K.; Sandler, S.I.

COMPONENTS:
1 Carbon dioxide; CO$_2$; [124-38-9]
2 Cyclohexane; C$_6$H$_{12}$; [110-82-7]

VARIABLES:

\[
\begin{align*}
T/K & = 298.15 \\
P_1/kPa & = 101.325 \text{ (1 atm)}
\end{align*}
\]

EXPERIMENTAL VALUES:

\[
\begin{array}{cccc}
T/K & \text{Carbon Dioxide Pressure} & \text{Mol Fraction}\,^1 & \text{Bunsen Coefficient} \, \alpha/(\text{cm}^3\text{(STP)}\text{cm}^{-3}\text{atm}^{-1}) & \text{Ostwald Coefficient} \, \lambda/\text{cm}^3\text{cm}^{-3} \\
298.15 & 700.3 & 7.67 & 1.57 & 1.71 \\
 & 814.1 & 7.77 & 1.59 & 1.73
\end{array}
\]

\^1 Mole fraction solubility values adjusted to a gas partial pressure of 101.325 kPa (1 atm) by the compiler.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
A calibrated all-glass combined manometer and bulb was enclosed in an air thermostat and shaken until equilibrium. Mercury was used for calibration and as confining liquid. The solvent was degassed in the apparatus.

The absorbed volume of gas is calculated from the initial and final amounts, both saturated with solvent vapor. The amount of solvent is determined by the weight of displaced mercury.

The mole fraction solubility values are at 1 atm assuming Henry's law is obeyed.

Details of the apparatus and procedure are given in ref. 1 and 2.

SOURCE AND PURITY OF MATERIALS:
1 Carbon dioxide. Prepared from potassium bicarbonate (analytical reagent) and concentrated sulfuric acid. 99.9 per cent CO$_2$.

ESTIMATED ERROR:
\[
\begin{align*}
\delta T/K & = \pm 0.05 \\
\delta x_1/x_2 & = \pm 0.015
\end{align*}
\]

REFERENCES:
COMPONENTS:
(1) Carbon dioxide; CO₂; [124-38-9]
(2) Cyclohexane; C₆H₁₂; [110-82-7]

ORIGINAL MEASUREMENTS:
Dymond, J.; Hildebrand, J. H.

VARIABLES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>298.15</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total P/kPa</td>
<td>101.325</td>
</tr>
</tbody>
</table>

PREPARED BY:
A. L. Cramer
H. L. Clever

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>Mol Fraction x₁ x 10⁴</th>
<th>Bunsen Coefficient α</th>
<th>Ostwald Coefficient L</th>
</tr>
</thead>
<tbody>
<tr>
<td>298.15</td>
<td>77.1</td>
<td>1.601</td>
<td>1.748</td>
</tr>
</tbody>
</table>

The Bunsen and Ostwald coefficients were calculated by the compiler.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
The apparatus consists of an all-glass buret system and a two bulb absorption vessel.

A magnetic pump forces solvent from the lower bulb over the wall of the upper bulb which contains the gas. The solvent flow back to the lower bulb. Pumping is continued until there is no further pressure change.

The amount of gas absorbed is calculated from the initial and final gas pressure.

SOURCE AND PURITY OF MATERIALS:
No information.

ESTIMATED ERROR:

\[ \delta T/K = +0.05 \]
\[ \delta x_1/x_1 = \pm 0.01 \text{ or less.} \]

REFERENCES:
COMPONENTS:
(1) Carbon dioxide; CO₂; [124-38-9]
(2) Cyclohexane; C₆H₁₂; [110-82-7]

ORIGINAL MEASUREMENTS:
Dymond, J. H.

### VARIABLES:

- **T/K:** 293.39 - 310.55
- **p/kPa:** 101.325 (1 atm)

PREPARED BY:
M. E. Derrick
H. L. Clever

### EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>Temperature (°C)</th>
<th>Mol Fraction</th>
<th>Bunsen Coefficient (a/cm³(STP) cm⁻³ atm⁻¹)</th>
<th>Ostwald Coefficient (L/cm³ cm⁻³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>20.24</td>
<td>293.39</td>
<td>10²x₁</td>
<td>1.51</td>
</tr>
<tr>
<td>26.60</td>
<td>299.75</td>
<td>7.58</td>
<td>1.57</td>
</tr>
<tr>
<td>31.08</td>
<td>304.23</td>
<td>7.31</td>
<td>1.42</td>
</tr>
<tr>
<td>37.40</td>
<td>310.55</td>
<td>6.94</td>
<td>1.42</td>
</tr>
</tbody>
</table>

The Bunsen and Ostwald coefficients were calculated by the compiler.

Smoothed Data: For use between 293.15 and 310.55 K.

\[
\ln x₁ = -7.4372 + 7.6609/(T/100K)
\]

The standard error about the regression line is 5.37 x 10⁻⁶.

<table>
<thead>
<tr>
<th>T/K</th>
<th>Mol Fraction</th>
</tr>
</thead>
<tbody>
<tr>
<td>293.15</td>
<td>8.03</td>
</tr>
<tr>
<td>298.15</td>
<td>7.69</td>
</tr>
<tr>
<td>303.15</td>
<td>7.37</td>
</tr>
<tr>
<td>308.15</td>
<td>7.07</td>
</tr>
</tbody>
</table>

### SOURCE AND PURITY OF MATERIALS:

2. Cyclohexane. Matheson, Coleman and Bell chromatoquality reagent. Dried and fractionally frozen. m.p. 6.45°C.

### ESTIMATED ERROR:

\[ \delta x₁/x₁ = 0.01 \]

### REFERENCES:

1. Dymond, J.; Hildebrand, J. H.
COMPONENTS:
(1) Carbon dioxide; CO\(_2\); [124-38-9]
(2) Cyclohexane; C\(_6\)H\(_{12}\); [110-82-7]

ORIGIANAL MEASUREMENTS:
Wilhelm, E.; Battino, R.

VARIABLES:

\[ T/\text{K}: \ 283.82 - 313.34 \]
\[ p/\text{kPa}: \ 101.325 (1 \text{ atm}) \]

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>( T/\text{K} )</th>
<th>Mol Fraction ( 10^3x_I )</th>
<th>Bunsen Coefficient ( \alpha )</th>
<th>Ostwald Coefficient ( L )</th>
</tr>
</thead>
<tbody>
<tr>
<td>283.82</td>
<td>8.56</td>
<td>1.81</td>
<td>1.88</td>
</tr>
<tr>
<td>297.63</td>
<td>7.55</td>
<td>1.57</td>
<td>1.71</td>
</tr>
<tr>
<td>313.34</td>
<td>6.85</td>
<td>1.39</td>
<td>1.60</td>
</tr>
</tbody>
</table>

The solubility values were adjusted to a carbon dioxide partial pressure of 101.325 kPa (1 atm) by Henry's law. The Bunsen coefficients were calculated by the compiler.

Smoothed Data: For use between 283.82 and 313.34 K

\[ \ln x_I = -7.1298 + 6.7089/(T/100K) \]

The standard error about the regression line is 9.86 x 10\(^{-4}\).

<table>
<thead>
<tr>
<th>( T/\text{K} )</th>
<th>Mol Fraction ( 10^3x_I )</th>
</tr>
</thead>
<tbody>
<tr>
<td>288.15</td>
<td>8.22</td>
</tr>
<tr>
<td>298.15</td>
<td>7.60</td>
</tr>
<tr>
<td>308.15</td>
<td>7.06</td>
</tr>
</tbody>
</table>

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
The solubility apparatus is based on the design of Morrison and Billett (1) and the version used is described by Battino, Evans, and Danforth (2). The degassing apparatus is that described by Battino, Banzhof, Bogan, and Wilhelm (3).

Degassing. Up to 500 cm\(^3\) of solvent is placed in a flask of such size that the liquid is about 4 cm deep. The liquid is rapidly stirred, and vacuum is intermittently applied through a liquid N\(_2\) trap until the permanent gas residual pressure drops to 5 microns.

Solubility Determination. The degassed solvent is passed in a thin film down a glass spiral tube containing solute gas plus the solvent vapor at a total pressure of one atm. The volume of gas absorbed is found by difference between the initial and final volumes in the buret system. The solvent is collected in a tared flask and weighed.

SOURCE AND PURITY OF MATERIALS:

ESTIMATED ERROR:
\[ \delta T/\text{K} = 0.03 \]
\[ \delta P/\text{mmHg} = 0.5 \]
\[ \delta x_I/x_I = 0.005 \]

REFERENCES:
COMPONENTS:

1. Carbon dioxide; CO$_2$; [124-38-9]
2. Cyclohexane; C$_6$H$_{12}$; [110-82-7]

VARIABLES:

$$T/K = 283.15-313.15$$

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>$T/K$</th>
<th>Solubility, $S$/mol dm$^{-3}$ bar$^{-1}$</th>
<th>Mole fraction$^+$ of carbon dioxide in liquid, $x_{CO_2}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>283.15</td>
<td>0.08130</td>
<td>0.00873</td>
</tr>
<tr>
<td>293.15</td>
<td>0.07150</td>
<td>0.00777</td>
</tr>
<tr>
<td>303.15</td>
<td>0.06341</td>
<td>0.00698</td>
</tr>
<tr>
<td>313.15</td>
<td>0.05667</td>
<td>0.00632</td>
</tr>
</tbody>
</table>

$^+$ at a partial pressure of 101.325 kPa.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Volumetric apparatus in which gas was dissolved in liquid in glass cell. Pressure measured. Amount of gas dissolved estimated from pressure measurements when gas was repeatedly expanded into known volume. Details in source. Values of solubility calculated from equations and graphs in original.

SOURCE AND PURITY OF MATERIALS:

No details given.

ESTIMATED ERROR:

$$\delta T/K = \pm 0.1; \ \delta x_{CO_2} = \pm 1-2\%.$$
<table>
<thead>
<tr>
<th>COMPONENTS:</th>
<th>ORIGINAL MEASUREMENTS:</th>
</tr>
</thead>
<tbody>
<tr>
<td>2. Cyclohexane; C₆H₁₂; [110-82-7]</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>VARIABLES:</th>
<th>PREPARED BY:</th>
</tr>
</thead>
<tbody>
<tr>
<td>(T/K = 298.15)</td>
<td>C. L. Young</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>EXPERIMENTAL VALUES:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>(T/K)</td>
<td>(\alpha)</td>
</tr>
<tr>
<td>298.15</td>
<td>1.57</td>
</tr>
</tbody>
</table>

\(\dagger\) volume of gas (measured at 101.325 kPa and 273.15 K) dissolved by one volume of cyclohexane.

**AUXILIARY INFORMATION**

**METHOD/APPARATUS/PROCEDURE:**

Volumetric method. Pressure measured when known amounts of gas were added, in increments, to a known amount of liquid in a vessel of known dimensions. Corrections were made for the partial pressure of solvent. Details in ref. (1).

**SOURCE AND PURITY OF MATERIALS:**

Purity better than 99 mole per cent as determined by gas chromatography.

**ESTIMATED ERROR:**

\(\delta T/K = \pm 0.1; \ \delta \alpha = \pm 4\% \text{ or less.}

**REFERENCES:**

COMPONENTS:
1. Carbon dioxide; CO₂; [124-38-9]
2. Cyclohexane, C₆H₁₂; [110-82-7]

VARIABLES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>P/MPa</th>
<th>( H/\text{MPa} )</th>
<th>( H/\text{kPa} )</th>
<th>Mole fraction ( x_{\text{CO}<em>2} ) at ( P</em>{\text{CO}_2} = 101.3 \text{ kPa}^* )</th>
</tr>
</thead>
<tbody>
<tr>
<td>283.15</td>
<td>11.48</td>
<td>11480</td>
<td>11480</td>
<td>0.00882</td>
</tr>
<tr>
<td>298.15</td>
<td>13.30</td>
<td>13300</td>
<td>13300</td>
<td>0.00762</td>
</tr>
<tr>
<td>303.15</td>
<td>13.89</td>
<td>13890</td>
<td>13890</td>
<td>0.00729</td>
</tr>
</tbody>
</table>

\[ H = \left[ \frac{f_1}{x_1} \right] \]

\[ x_1 = x_{\text{CO}_2} \]; \( f_1 \) = fugacity of CO₂

* taken by the compiler to be given approximately by \( P_{\text{CO}_2}/H \)

EXPERIMENTAL VALUES:

METHOD APPARATUS/PROCEDURE:
Apparatus able to withstand pressures to 20 MPa was used to determine phase equilibria by the bubble point method. Henry's constants at zero pressure were obtained from the experimental data by using the method described by Prausnitz and Chueh (1)

SOURCE AND PURITY OF MATERIALS:
1. Supplied by Showa Tansan Industry Co., Ltd; purity better than 99.9%
2. Supplied by Wako Pure Chem. Co., Ltd.; purity better than 99.8%

ESTIMATED ERROR:
\( \delta T/K = \pm 0.01 \)
\( \delta P/\text{kPa} = \pm 0.1 \) (authors)

REFERENCES:
1. Prausnitz, J.M.; Chueh, P.L.
   Computer Calculations for High Pressure Vapor-Liquid Equilibria,
COMPONENTS:
1. Carbon dioxide; CO₂; [124-38-9]
2. Alicyclics or 1-Tetradecene

ORIGIANL MEASUREMENTS:
Luhring, P.; Schumpe, A.

VARIABLES:
T/K = 293.2

PREPARED BY:
C.L. Young

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>Henry's Constant* / (Pa m³/mol⁻¹)</th>
<th>Mole fraction of CO₂ at 1 atm partial pressure†</th>
</tr>
</thead>
<tbody>
<tr>
<td>293.2</td>
<td>1414</td>
<td>0.007746</td>
</tr>
<tr>
<td></td>
<td>Cyclohexane; C₆H₁₂; [110-82-7]</td>
<td></td>
</tr>
<tr>
<td>293.2</td>
<td>1610</td>
<td>0.008576</td>
</tr>
<tr>
<td></td>
<td>Tetrahydronaphthalene, (tetralin); C₁₆H₁₂; [119-64-2]</td>
<td></td>
</tr>
<tr>
<td>293.2</td>
<td>2001</td>
<td>0.007897</td>
</tr>
<tr>
<td></td>
<td>Decahydroronaphthalene, (decalin); C₁₀H₁₂; [91-17-8]</td>
<td></td>
</tr>
<tr>
<td>293.2</td>
<td>1551</td>
<td>0.001654</td>
</tr>
<tr>
<td></td>
<td>1-Tetradecene; C₁₄H₂₉; [1120-36-1]</td>
<td></td>
</tr>
</tbody>
</table>

*referred to as Henry's constant in source but appears to be usual Henry's constant multiplied by molar volume.
†calculated by compiler using density data taken from ref.(1).

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE
Little information given in source. Method consisted of equilibrating known amounts of degassed liquid and gas and measuring the change in pressure. Equilibration was reached in 3 to 6 minutes. Some details given in ref.(2).

SOURCE AND PURITY OF MATERIALS:
Obtained from Merck at the highest available purity. No other details given.

ESTIMATED ERROR:
δT/K = ± 0.1 (authors)
δx/x = ± 0.01 to 0.15 (compiler)

REFERENCES:
COMPONENTS:
(1) Carbon dioxide; CO$_2$; [124-38-9]
(2) Cyclohexane; C$_6$H$_{12}$; [110-82-7]
    Methylcyclohexane; C$_7$H$_{14}$; [108-87-2]

VARIABLES:
$T/K = 293.2, 294.3$
$P_1/kPa = $ not given

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>Temperature</th>
<th>Ostwald Coefficient</th>
<th>Number of Runs</th>
</tr>
</thead>
<tbody>
<tr>
<td>$^{t/°C}$</td>
<td>$T/K$</td>
<td>$L/cm^3 cm^{-3}$</td>
</tr>
<tr>
<td>Cyclohexane</td>
<td>20.0</td>
<td>293.2</td>
</tr>
<tr>
<td></td>
<td>21.1</td>
<td>294.3</td>
</tr>
</tbody>
</table>

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
A cylindrical glass container of approximately 15 cm$^3$ volume is partly filled with solvent and closed with a half-hole septum. An amount of the gaseous solute is added to the container. The closed container is shaken for 30 minutes. Samples of both the vapor and liquid phases are taken in a calibrated syringes. The samples are injected into a gas chromatograph. The Ostwald coefficient is calculated from the known sample size and the measured peak areas.

The chromatograph is a Hewlett-Packard model 5750 equipped with a thermal conductivity cell detector. The carrier gas is helium. A 200 cm Porapak column is used for the separation.

SOURCE AND PURITY OF MATERIALS:
(2) Cyclohexane. Merck and Co. Uvasol spektroskopie grade. Methylcyclohexane. Fluka. UV-Spektroskopie grade. Impurities which gave same retension times as the gas were removed by absorption or distillation. Otherwise used as rcvd.

ESTIMATED ERROR:
$\delta L/L = \pm 0.05$

REFERENCES:
COMPONENTS:
(1) Carbon dioxide; CO₂; [124-38-9]
(2) Methylcyclohexane; C₇H₁₄; [108-87-2]

ORIGINAL MEASUREMENTS:
Field, L. R.; Wilhelm, E.; Battino, R.

VARIABLES:
T/K: 283.89 - 313.28
P/kPa: 101.325 (1 atm)

PREPARED BY:
H. L. Clever

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K (K)</th>
<th>Mol Fraction (10⁻³ x₁)</th>
<th>Bunsen Coefficient (a/cm³(STP) cm⁻³ atm⁻¹)</th>
<th>Ostwald Coefficient (L/cm² cm⁻¹)</th>
</tr>
</thead>
<tbody>
<tr>
<td>283.89</td>
<td>11.53</td>
<td>2.07</td>
<td>2.151</td>
</tr>
<tr>
<td>298.13</td>
<td>9.28</td>
<td>1.63</td>
<td>1.784</td>
</tr>
<tr>
<td>313.28</td>
<td>7.67</td>
<td>1.33</td>
<td>1.521</td>
</tr>
</tbody>
</table>

The gas solubility values were adjusted to a CO₂ partial pressure of 101.325 kPa (1 atm) by Henry's law.

The Bunsen coefficients were calculated by the compiler.

Smoothed Data: For use between 283.15 and 313.28 K.

\[
\ln x_1 = -8.8123 + 12.3390/(T/100 K)
\]

The standard error about the regression line is 7.36 x 10⁻⁴.

<table>
<thead>
<tr>
<th>T/K (K)</th>
<th>Mol Fraction (10⁻³ x₁)</th>
</tr>
</thead>
<tbody>
<tr>
<td>283.15</td>
<td>11.63</td>
</tr>
<tr>
<td>293.15</td>
<td>10.02</td>
</tr>
<tr>
<td>298.15</td>
<td>9.34</td>
</tr>
<tr>
<td>303.15</td>
<td>8.72</td>
</tr>
<tr>
<td>313.15</td>
<td>7.66</td>
</tr>
</tbody>
</table>

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
The solubility apparatus is based on the design of Morrison and Billett (1) and the version used is described by Battino, Evans, and Danforth (2). The degassing apparatus is that described by Battino, Banzhof, Bogan, and Wilhelm (3).

Degassing. Up to 500 cm³ of solvent is placed in a flask of such size that the liquid is about 4 cm deep. The liquid is rapidly stirred, and vacuum is intermittently applied through a liquid N₂ trap until the permanent gas residual pressure drops to 5 microns.

Solubility Determination. The degassed solvent is passed in a thin film down a glass spiral tube containing solute gas plus the solvent vapor at a total pressure of one atm. The volume of gas absorbed is found by difference between the initial and final volumes in the buret system. The solvent is collected in a tared flask and weighed.

SOURCE AND PURITY OF MATERIALS:
(1) Carbon dioxide. Either Matheson Co., Inc. or Air Products and Chemicals, Inc. Purest grade available, minimum purity greater than 99 mole per cent.

ESTIMATED ERROR:

\[\delta T/K = 0.03\]
\[\delta P/\text{mmHg} = 0.5\]
\[\delta x_1/x_1 = 0.005\]

REFERENCES:
COMPONENTS:
(1) Carbon dioxide; CO\textsubscript{2}; [124-38-9]
(2) Cyclooctane; C\textsubscript{8}H\textsubscript{16}; [292-64-8]

ORIGINAL MEASUREMENTS:
Wilcock, R. J.; Battino, R.; Wilhelm, E.

VARIABLES:
\(T/\text{K}:\) 289.09 - 313.52
\(p/\text{kPa}:\) 101.325 (1 atm)

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>(T/\text{K})</th>
<th>(10^3 x_1)</th>
<th>Bunsen Coefficient</th>
<th>Ostwald Coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>289.09</td>
<td>7.548</td>
<td>1.268</td>
<td>1.342</td>
</tr>
<tr>
<td>298.27</td>
<td>6.860</td>
<td>1.142</td>
<td>1.247</td>
</tr>
<tr>
<td>313.52</td>
<td>6.036</td>
<td>0.9897</td>
<td>1.136</td>
</tr>
</tbody>
</table>

The Bunsen coefficients were calculated by the compiler.
The solubility values were adjusted to a carbon dioxide partial pressure of 101.325 kPa by Henry's law.

Smoothed Data: For 288.15 to 313.15 K.
\[
\ln x_1 = -7.7453 + 8.2561/(T/100K)
\]
The standard error about the regression line is 4.11 \(\times 10^{-5}\).

METHOD/APPARATUS/PROCEDURE:
The solubility apparatus is based on the design of Morrison and Billett (1) and the version used is described by Battino, Evans, and Danforth (2). The degassing apparatus is that described by Battino, Banzhof, Bogan, and Wilhelm (3).

Degassing. Up to 500 cm\textsuperscript{3} of solvent is placed in a flask of such size that the liquid is about 4 cm deep. The liquid is rapidly stirred, and vacuum is intermittently applied through a liquid N\textsubscript{2} trap until the permanent gas residual pressure drops to 5 microns.

Solubility Determination. The degassed solvent is passed in a thin film down a glass spiral tube containing solute gas plus the solvent vapor at a total pressure of one atm. The volume of gas absorbed is found by difference between the initial and final volumes in the buret system. The solvent is collected in a tared flask and weighed.

AUXILIARY INFORMATION

SOURCE AND PURITY OF MATERIALS:
(1) Carbon dioxide. Air Products and Chemicals, Inc. Minimum mole per cent purity is 99.8.
(2) Cyclooctane. Chemical Samples Co. 99 mole per cent, distilled, refractive index (NaD, 298.15 K) 1.4562.

ESTIMATED ERROR:
\(\delta T/\text{K} = 0.03\)
\(\delta P/\text{mmHg} = 0.5\)
\(\delta x_1/x_1 = 0.005\)

REFERENCES:
COMPONENTS:
(1) Carbon dioxide; CO₂; [124-38-9]
(2) trans-1,2-Dimethylcyclohexane; C₈H₁₆; [6876-23-9]

ORIGINAL MEASUREMENTS:
Geller, E. B.; Battino, R. Wilhelm, E.

VARIABLES:
\[ T / K: \begin{array}{c} 298.19 \text{, } 312.88 \\ \end{array} \]
\[ p / kPa: 101.325 \text{ (1 atm)} \]

EXPERIMENTAL VALUES:
\[
\begin{array}{cccc}
T / K & \text{Mol Fraction} & \text{Bunsen Coefficient} & \text{Ostwald Coefficient} \\
& \times 10^3 x_j & a / cm³( STP) cm⁻¹ atm⁻¹ & L / cm³ cm⁻³ \\
298.19 & 10.197 & 1.598 & 1.734 \\
312.88 & 8.778 & 1.345 & 1.541 \\
\end{array}
\]

The Bunsen coefficients were calculated by the compiler assuming ideal gas behavior.

The solubility values were adjusted to a carbon dioxide partial pressure of 101.325 kPa by Henry's law.

Smoothed Data: The equation is based on only two pair of experimental points and should be used with caution.

For use between 298.19 and 312.88 K

\[ \ln x_j = -7.7777 + 9.5187/(T/100K) \]

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
The solubility apparatus is based on the design of Morrison and Billett (1) and the version used is described by Battino, Evans, and Danforth (2).
The degassing apparatus is that described by Battino, Banzhof, Bogan, and Wilhelm (3).

Degassing. Up to 500 cm³ of solvent is placed in a flask of such size that the liquid is about 4 cm deep.
The liquid is rapidly stirred, and vacuum is intermittently applied through a liquid N₂ trap until the permanent gas residual pressure drops to 5 microns.

Solubility Determination. The degassed solvent is passed in a thin film down a glass helical tube containing solute gas plus the solvent vapor at a total pressure of one atm.
The volume of gas absorbed is found by differences between the initial and final volumes in the buret system. The solvent is collected in a tared flask and weighed.

SOURCE AND PURITY OF MATERIALS:
(1) Carbon dioxide. Air Products and Chemicals Co. Stated to be 99.8 mole percent minimum.
(2) trans-1,2-Dimethylcyclohexane. Chemicals Samples Co. Fractionally distilled and stored in dark. Refractive index (Na-D, 298.15 K) 1.4248.

ESTIMATED ERROR:
\[ \delta T / K = 0.03 \]
\[ \delta p / mmHg = 0.5 \]
\[ \delta x_j / x_j = 0.005 \]

REFERENCES:
COMPONENTS:
(1) Carbon dioxide; \( \text{CO}_2; [124-38-9] \)
(2) \( \text{cis}-1,2\)-Dimethylcyclohexane; \( \text{C}_8\text{H}_{16}; [2207-01-4] \)

ORIGINAL MEASUREMENTS:
Geller, E. B.; Battino, R.; Wilhelm, E.

\[ J. \text{Chem. Thermodyn. 1976, 8, 197-202.} \]

VARIABLES:
\[ T/\text{K}: \quad 297.88, 312.99 \]
\[ p/\text{kPa}: \quad 101.325 \text{ (1 atm)} \]

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>( T/\text{K} )</th>
<th>( 10^3 \times x_1 )</th>
<th>( a/\text{cm}^3(\text{STP})\text{cm}^{-3}\text{atm}^{-1} )</th>
<th>( l/\text{cm}^3\text{cm}^{-3} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>297.88</td>
<td>9.408</td>
<td>1.504</td>
<td>1.640</td>
</tr>
<tr>
<td>312.99</td>
<td>7.972</td>
<td>1.252</td>
<td>1.435</td>
</tr>
</tbody>
</table>

The Bunsen coefficients were calculated by the compiler assuming ideal gas behavior.

The solubility values were adjusted to a carbon dioxide partial pressure of 101.325 kPa by Henry's law.

Smoothed Data: The equation is based on only two pair of experimental points and should be used with caution.

For use between 297.88 and 312.99 K

\[ \ln x_1 = -8.1034 + 10.2396/(T/100K) \]

<table>
<thead>
<tr>
<th>( T/\text{K} )</th>
<th>( 10^3 x_1 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>298.15</td>
<td>9.38</td>
</tr>
<tr>
<td>308.15</td>
<td>8.39</td>
</tr>
</tbody>
</table>

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
The solubility apparatus is based on the design of Morrison and Billett (1) and the version used is described by Battino, Evans, and Danforth (2). The degassing apparatus is that described by Battino, Banzhof, Bogan, and Wilhelm (3).

Degassing. Up to 500 cm³ of solvent is placed in a flask of such size that the liquid is about 4 cm deep. The liquid is rapidly stirred, and vacuum is intermittently applied through a liquid N₂ trap until the permanent gas residual pressure drops to 5 microns.

Solubility Determination. The degassed solvent is passed in a thin film down a glass helical tube containing solute gas plus the solvent vapor at a total pressure of one atm. The volume of gas absorbed is found by differences between the initial and final volumes in the buret system. The solvent is collected in a tared flask and weighed.

SOURCE AND PURITY OF MATERIALS:
(1) Carbon dioxide. Air Products and Chemicals Co. Stated to be 99.8 mole percent minimum.
(2) \( \text{cis}-1,2\)-Dimethylcyclohexane. Chemical Samples Co. Fractionally distilled and stored in dark. Refractive index (Na-D, 298.15 K) 1.4337.

ESTIMATED ERROR:
\[ \delta T/\text{K} = 0.03 \]
\[ \delta p/\text{mmHg} = 0.5 \]
\[ \delta x_1/x_1 = 0.005 \]

REFERENCES:
COMPONENTS:
(1) Carbon dioxide; CO$_2$; [124-38-9]
(2) trans-1,4-Dimethylcyclohexane, 30 mol %; C$_8$H$_{16}$; [2207-04-7]
(3) cis-1,4-Dimethylcyclohexane, 70 mol %; C$_8$H$_{16}$; [624-29-3]

ORIGINAL MEASUREMENTS:
Geller, E. B.; Battino, R. Wilhelm, E.

VARIABLES:

<table>
<thead>
<tr>
<th>$T/K$</th>
<th>Mol Fraction $x_1$</th>
<th>Bunsen Coefficient $a/cm^3(STP)cm^{-3}atm^{-1}$</th>
<th>Ostwald Coefficient $L/cm^3cm^{-1}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>298.32</td>
<td>10.300</td>
<td>1.605</td>
<td>1.753</td>
</tr>
<tr>
<td>313.01</td>
<td>8.783</td>
<td>1.347</td>
<td>1.544</td>
</tr>
</tbody>
</table>

The Bunsen coefficients were calculated by the compiler.

The solubility values were adjusted to a carbon dioxide partial pressure of 101.325 kPa (1 atm) by Henry's law.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
The solubility apparatus is based on the design of Morrison and Billett (1) and the version used is described by Battino, Evans, and Danforth (2). The degassing apparatus is that described by Battino, Banzhof, Bogan, and Wilhelm (3).

Degassing. Up to 500 cm$^3$ of solvent is placed in a flask of such size that the liquid is about 4 cm deep. The liquid is rapidly stirred, and vacuum is intermittently applied through a liquid N$_2$ trap until the permanent gas residual pressure drops to 5 microns.

Solubility Determination. The degassed solvent is passed in a thin film down a glass helical tube containing solute gas plus the solvent vapor at a total pressure of one atm. The volume of gas absorbed is found by differences between the initial and final volumes in the buret system. The solvent is collected in a tared flask and weighed.

SOURCE AND PURITY OF MATERIALS:

(1) Carbon dioxide. Air Products and Chemicals Co. Stated to be 99.8 mole percent minimum.

(2) trans-1,4-Dimethylcyclohexane.

(3) cis-1,4-Dimethylcyclohexane. Chemical Samples Co. Binary mixture used as received. Authors analyzed mixture by refractive index.

ESTIMATED ERROR:

$\delta T/K = 0.03$
$\delta p/mmHg = 0.5$
$\delta x_1/x_1 = 0.005$

REFERENCES:

**COMPONENTS:**
1. Carbon dioxide; CO₂; [124-38-9]
2. trans-1,3-Dimethylcyclohexane, 41 mole %; C₈H₁₆; [2207-03-6]
3. cis-1,3-Dimethylcyclohexane, 59 mole %; C₈H₁₆; [638-04-0]

**ORIGINAL MEASUREMENTS:**
Geller, E. B.; Battino, R.
Wilhelm, E.

**VARIABLES:**

<table>
<thead>
<tr>
<th>T/K</th>
<th>p/kPa</th>
<th>EXPERIMENTAL VALUES:</th>
</tr>
</thead>
<tbody>
<tr>
<td>298.03</td>
<td>101.325 (1 atm)</td>
<td>T/K</td>
</tr>
<tr>
<td>313.01</td>
<td></td>
<td>10³x₁</td>
</tr>
<tr>
<td>10.184</td>
<td>1.582</td>
<td>1.726</td>
</tr>
<tr>
<td>8.592</td>
<td>1.312</td>
<td>1.503</td>
</tr>
</tbody>
</table>

The Bunsen coefficients were calculated by the compiler.

The solubility values were adjusted to a carbon dioxide partial pressure of 101.325 kPa (1 atm) by Henry's law.

**AUXILIARY INFORMATION**

**METHOD/APPARATUS/PROCEDURE:**
The solubility apparatus is based on the design of Morrison and Billett (1) and the version used is described by Battino, Evans, and Danforth (2). The degassing apparatus is that described by Battino, Banzhof, Bogan, and Wilhelm (3).

Degassing. Up to 500 cm³ of solvent is placed in a flask of such size that the liquid is about 4 cm deep. The liquid is rapidly stirred, and vacuum is intermittently applied through a liquid N₂ trap until the permanent gas residual pressure drops to 5 microns.

Solubility Determination. The degassed solvent is passed in a thin film down a glass helical tube containing solute gas plus the solvent vapor at a total pressure of one atm. The volume of gas absorbed is found by differences between the initial and final volumes in the buret system. The solvent is collected in a tared flask and weighed.

**SOURCE AND PURITY OF MATERIALS:**
1. Carbon dioxide. Air Products and Chemicals Co. Stated to be 99.8 mole per cent minimum.
2. trans-1,3-Dimethylcyclohexane.
3. cis-1,3-Dimethylcyclohexane. Chemical Samples Co. Binary mixture used as received. Authors analyzed mixture by refractive index.

**ESTIMATED ERROR:**

δT/K = 0.03
δp/mmHg = 0.5
δx₁/x₁ = 0.005

**REFERENCES:**
COMPONENTS:
1. Carbon dioxide; CO$_2$; [124-38-9]
2. 1, 1'-Bicyclohexyl; C$_{12}$H$_{22}$; [92-51-3]

VARIABLES:
$T/K = 300-475$

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>$T/K$</th>
<th>Henry's Constanta/atm</th>
<th>Mole fractionb of carbon dioxide at 1 atm partial pressure, $x_{CO_2}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>300</td>
<td>128.0</td>
<td>0.00781</td>
</tr>
<tr>
<td>325</td>
<td>155.0</td>
<td>0.00645</td>
</tr>
<tr>
<td>350</td>
<td>188.0</td>
<td>0.00532</td>
</tr>
<tr>
<td>375</td>
<td>222.0</td>
<td>0.00450</td>
</tr>
<tr>
<td>400</td>
<td>251.0</td>
<td>0.00398</td>
</tr>
<tr>
<td>425</td>
<td>270.0</td>
<td>0.00370</td>
</tr>
<tr>
<td>450</td>
<td>272.0</td>
<td>0.00368</td>
</tr>
<tr>
<td>475</td>
<td>258.0</td>
<td>0.00388</td>
</tr>
</tbody>
</table>

a. Authors stated measurements were made at several pressures and values of solubility used were all within the Henry's-Law region.
b. Calculated by compiler assuming linear relationship between mole fraction and pressure.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE
Volumetric apparatus similar to that described by Dymond and Hildebrand (1). Pressure measured with a null detector and precision gauge. Details in ref. (2).

SOURCE AND PURITY OF MATERIALS:
Solvent degassed, no other details given.

ESTIMATED ERROR:
$\delta T/K = \pm 0.1$; $\delta x_{CO_2} = \pm 1\%$.

REFERENCES:
COMPONENTS:
(1) Carbon dioxide; CO₂; [124-38-9]
(2) 1,1'-Bicyclohexyl; C₁₂H₂₂; [92-51-3]

VARIABLES:
\[ T/K = 295.2 \]
\[ P₁/kPa = \text{not given} \]

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>Temperature/°C</th>
<th>Ostwald Coefficient/L/cm³ cm⁻³</th>
<th>Number of Runs</th>
</tr>
</thead>
<tbody>
<tr>
<td>22.0</td>
<td>1.09</td>
<td>(2)</td>
</tr>
</tbody>
</table>

ORIGINAL MEASUREMENTS:
Horsman-van den Dool, L. E. W.; Warman, J. W.
Interuniversity Reactor Institute (IRI)-Report 134-81-01

PREPARED BY:
H. L. Clever

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
A cylindrical glass container of approximately 15 cm³ volume is partly filled with solvent and closed with a half-hole septum. An amount of the gaseous solute is added to the container. The closed container is shaken for 30 minutes. Samples of both the vapor and liquid phases are taken in a calibrated syringes. The samples are injected into a gas chromatograph. The Ostwald coefficient is calculated from the known sample size and the measured peak areas.

The chromatograph is a Hewlett-Packard model 5750 equipped with a thermal conductivity cell detector. The carrier gas is helium. A 200 cm Porapak column is used for the separation.

SOURCE AND PURITY OF MATERIALS:
(2) 1,1'-Bicyclohexyl. Fluka. purum grade. Impurities which give the same retention time as the gas are removed before the experiment by adsorption or distillation.

ESTIMATED ERROR:
\[ \delta L/L = \pm 0.05 \]

REFERENCES:
COMPONENTS:
1. Carbon dioxide; C\textsubscript{02}; [124-38-9]
2. Decahydronaphthalene, (decalin); C\textsubscript{18}H\textsubscript{18}; [91-17-8]

VARIABLES:
T/K = 298.2; 323.2

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>Henry's constant, H /atm</th>
<th>x\textsubscript{CO₂} at P\textsubscript{CO₂} = 101.3 kPa</th>
</tr>
</thead>
<tbody>
<tr>
<td>298.2</td>
<td>110</td>
<td>0.00909</td>
</tr>
<tr>
<td>323.2</td>
<td>136</td>
<td>0.00735</td>
</tr>
</tbody>
</table>

* calculated by the compiler assuming that x\textsubscript{CO₂} = P\textsubscript{CO₂}/H

A conventional gas-liquid chromatographic unit was used with helium as carrier gas. Values of Henry's constant were calculated from retention times extrapolated to zero sample size. Values correspond to very low partial pressure of carbon dioxide. Surface adsorption can cause appreciable errors in this method of measuring Henry's law constants.

SOURCE AND PURITY OF MATERIALS:
1. Sample from L'Air Liquide; minimum purity 99.9 mol%
2. Sample from Touzart and Matignon or from Serlabo of purity 99 mol%

ESTIMATED ERROR:
\(\delta T/K = \pm 0.1\) (estimated by compiler)
COMPONENTS:
(1) Carbon dioxide; CO₂; [124-38-9]
(2) cis-Decahydronaphthalene or cis-decalin; C₁₀H₁₈; [493-01-6]
    trans-Decahydronaphthalene or trans-decalin; C₁₀H₁₈; [493-02-7]

VARIABLES:
T/K = 296.3, 296.6
p₁/kPa = not given

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>Temperature</th>
<th>Ostwald Coefficient</th>
<th>Number of Runs</th>
</tr>
</thead>
<tbody>
<tr>
<td>t/°C</td>
<td>T/K</td>
<td>L/cm³ cm⁻³</td>
</tr>
<tr>
<td>cis-Decalin</td>
<td>23.4</td>
<td>296.6</td>
</tr>
<tr>
<td>trans-Decalin</td>
<td>23.1</td>
<td>296.3</td>
</tr>
</tbody>
</table>

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
A cylindrical glass container of approximately 15 cm³ volume is partly filled with solvent and closed with a half-hole septum. An amount of the gaseous solute is added to the container. The closed container is shaken for 30 minutes. Samples of both the vapor and liquid phases are taken in a calibrated syringes. The samples are injected into a gas chromatograph. The Ostwald coefficient is calculated from the known sample size and the measured peak areas.

The chromatograph is a Hewlett-Packard model 5750 equipped with a thermal conductivity cell detector. The carrier gas is helium. A 200 cm Porapak column is used for the separation.

SOURCE AND PURITY OF MATERIALS:
(2) cis-Decalin and trans-Decalin. Merck. Zur Synthese grade.
Impurities which give the same retention time as the gas are removed before the experiment by adsorption or distillation.

ESTIMATED ERROR:

$5 \frac{L}{L} = ± 0.05$

REFERENCES:
COMPONENTS:

1. Carbon dioxide; CO₂; [124-38-9]
2. Ethene; C₂H₄; [74-85-1]
   Propene; C₃H₆; [115-07-1]
   1-Butene; C₄H₉; [106-98-9]

ORIGINAL MEASUREMENTS:

Nagahama, K.; Konishi, H.
Hoshino, D.; Hirata, M.

VARIABLES:

T/K = 231.55-273.15
P CO₂ = 81-219 kPa

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>Solvent</th>
<th>T/K</th>
<th>P total/ atm</th>
<th>x CO₂</th>
<th>y CO₂</th>
<th>P CO₂/atm</th>
<th>P CO₂/kPa</th>
</tr>
</thead>
<tbody>
<tr>
<td>231.55</td>
<td>13.85</td>
<td>0.079</td>
<td>0.084</td>
<td>1.16</td>
<td>118</td>
<td></td>
</tr>
<tr>
<td>252.95</td>
<td>25.15</td>
<td>0.071</td>
<td>0.072</td>
<td>1.81</td>
<td>183</td>
<td></td>
</tr>
<tr>
<td>252.95</td>
<td>4.5</td>
<td>0.076</td>
<td>0.404</td>
<td>1.82</td>
<td>184</td>
<td></td>
</tr>
<tr>
<td>273.15</td>
<td>6.7</td>
<td>0.014</td>
<td>0.119</td>
<td>0.60</td>
<td>81</td>
<td></td>
</tr>
<tr>
<td>273.15</td>
<td>7.9</td>
<td>0.050</td>
<td>0.274</td>
<td>2.16</td>
<td>219</td>
<td></td>
</tr>
<tr>
<td>273.15</td>
<td>3.1</td>
<td>0.059</td>
<td>0.616</td>
<td>1.91</td>
<td>193</td>
<td></td>
</tr>
</tbody>
</table>

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The data given above were obtained during studies of the systems to higher pressures over the whole of each composition range. The apparatus has been described previously (1). The components were charged into a glass-windowed equilibrium cell. A magnetic piston pump recirculated vapor, removed it from the top of the liquid and reintroduced it into the bottom of the liquid. After equilibrium was reached (c. 0.5 h) samples of the gas phase and of the liquid phase were analysed by gas chromatography.

SOURCE AND PURITY OF MATERIALS:

1. Purity at least 99.8%
2. Ethene; purity at least 99.95%
   Propene; purity at least 99.32%
   1-Butene; purity at least 99.4%

EXPERIMENTAL ERROR:

δT/K = ±0.05 (authors)

REFERENCES:

COMPONENTS:
1. Carbon dioxide; CO₂; [124-38-9]
2. Propene; C₆H₆; [115-07-1]

VARIABLES:
\( T/K = 166.4-229.1 \)
\( P_{\text{total}}/\text{kPa} = 9-218 \)

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>( y_{\text{CO}_2} )</th>
<th>Total ( P/\text{atm} )</th>
<th>Total ( P/\text{kPa}^* )</th>
<th>( T/K )</th>
<th>( y_{\text{CO}_2} )</th>
<th>Total ( P/\text{atm} )</th>
<th>Total ( P/\text{kPa}^* )</th>
<th>( T/K )</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.2116</td>
<td>0.2486</td>
<td>25.19</td>
<td>192.7</td>
<td>0.6001</td>
<td>0.2291</td>
<td>23.21</td>
<td>182.4</td>
</tr>
<tr>
<td></td>
<td>0.4484</td>
<td>45.43</td>
<td>202.9</td>
<td>0.5103</td>
<td>1.0192</td>
<td>103.27</td>
<td>206.4</td>
</tr>
<tr>
<td></td>
<td>0.9225</td>
<td>100.57</td>
<td>218.9</td>
<td>1.5363</td>
<td>1.5553</td>
<td>197.89</td>
<td>220.1</td>
</tr>
<tr>
<td></td>
<td>1.4433</td>
<td>146.24</td>
<td>226.8</td>
<td>1.9530</td>
<td>1.9553</td>
<td>258.77</td>
<td>173.2</td>
</tr>
<tr>
<td></td>
<td>1.9438</td>
<td>196.96</td>
<td>234.4</td>
<td>0.7992</td>
<td>0.2553</td>
<td>25.87</td>
<td>173.2</td>
</tr>
<tr>
<td></td>
<td>0.4866</td>
<td>49.30</td>
<td>200.3</td>
<td>0.5054</td>
<td>1.0167</td>
<td>103.02</td>
<td>193.4</td>
</tr>
<tr>
<td></td>
<td>1.0131</td>
<td>102.65</td>
<td>213.9</td>
<td>1.5249</td>
<td>154.51</td>
<td>203.2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1.5607</td>
<td>158.14</td>
<td>223.3</td>
<td>1.9245</td>
<td>195.00</td>
<td>207.4</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2.0052</td>
<td>203.18</td>
<td>229.1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>( x_{\text{CO}_2} )</th>
<th>Total ( P/\text{atm} )</th>
<th>Total ( P/\text{kPa}^* )</th>
<th>( T/K )</th>
<th>( x_{\text{CO}_2} )</th>
<th>Total ( P/\text{atm} )</th>
<th>Total ( P/\text{kPa}^* )</th>
<th>( T/K )</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.089</td>
<td>1.9979</td>
<td>202.44</td>
<td>225.1</td>
<td>1.3145</td>
<td>133.19</td>
<td>200.3</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1.5340</td>
<td>155.43</td>
<td>218.3</td>
<td>1.0788</td>
<td>109.31</td>
<td>195.6</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1.0019</td>
<td>101.52</td>
<td>208.4</td>
<td>0.9215</td>
<td>93.37</td>
<td>191.7</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.6946</td>
<td>70.38</td>
<td>200.6</td>
<td>0.7473</td>
<td>75.72</td>
<td>186.8</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.4926</td>
<td>49.91</td>
<td>193.8</td>
<td>0.331</td>
<td>2.1490</td>
<td>217.75</td>
<td>205.7</td>
</tr>
<tr>
<td></td>
<td>0.3053</td>
<td>30.93</td>
<td>185.3</td>
<td>1.8701</td>
<td>189.49</td>
<td>202.0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.2096</td>
<td>21.24</td>
<td>179.1</td>
<td>1.7397</td>
<td>176.28</td>
<td>200.4</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.1361</td>
<td>13.79</td>
<td>172.5</td>
<td>1.4702</td>
<td>148.97</td>
<td>196.0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.0919</td>
<td>9.31</td>
<td>166.4</td>
<td>1.3412</td>
<td>135.90</td>
<td>194.1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.197</td>
<td>210.72</td>
<td>212.3</td>
<td>0.453</td>
<td>2.1222</td>
<td>215.03</td>
<td>202.5</td>
</tr>
<tr>
<td></td>
<td>1.633</td>
<td>185.73</td>
<td>208.9</td>
<td>1.9788</td>
<td>200.50</td>
<td>200.8</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1.505</td>
<td>152.49</td>
<td>203.4</td>
<td>1.8034</td>
<td>182.73</td>
<td>198.7</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1.3629</td>
<td>138.10</td>
<td>200.8</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\( x_{\text{CO}_2} \) = mole fraction of carbon dioxide in the liquid phase
\( y_{\text{CO}_2} \) = mole fraction of carbon dioxide in the gas phase
\( ^* \) calculated by the compiler

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
Dew points and bubble points of various mixtures of carbon dioxide and propene were measured. The dew and bubble points cells were immersed in a cryostat. Full details of the apparatus are described in the paper.

SOURCE AND PURITY OF MATERIALS:
No information

ESTIMATED ERROR:
\( \delta T/K = \pm 0.02 \) (authors)

REFERENCES:
COMPONENTS:
1. Carbon dioxide; CO₂; [124-38-9]
2. Ethane; C₂H₆; [74-84-0]
3. Ethene; C₂H₄; [74-85-1]

VARIABLES:
\[ T/K = 130-180 \]
\[ P_{CO₂}/kPa = 0.033-27.6 \]

EXPERIMENTAL VALUES:

Mole percent solubility of solid carbon dioxide in various liquid mixtures of ethane and ethene

<table>
<thead>
<tr>
<th>T/K</th>
<th>( P_{CO₂} )* /kPa</th>
<th>100% C₂H₆</th>
<th>70% C₂H₄</th>
<th>50% C₂H₄</th>
<th>25% C₂H₄</th>
<th>100% C₂H₆</th>
</tr>
</thead>
<tbody>
<tr>
<td>130</td>
<td>0.033</td>
<td>1.4</td>
<td>1.0</td>
<td>0.7</td>
<td>0.4</td>
<td>0.2</td>
</tr>
<tr>
<td>135</td>
<td>0.082</td>
<td>1.9</td>
<td>1.4</td>
<td>0.9</td>
<td>0.5</td>
<td>0.3</td>
</tr>
<tr>
<td>140</td>
<td>0.190</td>
<td>2.5</td>
<td>1.9</td>
<td>1.3</td>
<td>0.7</td>
<td>0.4</td>
</tr>
<tr>
<td>145</td>
<td>0.417</td>
<td>3.3</td>
<td>2.5</td>
<td>1.8</td>
<td>1.1</td>
<td>0.6</td>
</tr>
<tr>
<td>150</td>
<td>0.856</td>
<td>4.3</td>
<td>3.3</td>
<td>2.4</td>
<td>1.5</td>
<td>0.9</td>
</tr>
<tr>
<td>155</td>
<td>1.68</td>
<td>5.6</td>
<td>4.3</td>
<td>3.3</td>
<td>2.1</td>
<td>1.2</td>
</tr>
<tr>
<td>160</td>
<td>3.15</td>
<td>7.2</td>
<td>5.5</td>
<td>4.3</td>
<td>2.8</td>
<td>1.6</td>
</tr>
<tr>
<td>165</td>
<td>5.70</td>
<td>9.2</td>
<td>7.1</td>
<td>5.6</td>
<td>3.8</td>
<td>2.2</td>
</tr>
<tr>
<td>170</td>
<td>9.94</td>
<td>13.0</td>
<td>9.4</td>
<td>7.4</td>
<td>5.0</td>
<td>3.1</td>
</tr>
<tr>
<td>175</td>
<td>16.8</td>
<td>10.0</td>
<td>6.7</td>
<td>4.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>180</td>
<td>27.6</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>6.7</td>
</tr>
</tbody>
</table>

* calculated by the compiler from vapor pressure equations for solid CO₂ given in the literature; 130-145 K ref.(1); 150-180 K ref.(2).

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
The experimental method is described in ref. (3). Vapor pressures of saturated solutions of carbon dioxide with excess solid in various mixtures of ethane and ethene were measured over temperature ranges with a five junction copper constantin thermocouple. The vapor pressures of solutions of carbon dioxide of known composition were then measured at the point of appearance and of disappearance of the solid carbon dioxide. The corresponding temperatures were then found from the relationship between temperature and vapor pressure which had been established in the first series of measurements.

SOURCE AND PURITY OF MATERIALS:
Components were obtained from commercial sources and purified as described in ref. (3).

ESTIMATED ERROR:

REFERENCES:
COMPONENTS:
(1) Carbon dioxide; CO₂; [123-38-9]
(2) Various solvents. See table below.

VARIABLES:
\[ T/K = 293 \]
\[ p_1/kPa = 101.3 \]

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>t/°C</th>
<th>Bunsen Coefficient ( \alpha/m^3 m^{-3} atm^{-1} )</th>
<th>Ostwald Coefficient ( L/m^3 m^{-3} )</th>
<th>Mol Fraction ( x_1 )</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Water; ( H_2O; [7732-18-5] )</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>0.88</td>
<td>0.94</td>
<td>0.00071</td>
</tr>
<tr>
<td></td>
<td>Methanol; ( CH_4O; [67-56-1] )</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>3.5</td>
<td>3.75</td>
<td>0.0063</td>
</tr>
<tr>
<td></td>
<td>1,2,3,4-Tetrahydronaphthalene or tetralin; ( C_{10}H_{12}; [119-64-2] )</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>1.3</td>
<td>1.4</td>
<td>0.0079</td>
</tr>
<tr>
<td></td>
<td>Dimethylbenzene or xylene; ( C_8H_{10}; [1330-20-7] )</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>2.0</td>
<td>2.15</td>
<td>0.011</td>
</tr>
<tr>
<td></td>
<td>4-Methyl-1,3-dioxolane-2-one or propylene carbonate; ( C_4H_6O_3; [108-32-7] )</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>3.8</td>
<td>4.1</td>
<td>0.014</td>
</tr>
<tr>
<td></td>
<td>1-Methylpyrrolidinone; ( C_5H_9NO; [872-50-4] )</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>4.0</td>
<td>4.3</td>
<td>0.017</td>
</tr>
<tr>
<td></td>
<td>Hexamethyolphosphoric triamide; ([(CH_3)_2N]_3PO; [680-31-9] )</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>4.9</td>
<td>5.25</td>
<td>0.037</td>
</tr>
</tbody>
</table>

The Ostwald coefficient and mole fraction solubilities were calculated by the compiler.
The \( CO_2 \) molar volume was taken to be 22.262 \( mol L^{-1} \) (STP).

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
Nothing specified.

SOURCE AND PURITY OF MATERIALS:
Nothing specified.

ESTIMATED ERROR:
Nothing specified.

REFERENCES:
COMPONENTS:
1. Carbon dioxide; CO₂; [124-38-9]
2. 1,2,3,4-Tetrahydronaphthalene (Tetralin); C₁₅H₁₂; [119-64-2]

ORIGINAL MEASUREMENTS:
Krauss, W.; Gestrich, W.
*Chem. - Tech (Heidelberg)* 1977, 6, 513-6.

VARIABLES:

\[ T/K = 283.15 - 313.15 \]

PREPARED BY:
C.L. Young

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>Solubility, ( S^+ )/mol dm⁻³ bar⁻¹</th>
<th>Mole fraction(^+) of carbon dioxide in liquid, ( x_{CO₂} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>283.15</td>
<td>0.06589</td>
<td>0.00895</td>
</tr>
<tr>
<td>293.15</td>
<td>0.05795</td>
<td>0.00794</td>
</tr>
<tr>
<td>303.15</td>
<td>0.05140</td>
<td>0.00710</td>
</tr>
<tr>
<td>313.15</td>
<td>0.04595</td>
<td>0.00640</td>
</tr>
</tbody>
</table>

+ at a partial pressure of 101.325 kPa.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
Volumetric apparatus in which gas was dissolved in liquid in glass cell. Pressure measured. Amount of gas dissolved estimated from pressure measurements when gas was repeatedly expanded into known volume. Details in source. Values of solubility calculated from equations and graphs in original.

SOURCE AND PURITY OF MATERIALS:
No details given.

ESTIMATED ERROR:
\[ \delta T/K = \pm 0.1; \ \delta x_{CO₂} = \pm 1-2\% \]

REFERENCES:
**COMPONENTS:**

1. Carbon dioxide; \( \text{CO}_2; \) [124-38-9]
2. 1,2,3,4-Tetrahydronaphthalene (tetralin); \( \text{C}_{10}\text{H}_{12}; \) [119-64-2]

**ORIGINAL MEASUREMENTS:**

Horvath, M. J.; Sebastian, H. M.; Chao, K.-C.

**VARIABLES:**

\[
\begin{align*}
T/K &= 300 \\
P/kPa &= 101.3
\end{align*}
\]

**EXPERIMENTAL VALUES:**

<table>
<thead>
<tr>
<th>(T/K)</th>
<th>Henry's constant (H/\text{atm})</th>
<th>Mole fraction of carbon dioxide in liquid, (x_{\text{CO}_2})</th>
</tr>
</thead>
<tbody>
<tr>
<td>300</td>
<td>144</td>
<td>0.00691</td>
</tr>
</tbody>
</table>

\(\dagger\) at a partial pressure of carbon dioxide of 1 atmosphere calculated by compiler assuming \(\phi = 0.995\).

**AUXILIARY INFORMATION**

**METHOD/APPARATUS/PROCEDURE:**

Gas chromatographic analysis of a saturated solution at barometric pressure. Henry's constants determined from formula

\[
H = (p - p_0)\phi (m + 1)/m
\]

where \(p\) is the total pressure, \(p_0\) the vapor pressure of the solvent and \(\phi\) is the fugacity coefficient of the gas. The mole ratio, \(m\), is defined by

\[
m = \frac{\text{Moles of carbon dioxide in gas phase}}{\text{Moles of carbon dioxide in liquid phase}}
\]

**SOURCE AND PURITY OF MATERIALS:**

1. No details given.
2. Purity 99.06 mole per cent.

**ESTIMATED ERROR:**

\(\delta T/K = \pm 0.25; \delta H/\text{atm} = \pm 3\%\)

(estimated by compiler).

**REFERENCES:**
COMPONENTS:
(1) Carbon dioxide; CO₂; [124-38-9]
(2) 1-Methyl-4-(1-Methylethenyl)cyclohexene or d-limonene or carvene; C₁₀H₁₆; [138-86-3]

VARIABLES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>Mol Fraction</th>
<th>Bunsen Coefficient</th>
<th>Ostwald Coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>288.15</td>
<td>1.37</td>
<td>1.93</td>
<td>2.034</td>
</tr>
<tr>
<td>293.15</td>
<td>1.27</td>
<td>1.79</td>
<td>1.921</td>
</tr>
<tr>
<td>298.15</td>
<td>1.18</td>
<td>1.65</td>
<td>1.802</td>
</tr>
</tbody>
</table>

The author measured the Ostwald coefficient at a pressure of about 746 mmHg. The compiler assumed the Ostwald coefficient to be independent of pressure, and calculated the mole fraction and Bunsen coefficient values at 101.325 kPa (1 atm) partial pressure of the gas.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
An Ostwald apparatus as modified by Timofejew (1), and Steiner (2) is used. The apparatus consists of a gas buret, an absorption flask, and a mercury manometer. The system is thermostated with a water jacket.

The gas is introduced into the degassed liquid. The gas volume absorbed is determined by the gas buret. The solvent volume is determined at the end of the experiment by pouring the solvent into a graduated flask.

SOURCE AND PURITY OF MATERIALS:
(1) Carbon dioxide. Generated in a Kipp apparatus using marble and hydrochloric acid.
(2) 1-Methyl-4-(1-Methylethenyl)cyclohexene. No information.

ESTIMATED ERROR:

\[ \delta L/L = 0.03 \] (compiler)

REFERENCES:
1. Timofejew, W. Z. Phys. Chem. 1890, 6, 141.
CRITICAL EVALUATION:

Solubility of carbon dioxide in aromatic hydrocarbons

Solubility in benzene at pressures below 200 kPa has been studied by at least ten groups (1-10). Limiting values of Henry's constant from high pressure data published by Kaminishi et al. (11) can also be used to estimate the mole fraction solubility at lower pressures. Values of mole fraction solubility at a partial pressure of 101.3 kPa from the available data are not very consistent. Values for 283.2 K range from 0.0107 to 0.01208 and values for 293.2 K range from 0.0091 to 0.0099 with a value of 0.0105 at 293.6 K. There is better agreement at other temperatures. Over the whole temperature range the values of mole fraction solubility at a partial pressure of 101.3 kPa, based on (1-10), fit the equation given below.

\[ \ln x_{\text{CO}_2} = -18.437 + 1296.5/(T/K) + 1.6511\ln(T/K) \]

temperature range = 283.2-313.2 K
standard deviation in \( x_{\text{CO}_2} \) = 0.00037

At least ten groups (1,2,4,6,8,12-16) have measured solubility of carbon dioxide in methylbenzene at pressures below 200 kPa. There is, in general, good agreement between values for mole fraction solubility in this solvent at a partial pressure of 101.3 kPa. However the solubility at 193.2 K reported by Williams seems to be too low. Values of the mole fraction solubility at a partial pressure of 101.3 kPa from other measurements by Williams and by other workers fit the equation below.

\[ \ln x_{\text{CO}_2} = -13.921 + 1547.7/(T/K) + 0.72764\ln(T/K) \]

temperature range = 203.2-316.2 K
standard deviation in \( x_{\text{CO}_2} \) = 0.00128

Three groups (1,9,17) measured solubility in 1,2-dimethylbenzene. Values of mole fraction solubility at a partial pressure of 101.3 kPa are consistent with each other and fit the equation below.

\[ \ln x_{\text{CO}_2} = -52.371 + 3066.3/(T/K) + 6.5757\ln(T/K) \]

temperature range = 253.2-313.2
standard deviation in \( x_{\text{CO}_2} \) = 0.00016

Six groups (1,4,6,8,9,17) measured solubility in 1,3-dimethylbenzene. Again there is good consistency between different sets of data. Values of mole fraction solubility fit the following equation

\[ \ln x_{\text{CO}_2} = -49.384 + 2960.3/(T/K) + 6.1263\ln(T/K) \]

temperature range = 233.2-313.1 K
standard deviation in \( x_{\text{CO}_2} \) = 0.00015

Solubility in 1,4-dimethylbenzene was measured at 293.15 K by Rosenthal (9) and by Piskovsky and Lakomy (1). Byrne et al. (17) measured the solubility at 313.13 K, 298.12 K and three temperatures between 288 K and 289 K. Values of mole fraction solubility at a partial pressure of 101.3 kPa are consistent with each other but the temperature range is small in comparison with measurements of the solubility in the other two isomers of dimethylbenzene. These values fit the following equation

\[ \ln x_{\text{CO}_2} = -247.112 + 11816.1/(T/K) + 35.617\ln(T/K) \]

temperature range = 288.2-313.1
standard deviation in \( x_{\text{CO}_2} \) = 0.00021
COMPONENTS:

1. Carbon dioxide; CO₂; [124-38-9]
2. Aromatic Hydrocarbons

EVALUATOR:
Peter G.T. Fogg,
School of Applied Chemistry,
Polytechnic of North London,
Holloway Road, London, N7 8DB, U.K.
July 1991

CRITICAL EVALUATION:

Mole fraction solubilities at a partial pressure of 101.3 kPa at 293.15 K from smoothing equations for the three isomers are as follows:

1,2-dimethylbenzene 0.0105
1,3-dimethylbenzene 0.0113
1,4-dimethylbenzene 0.0114

Bratzler et al. (18) have published the Bunsen coefficient for a mixture of isomers of dimethylbenzene at 293 K. The corresponding mole fraction solubility at a partial pressure of 101.3 kPa is 0.011. The mole fraction solubility in a mixture of isomers at 293.15 K and 101.3 kPa from measurements by Vitovec (19) is 0.0109. These values are consistent with the values for the individual isomers.

Solubility in ethylbenzene has been measured by Piskovsky and Lakomy (1) from 198.2 K to 293.2 K and by Luhring and Schumpe (8) at 293.2 K. Piskovsky's measurements are self consistent. The mole fraction solubility at 293.2 K and a partial pressure of 101.3 kPa from Piskovsky's measurements is 0.0108 compared with Luhring's value of 0.01022. Values from the two sources fit the equation

\[ \ln x_{CO_2} = -52.108 + 3033.9/(T/K) + 6.5525\ln(T/K) \]

temperature range = 198.2-293.2 K
standard deviation in \( x_{CO_2} \) = 0.00049

Just (6) reported the solubility of carbon dioxide in (1-methylethyl)benzene at temperatures from 288.15 K to 298.15 K. Values of mole fraction solubility are close to those for ethylbenzene but no other data on this solvent are available for comparison.

Luhring and Schumpe (8) reported a Henry's constant for solubility in 1,2,4-trimethylbenzene at 293.2 K. This corresponds to a mole fraction solubility of 0.01125 at a partial pressure of 101.3 kPa which is close to values for solubility in the dimethylbenzenes under these conditions. No other measurements of the solubility in this solvent are available for comparison.

Tremp and Prausnitz (20) have published Henry's constants for 1,1'-methylenebisbenzene for 300 K to 475 K. Horvath et al. (4) published a Henry's constant for 300 K of 124 atm. This is very close to Tremper's value of 123 atm. Mole fraction solubilities for a partial pressure of 101.3 kPa calculated from Henry's constants in the two papers fit the equation below.

\[ \ln x_{CO_2} = -37.246 + 2368.7/(T/K) + 4.3008\ln(T/K) \]

temperature range = 300-475 K
standard deviation in \( x_{CO_2} \) = 6.2 \times 10^{-5}

Measurements by Glazunova (21) show that the mole fraction solubility in 1,1'-methylenebis(methylbenzene) in the temperature range 293 K to 393 K is greater than that in 1,1'-methylenebisbenzene under the same conditions. Mole fraction solubility in methylbenzene is greater than that in benzene under similar conditions. No other measurements of the solubility in 1,1'-methylenebis(methylbenzene) are available for comparison. Glazunova's measurements fit the equation given below. This equation can only be accepted on a tentative basis.

\[ \ln x_{CO_2} = -8.3777 + 1156.2/(T/K) \]

temperature range = 293-393 K
standard deviation in \( x_{CO_2} \) = 0.00019
COMPONENTS:
1. Carbon dioxide; CO₂; [124-38-9]
2. Aromatic Hydrocarbons

EVALUATOR:
Peter G.T. Fogg,
School of Applied Chemistry,
Polytechnic of North London,
Holloway Road, London, N7 8DB, U.K.
July 1991

CRITICAL EVALUATION:
The solubility of carbon dioxide in (1-methylethyl)-1,1'-biphenyl has been measured to high pressures at 293.2 K, 373.2 K and 473.2 K by Bogdanov (22). The mole fraction solubility at 293.2 K and a partial pressure of 101.3 kPa is approximately 0.0113. No measurements by other authors are available for comparison.

Horvath et al. (4) have found a Henry's constant of 151 atm for dissolution in 1-methylnaphthalene at 300 K. Chai and Paulaitis (23) reported Henry's constants at temperatures from 298.6 K to 330.2 K. The interpolated value at 300 K is 151.4, close to the value reported by Horvath. Mole fraction solubilities calculated from Henry's constants published by the two groups fit the equation

\[ \ln x_{\text{CO}_2} = -1.8516 + 759.73/(T/K) - 0.99967\ln(T/K) \]

temperature range = 298.6-311.0
standard deviation in \( x_{\text{CO}_2} \) = 3.4 × 10⁻⁵

A selection of mole fraction solubilities in aromatic hydrocarbons is shown in Table 1 and Fig 1.

REFERENCES
### COMPONENTS:

1. Carbon dioxide; CO$_2$; [124-38-9]
2. Aromatic Hydrocarbons

### CRITICAL EVALUATION:


### EVALUATOR:

Peter G.T. Fogg, School of Applied Chemistry, Polytechnic of North London, Holloway Road, London, N7 8DB, U.K.

July 1991
Fig. 1  Mole fraction solubility of carbon dioxide in various aromatic hydrocarbons at a partial pressure of gas of 101.3 kPa.

The curves showing the variation of solubility with temperature correspond to equations derived by the evaluator.

A reference line corresponding to values from the Raoult's law equation is also shown.
Table 1. Mole fraction solubilities of carbon dioxide at a partial pressure of 101.3 kPa in aromatic hydrocarbons.

<table>
<thead>
<tr>
<th>Solvent</th>
<th>T/K</th>
<th>$x_{CO2}$</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Benzene</td>
<td>293.15</td>
<td>0.00969 ±0.00038</td>
<td>*</td>
</tr>
<tr>
<td></td>
<td>298.15</td>
<td>0.00926 ±0.00038</td>
<td>*</td>
</tr>
<tr>
<td>Methylbenzene</td>
<td>293.15</td>
<td>0.01102 ±0.00128</td>
<td>*</td>
</tr>
<tr>
<td></td>
<td>298.15</td>
<td>0.01021 ±0.00128</td>
<td>*</td>
</tr>
<tr>
<td>1,2-Dimethylbenzene</td>
<td>293.15</td>
<td>0.01050 ±0.00016</td>
<td>*</td>
</tr>
<tr>
<td></td>
<td>298.15</td>
<td>0.00984 ±0.00016</td>
<td>*</td>
</tr>
<tr>
<td>1,3-Dimethylbenzene</td>
<td>293.15</td>
<td>0.01129 ±0.00015</td>
<td>*</td>
</tr>
<tr>
<td></td>
<td>298.15</td>
<td>0.01057 ±0.00015</td>
<td>*</td>
</tr>
<tr>
<td>1,4-Dimethylbenzene</td>
<td>293.15</td>
<td>0.01138 ±0.00021</td>
<td>*</td>
</tr>
<tr>
<td></td>
<td>298.15</td>
<td>0.01057 ±0.00021</td>
<td>*</td>
</tr>
<tr>
<td>1,2,4-Trimethylbenzene</td>
<td>293.15</td>
<td>0.01125</td>
<td>8</td>
</tr>
<tr>
<td>Ethylbenzene</td>
<td>293.15</td>
<td>0.01072 ±0.00049</td>
<td>*</td>
</tr>
<tr>
<td></td>
<td>298.15</td>
<td>0.01006 ±0.00049</td>
<td>*</td>
</tr>
<tr>
<td>(1-Methylethyl)benzene</td>
<td>298.15</td>
<td>0.0101</td>
<td>6</td>
</tr>
<tr>
<td>1,1'-Methylenebisbenzene</td>
<td>298.15</td>
<td>0.00825 ±0.00006</td>
<td>*</td>
</tr>
<tr>
<td>1,1'-Methylenebis(methylbenzene)</td>
<td>293.15</td>
<td>0.01165</td>
<td>21</td>
</tr>
<tr>
<td></td>
<td>298.15</td>
<td>0.01111</td>
<td>21 †</td>
</tr>
<tr>
<td>1-Methylnaphthalene</td>
<td>298.15</td>
<td>0.00674 ±0.00003</td>
<td>*</td>
</tr>
</tbody>
</table>

* from the equation given by the evaluator on a previous page
† interpolated
### COMPONENTS:
1. Carbon dioxide; CO$_2$; [124-38-9]
2. Benzene; C$_6$H$_6$; [71-43-2]

### ORIGINAL MEASUREMENTS:
Just, G.

### VARIABLES:
- $T/K = 288.15 - 298.15$
- $P/kPa = 101.325$ (1 atm)

### PREPARED BY:
M. E. Derrick
H. L. Clever

### EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>$T/K$</th>
<th>Mol Fraction $10^3 x_1$</th>
<th>Bunsen Coefficient $a/cm^3(STP)cm^{-3}atm^{-1}$</th>
<th>Ostwald Coefficient $L/cm^3cm^{-3}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>288.15</td>
<td>10.03</td>
<td>2.57</td>
<td>2.710</td>
</tr>
<tr>
<td>293.15</td>
<td>9.30</td>
<td>2.37</td>
<td>2.540</td>
</tr>
<tr>
<td>298.15</td>
<td>8.79</td>
<td>2.22</td>
<td>2.425</td>
</tr>
</tbody>
</table>

The author measured the Ostwald coefficient at a pressure of about 746 mmHg. The compiler assumed the Ostwald coefficient to be independent of pressure, and calculated the mole fraction and Bunsen coefficient values at 101.325 kPa (1 atm) partial pressure of the gas.

### AUXILIARY INFORMATION

#### METHOD/Apparatus/Procedure:
An Ostwald apparatus as modified by Timofejew (1), and Steiner (2) is used. The apparatus consists of a gas buret, an absorption flask, and a mercury manometer. The system is thermostated with a water jacket.

The gas is introduced into the degassed liquid. The gas volume absorbed is determined by the gas buret. The solvent volume is determined at the end of the experiment by pouring the solvent into a graduated flask.

#### Source and Purity of Materials:
2. Benzene. No information.

#### Estimated Error:
$\delta L/L = 0.03$ (compiler)

#### REFERENCES:
1. Timofejew, W.
2. Steiner, P.
COMPONENTS:
(1) Carbon dioxide; CO$_2$; [124-38-9]
(2) Benzene; C$_6$H$_6$; [71-43-2]

ORIGINAL MEASUREMENTS:
Gjaldbaek, J. H.

VARIABLES:
\[ T/K = 293.55 - 307.35 \]
\[ P_1/kPa = 101.325 \text{ (1 atm)} \]

PREPARED BY:
J. Chr. Gjaldbaek

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>Carbon Dioxide Pressure $P_1$/mmHg</th>
<th>10$^{-3}x_1$</th>
<th>Bunsen Coefficient $a$/cm$^3$(STP)cm$^{-3}$atm$^{-1}$</th>
<th>Ostwald Coefficient $L$/cm$^3$cm$^{-1}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>293.55</td>
<td>714.2</td>
<td>10.6</td>
<td>2.65</td>
<td>2.85</td>
</tr>
<tr>
<td>293.65</td>
<td>556.6</td>
<td>10.5</td>
<td>2.62</td>
<td>2.82</td>
</tr>
<tr>
<td>298.15</td>
<td>656.1</td>
<td>9.76</td>
<td>2.43</td>
<td>2.65</td>
</tr>
<tr>
<td>302.85</td>
<td>663.5</td>
<td>9.42</td>
<td>2.33</td>
<td>2.58</td>
</tr>
<tr>
<td>307.35</td>
<td>609.4</td>
<td>8.82</td>
<td>2.17</td>
<td>2.44</td>
</tr>
</tbody>
</table>

1 Mole fraction solubility values adjusted to a gas partial pressure of 101.325 kPa (1 atm) by the compiler.

Smoothed Data: For use between 293.55 and 307.35 K.
\[ \ln x_1 = -8.4548 + 11.4497/(T/100 K) \]

The standard error about the regression line is 1.09 x 10$^{-4}$.

<table>
<thead>
<tr>
<th>T/K</th>
<th>Mol Fraction $10^{-3}x_1$</th>
</tr>
</thead>
<tbody>
<tr>
<td>293.15</td>
<td>10.58</td>
</tr>
<tr>
<td>298.15</td>
<td>9.91</td>
</tr>
<tr>
<td>303.15</td>
<td>9.30</td>
</tr>
<tr>
<td>308.15</td>
<td>8.75</td>
</tr>
</tbody>
</table>

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
A calibrated all-glass combined manometer and bulb was enclosed in an air thermostat and shaken until equilibrium. Mercury was used for calibration and as confining liquid. The solvent was degassed in the apparatus.
The absorbed volume of gas is calculated from the initial and final amounts, both saturated with solvent vapor. The amount of solvent is determined by the weight of displaced mercury.
The mole fraction solubility values are at 1 atm assuming Henry's law is obeyed.
Details of the apparatus and procedure are given in ref. 1 and 2.

SOURCE AND PURITY OF MATERIALS:
(1) Carbon dioxide. Prepared from potassium bicarbonate (analytical reagent) and concentrated sulfuric acid. 99.9 per cent CO$_2$.
(2) Benzene. Merck and Co. Analytical reagent. M.p./°C = 5.43, b.p. (760 mmHg)/°C = 80.28.

ESTIMATED ERROR:
\[ \delta T/K = \pm 0.05 \]
\[ \delta x_1/x_1 = \pm 0.015 \]

REFERENCES:
1. Lannung, A.
   J. Am. Chem. Soc. 1930, 52, 68.
2. Gjaldbaek, J. C.
COMPONENTS:
1. Carbon dioxide; CO₂; [124-38-9]
2. Aromatic hydrocarbons

VARIABLES:
T/K = 198-293
P/kPa = 101.3

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>Solvent</th>
<th>T/K</th>
<th>Kuenen coefficient†</th>
<th>x_CO₂ at P_CO₂ = 101.3 kPa*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Benzene C₆H₆; [71-43-2]</td>
<td>283.15</td>
<td>3.15</td>
<td>0.0109</td>
</tr>
<tr>
<td></td>
<td>293.15</td>
<td>2.61</td>
<td>0.0091</td>
</tr>
<tr>
<td>Methylbenzene C₇H₈; [108-88-3]</td>
<td>198.15</td>
<td>36.32</td>
<td>0.1307</td>
</tr>
<tr>
<td></td>
<td>213.15</td>
<td>17.73</td>
<td>0.0684</td>
</tr>
<tr>
<td></td>
<td>233.15</td>
<td>9.07</td>
<td>0.0362</td>
</tr>
<tr>
<td></td>
<td>253.15</td>
<td>5.49</td>
<td>0.0222</td>
</tr>
<tr>
<td></td>
<td>273.15</td>
<td>3.67</td>
<td>0.0150</td>
</tr>
<tr>
<td></td>
<td>283.15</td>
<td>3.10</td>
<td>0.0127</td>
</tr>
<tr>
<td></td>
<td>293.15</td>
<td>2.64</td>
<td>0.0108</td>
</tr>
<tr>
<td>1,2-Dimethylbenzene C₈H₁₀; [95-47-6]</td>
<td>253.15</td>
<td>4.47</td>
<td>0.0209</td>
</tr>
<tr>
<td></td>
<td>263.15</td>
<td>3.63</td>
<td>0.0170</td>
</tr>
<tr>
<td></td>
<td>273.15</td>
<td>3.00</td>
<td>0.0141</td>
</tr>
<tr>
<td></td>
<td>283.15</td>
<td>2.53</td>
<td>0.0119</td>
</tr>
<tr>
<td></td>
<td>293.15</td>
<td>2.17</td>
<td>0.0102</td>
</tr>
</tbody>
</table>

† The Kuenen coefficient is defined as the volume of gas, reduced to 273.15 K and 101.325 kPa, dissolved by one gram of solvent when the partial pressure of the gas is 101.325 kPa.

* calculated by the compiler

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
The volume of gas dissolved in a weighed quantity of solvent in an absorption vessel was measured by use of a gas buret. The temperature of the absorption vessel was controlled by an alcohol bath to which solid carbon dioxide could be added as required. The vessel was shaken until equilibrium was reached.

SOURCE AND PURITY OF MATERIALS:
1. Obtained from solid carbon dioxide.

ESTIMATED ERROR:
δ(Kuenen coeff.) = ±0.67% (authors)

REFERENCES:
COMPONENTS:
1. Carbon dioxide; CO₂; [124-38-9]
2. Aromatic hydrocarbons

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>Solvent</th>
<th>T/K</th>
<th>Kuenen coefficient</th>
<th>x⁰₂ at P⁰₂ = 101.3 kPa*</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,3-Dimethylbenzene C₆H₁₀; [108-38-3]</td>
<td>233.15</td>
<td>8.09</td>
<td>0.0372</td>
</tr>
<tr>
<td></td>
<td>243.15</td>
<td>6.20</td>
<td>0.0287</td>
</tr>
<tr>
<td></td>
<td>253.15</td>
<td>4.88</td>
<td>0.0228</td>
</tr>
<tr>
<td></td>
<td>263.15</td>
<td>3.94</td>
<td>0.0185</td>
</tr>
<tr>
<td></td>
<td>273.15</td>
<td>3.26</td>
<td>0.0153</td>
</tr>
<tr>
<td></td>
<td>283.15</td>
<td>2.75</td>
<td>0.0130</td>
</tr>
<tr>
<td></td>
<td>293.15</td>
<td>2.35</td>
<td>0.0111</td>
</tr>
<tr>
<td>1,4-Dimethylbenzene; C₆H₁₀; [106-42-3]</td>
<td>293.15</td>
<td>2.38</td>
<td>0.0112</td>
</tr>
<tr>
<td>Ethylbenzene C₆H₁₀; [100-41-4]</td>
<td>198.15</td>
<td>27.92</td>
<td>0.1176</td>
</tr>
<tr>
<td></td>
<td>213.15</td>
<td>14.22</td>
<td>0.0635</td>
</tr>
<tr>
<td></td>
<td>233.15</td>
<td>7.48</td>
<td>0.0345</td>
</tr>
<tr>
<td></td>
<td>253.15</td>
<td>4.58</td>
<td>0.0214</td>
</tr>
<tr>
<td></td>
<td>273.15</td>
<td>3.11</td>
<td>0.0146</td>
</tr>
<tr>
<td></td>
<td>283.15</td>
<td>2.65</td>
<td>0.0125</td>
</tr>
<tr>
<td></td>
<td>293.15</td>
<td>2.29</td>
<td>0.0108</td>
</tr>
</tbody>
</table>

† The Kuenen coefficient is defined as the volume of gas, reduced to 273.15 K and 101.325 kPa, dissolved by one gram of solvent when the partial pressure of the gas is 101.325 kPa.

* calculated by the compiler
COMPONENTS:
(1) Carbon dioxide; CO₂; [124-38-9]
(2) Benzene; C₆H₆; [71-43-2]

ORIGINAL MEASUREMENTS:
Byrne, J. E.; Battino, R.; Danforth, W. F.

VARIABLES:
T/K: 310.65
P/kPa: 101.325 (1 atm)

PREPARED BY:
H. L. Clever

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>Mol Fraction</th>
<th>Bunsen Coefficient</th>
<th>Ostwald Coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>10⁻³x₁</td>
<td>a/cm³(STP)cm⁻³ atm⁻¹</td>
<td>L/cm³cm⁻³</td>
</tr>
<tr>
<td>310.64</td>
<td>8.07</td>
<td>2.008</td>
<td>2.284</td>
</tr>
<tr>
<td>310.69</td>
<td>8.07</td>
<td>2.007</td>
<td>2.283</td>
</tr>
</tbody>
</table>

The mole fraction and Bunsen coefficient values were calculated by the compiler assuming ideal gas behavior.

**AUXILIARY INFORMATION**

**METHOD/APPARATUS/PROCEDURE:**
The solubility apparatus is based on the design of Morrison and Billett (1) and the version used is described by Battino, Evans and Danforth (2).
The degassing apparatus is that described by Battino, Banzhof, Bogan, and Wilhelm (3).

Degassing. Up to 500 cm³ of solvent is placed in a flask of such size that the liquid is about 4 cm deep. The liquid is rapidly stirred, and vacuum is intermittently applied through a liquid nitrogen trap until the permanent gas residual pressure drops to 5 microns.

Solubility Determination. The degassed solvent is passed in a thin film down a glass helical tube containing solute gas plus the solvent vapor at a total pressure of one atm. The volume of gas absorbed is found by difference between the initial and final volumes in the buret system. The solvent is collected in a tared flask and weighed.

**SOURCE AND PURITY OF MATERIALS:**
(1) Carbon dioxide. Air Products and Chemicals, Inc. Minimum purity is 99.8 mole per cent.

(2) Benzene. J. T. Baker Analyzed Reagent Grade. 99.9 mole per cent, thiophene free.

**ESTIMATED ERROR:**

ΔT/K = 0.01
ΔP/mmHg = 0.5
ΔL₀/L₀ = 0.01
ΔLₚ/Lₚ = 0.02

**REFERENCES:**
COMPONENTS:

1. Carbon dioxide; CO₂; [124-38-9]
2. Benzene; C₆H₆; [71-43-2]

VARIABLES:

\[ T/K = 283.15 - 313.15 \]

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>Solubility, S/mol dm⁻³ bar⁻¹</th>
<th>Mole fraction of carbon dioxide in liquid, x_{CO₂}</th>
</tr>
</thead>
<tbody>
<tr>
<td>283.15</td>
<td>0.1220</td>
<td>0.0107</td>
</tr>
<tr>
<td>293.15</td>
<td>0.1088</td>
<td>0.00970</td>
</tr>
<tr>
<td>303.15</td>
<td>0.09779</td>
<td>0.00883</td>
</tr>
<tr>
<td>313.15</td>
<td>0.08848</td>
<td>0.00810</td>
</tr>
</tbody>
</table>

+ at a partial pressure of 101.325 kPa.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Volumetric apparatus in which gas was dissolved in liquid in glass cell. Pressure measured. Amount of gas dissolved estimated from pressure measurements when gas was repeatedly expanded into known volume.

Details in source. Values of solubility calculated from equations and graphs in original.

SOURCE AND PURITY OF MATERIALS:

No details given.

ESTIMATED ERROR:

\[ \delta T/K = \pm 0.1; \delta x_{CO₂} = \pm 1-2\% \]

REFERENCES:

Original Measurements:

Krauss, W.; Gestrich, W.

Prepared By:

C.L. Young
COMPONENTS:  
1. Carbon dioxide; CO₂; [124-38-9]  
2. Benzene; C₆H₆; [71-43-2]  

ORIGINAL MEASUREMENTS:  
Patyi, L.; Furmer, I. E.; Makranczy, J.; Sadilenko, A. S.; Stepanova, Z. G.; Berengarten, M. G.  

VARIABLES:  
T/K = 298.15  

PREPARED BY:  
C. L. Young  

EXPERIMENTAL VALUES:  

<table>
<thead>
<tr>
<th>T/K</th>
<th>α⁺</th>
<th>( x_{CO₂} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>298.15</td>
<td>2.23</td>
<td>0.00888</td>
</tr>
</tbody>
</table>

\( \dagger \) volume of gas (measured at 101.325 kPa and 273.15 K) dissolved by one volume of benzene.

AUXILIARY INFORMATION  

METHOD/APPARATUS/PROCEDURE:  
Volumetric method. Pressure measured when known amounts of gas were added, in increments, to a known amount of liquid in a vessel of known dimensions. Corrections were made for the partial pressure of solvent. Details in ref. (1).  

SOURCE AND PURITY OF MATERIALS:  
Purity better than 99 mole per cent as determined by gas chromatography.

ESTIMATED ERROR:  
\( \delta T/K = \pm 0.1; \ \delta \alpha = \pm 4\% \) or less.

REFERENCES:  
1. Bodor, E.; Bor, G. J.; Mohai, B.; Sipos, G.  
COMPONENTS:  
1. Carbon dioxide; CO₂; [124-38-9]  
2. Benzene; C₆H₆; [71-43-2]  

ORIGINAL MEASUREMENTS:  
Horvath, M. J.; Sebastian, H. M.; Chao, K.-C.  

VARIABLES:  
T/K = 300  
P/kPa = 101.3  

EXPERIMENTAL VALUES:  

<table>
<thead>
<tr>
<th>T/K</th>
<th>Henry's constant /atm</th>
<th>Mole fraction of carbon dioxide in liquid, x_{CO₂} +</th>
</tr>
</thead>
<tbody>
<tr>
<td>300</td>
<td>109</td>
<td>0.0091</td>
</tr>
</tbody>
</table>

+ at a partial pressure of carbon dioxide of 1 atmosphere calculated by compiler assuming φ = 0.995.

AUXILIARY INFORMATION  
METHOD/APPARATUS/PROCEDURE:  
Gas chromatographic analysis of a saturated solution at barometric pressure. Henry's constants determined from formula  

\[ H = (p - p_o)\phi(m + 1)/m \]

where \( p \) is the total pressure, \( p_o \) the vapor pressure of the solvent and \( \phi \) is the fugacity coefficient of the gas. The mole ratio, \( m \), is defined by

\[ m = \frac{\text{Moles of carbon dioxide in gas phase}}{\text{Moles of carbon dioxide in liquid phase}} \]

SOURCE AND PURITY OF MATERIALS:  
1. No details given.  
2. Purity stated as "~ 100%".  

ESTIMATED ERROR:  
\( \delta T/K = \pm 0.25; \ \delta P/\text{atm} = \pm 3\% \)  
(estimated by compiler)  

REFERENCES:
**COMPONENTS:**

1. Carbon dioxide; CO\(_2\); [124-38-9]
2. Benzene, C\(_6\)H\(_6\); [71-43-2]

**ORIGINAL MEASUREMENTS:**

Kaminishi, G-I.; Yokoyama, C.; Takahashi, S.

**VARIABLES:**

\[ T/K = 273.15-303.15 \]
\[ P/\text{MPa} = 0.826-5.688 \]

**EXPERIMENTAL VALUES:**

<table>
<thead>
<tr>
<th>( T/K )</th>
<th>( H/\text{MPa} )</th>
<th>( H/\text{kPa} )</th>
<th>Mole fraction ( x_{CO_2} ) at ( P_{CO_2} = 101.3\text{kPa}^* )</th>
</tr>
</thead>
<tbody>
<tr>
<td>283.15</td>
<td>8.39</td>
<td>8390</td>
<td>0.01208</td>
</tr>
<tr>
<td>298.15</td>
<td>10.37</td>
<td>10370</td>
<td>0.00977</td>
</tr>
<tr>
<td>303.15</td>
<td>11.06</td>
<td>11060</td>
<td>0.00916</td>
</tr>
</tbody>
</table>

\[ H = \left[ \frac{f_1}{x_1} \right] \]

\( x_1 = x_{CO_2}; \quad f_1 = \text{fugacity of CO}_2 \)

* taken by the compiler to be given approximately by \( P_{CO_2}/H \)

**AUXILIARY INFORMATION**

**METHOD/APPARATUS/PROCEDURE:**

Apparatus able to withstand pressures to 20 MPa was used to determine phase equilibria by the bubble point method. Henry's constants at zero pressure were obtained from the experimental data by using the method described by Prausnitz and Chueh (1)

**SOURCE AND PURITY OF MATERIALS:**

1. Supplied by Showa Tansan Industry Co., Ltd; purity better than 99.9%
2. Supplied by Merck Co. Ltd; purity better than 99.7%

**ESTIMATED ERROR:**

\[ \delta T/K = \pm 0.01 \text{ (authors)} \]
\[ \delta P/\text{kPa} = \pm 0.1 \]

**REFERENCES:**

1. Prausnitz, J.M.; Chueh, P.L.
   Computer Calculations for High Pressure Vapor-Liquid Equilibria,
COMPONENTS:
1. Carbon dioxide; CO₂; [124-38-9]
2. Benzene and methylbenzenes

ORIGINAL MEASUREMENTS:
Luhring, P.; Schumpe, A.

VARIABLES:
T/K = 293.2

PREPARED BY:
C.L. Young

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>Henry’s Constant* / (Pa m³/mol)</th>
<th>Mole fraction of CO₂ at 1 atm partial pressure</th>
</tr>
</thead>
<tbody>
<tr>
<td>293.2</td>
<td>946</td>
<td>0.009518</td>
</tr>
<tr>
<td></td>
<td>[71-43-2]</td>
<td></td>
</tr>
<tr>
<td>293.2</td>
<td>965</td>
<td>0.009080</td>
</tr>
<tr>
<td></td>
<td>Methylbenzene, (toluene); C₇H₈; [108-88-3]</td>
<td></td>
</tr>
<tr>
<td>293.2</td>
<td>1067</td>
<td>0.01167</td>
</tr>
<tr>
<td></td>
<td>1,3-Dimethylbenzene, (m-xylene); C₈H₁₀; [108-38-3]</td>
<td></td>
</tr>
<tr>
<td>293.2</td>
<td>1251</td>
<td>0.01125</td>
</tr>
<tr>
<td></td>
<td>1,2,4-Trimethylbenzene; C₉H₁₂; [95-63-6]</td>
<td></td>
</tr>
<tr>
<td>293.2</td>
<td>1124</td>
<td>0.01022</td>
</tr>
<tr>
<td></td>
<td>Ethylbenzene; C₉H₁₂; [100-41-4]</td>
<td></td>
</tr>
</tbody>
</table>

*referred to as Henry’s constant in source but appears to be usual Henry’s constant multiplied by molar volume.
†calculated by compiler using density data taken from ref. (1).

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE
Little information given in source. Method consisted of equilibrating known amounts of degassed liquid and gas and measuring the change in pressure. Equilibration was reached in 3 to 6 minutes. Some details given in ref

SOURCE AND PURITY OF MATERIALS:
Obtained from Merck at the highest available purity. No other details given.

ESTIMATED ERROR:
δT/K = ± 0.1 (authors)
δx/x = ± 0.01 to 0.15 (compiler)

REFERENCES:
COMPONENTS:  
(1) Carbon dioxide; CO$_2$; [124-38-9]  
(2) Methyl benzene or toluene; C$_7$H$_8$; [108-88-3]

ORIGINAL MEASUREMENTS:  
Just, G.  

VARIABLES:  
\[
\begin{align*} 
T/K &= 288.15 - 298.15 \\
p_f/kPa &= 101.325 \text{ (1 atm)} 
\end{align*}
\]

PREPARED BY:  
M. E. Derrick  
H. L. Clever

EXPERIMENTAL VALUES:  

<table>
<thead>
<tr>
<th>T/K</th>
<th>10$^3$x$_I$</th>
<th>Bunsen Coefficient</th>
<th>Ostwald Coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$\alpha/cm^3(STP)cm^{-3}atm^{-1}$</td>
<td>L/cm$^3$cm$^{-1}$</td>
<td></td>
</tr>
<tr>
<td>288.15</td>
<td>11.30</td>
<td>2.42</td>
<td>2.557</td>
</tr>
<tr>
<td>293.15</td>
<td>10.61</td>
<td>2.26</td>
<td>2.426</td>
</tr>
<tr>
<td>298.15</td>
<td>9.97</td>
<td>2.11</td>
<td>2.305</td>
</tr>
</tbody>
</table>

The author measured the Ostwald coefficient at a pressure of about 746 mmHg. The compiler assumed the Ostwald coefficient to be independent of pressure, and calculated the mole fraction and Bunsen coefficient values at 101.325 kPa (1 atm) partial pressure of the gas.

**AUXILIARY INFORMATION**

METHOD/APPARATUS/PROCEDURE:  
An Ostwald apparatus as modified by Timofejew (1), and Steiner (2) is used. The apparatus consists of a gas buret, an absorption flask, and a mercury manometer. The system is thermostated with a water jacket.

The gas is introduced into the degassed liquid. The gas volume absorbed is determined by the gas buret. The solvent volume is determined at the end of the experiment by pouring the solvent into a graduated flask.

SOURCE AND PURITY OF MATERIALS:  
(1) Carbon dioxide. Generated in a Kipp apparatus using marble and hydrochloric acid.

(2) Methyl benzene. No information.

ESTIMATED ERROR:  
\[\delta L/L = 0.03 \text{ (compiler)}\]

REFERENCES:  
1. Timofejew, W.  

2. Steiner, P.  
COMPONENTS:

1. Carbon dioxide; CO₂; [124-38-9]
2. Methylbenzene (Toluene); C₇H₈; [108-88-3]

VARIABLES:

<table>
<thead>
<tr>
<th>T/K (°C)</th>
<th>T/K</th>
<th>Total pressure /mmHg</th>
<th>Oberved Solubility cm³ (NTP) / g solvent</th>
<th>Solubility at 760 mmHg total pressure cm³ (NTP) / g solvent</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>273.2</td>
<td>588.6</td>
<td>2.95</td>
<td>3.81</td>
</tr>
<tr>
<td>-10</td>
<td>263.2</td>
<td>588.1</td>
<td>3.57</td>
<td>4.62</td>
</tr>
<tr>
<td>-20</td>
<td>253.2</td>
<td>588.8</td>
<td>4.34</td>
<td>5.60</td>
</tr>
<tr>
<td>-30</td>
<td>243.2</td>
<td>588.2</td>
<td>5.34</td>
<td>6.90</td>
</tr>
<tr>
<td>-40</td>
<td>233.2</td>
<td>589.1</td>
<td>6.82</td>
<td>8.80</td>
</tr>
<tr>
<td>-50</td>
<td>223.2</td>
<td>587.4</td>
<td>8.53</td>
<td>11.04</td>
</tr>
<tr>
<td>-60</td>
<td>213.2</td>
<td>587.8</td>
<td>12.34</td>
<td>15.96</td>
</tr>
<tr>
<td>-70</td>
<td>203.2</td>
<td>587.2</td>
<td>15.81</td>
<td>20.46</td>
</tr>
<tr>
<td>-80</td>
<td>193.2</td>
<td>588.2</td>
<td>17.25</td>
<td>22.27</td>
</tr>
</tbody>
</table>

METHOD/APPARATUS/PROCEDURE:

Toluene admitted to absorption flask. Amount determined by weighing. Carbon dioxide dissolved in toluene, amount added being measured volumetrically. Contents of absorption flask stirred with magnet enclosed in glass. Pressure measured with mercury manometer.

SOURCE AND PURITY OF MATERIALS:

1. Dried with anhydrous calcium chloride.

ESTIMATED ERROR:

δT/K = ±0.2; δP/mmHg = ±0.2;
δx_CO₂ = ±2% (estimated by compiler).

REFERENCES:
COMPONENTS:
(1) Carbon dioxide; CO₂; [124-38-9]
(2) Methylbenzene or toluene; C₇H₈; [108-88-3]

ORIGINAL MEASUREMENTS:
Gjøldbæk, J. C.; Andersen, E. K.

VARIABLES:
\[ T/K = 298.15 \]
\[ P_1/kPa = 101.325 \text{ (1 atm)} \]

EXPERIMENTAL VALUES:
\[
\begin{array}{c|cc|cc}
T/K & 10^2x_1 & \text{Bunsen Coefficient} & \text{Ostwald Coefficient} \\
\hline
298.15 & 1.05 & 2.22 & 2.42 \\
       & 1.05 & 2.20 & 2.40 \\
\end{array}
\]

The mole fraction and Ostwald coefficient values were calculated by the compiler.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
The apparatus consists of a calibrated all-glass manometer and bulb enclosed in an air thermostat. The solvent is added and degassed in the apparatus. The gas is added. The apparatus and contents are shaken until equilibrium is attained. Mercury is used for calibration and as the confining liquid.
The absorbed volume of gas is calculated from the initial and final amounts of gas, both saturated with solvent vapor. The amount of solvent is determined by the weight of displaced mercury. Further details are in the references (1,2).
The mole fraction values are at one atm pressure assuming Henry's law is obeyed.

SOURCE AND PURITY OF MATERIALS:
(1) Carbon dioxide. Prepared from potassium bicarbonate and sulfuric acid. 99.8 - 99.9% CO₂.
(2) Methylbenzene. Riedel-de-Haën. Analytical reagent. Fractionated by distillation. B.p. (760 mmHg)/°C = 110.75 - 110.80, refractive index nD(25.1°C) = 1.4936 - 1.4938.

ESTIMATED ERROR:
\[
\delta T/K = \pm 0.05 \\
\delta x_1/x_1 = \pm 0.015 \\
\]

REFERENCES:
1. Lannung, A.
   J. Am. Chem. Soc. 1930, 52, 68.
2. Gjøldbæk, J. C.
COMPONENTS:
1. Carbon dioxide; CO₂; [124-38-9]
2. Methanol; CH₃OH; [67-56-1]
   2-Butanone; C₅H₁₀O; [78-93-3]
   Acetic acid, ethyl ester, (ethyl acetate); C₄H₇O₂; [141-78-6]
   Methylbenzene, (toluene); C₇H₈; [108-88-3]

ORIGINAL MEASUREMENTS:

VARIABLES:
T/K = 228-248  P/kPa = 101-1621

EXPERIMENTAL VALUES:
<table>
<thead>
<tr>
<th>Solvent</th>
<th>T/K</th>
<th>H*/atm</th>
<th>Henry's constant, H*</th>
<th>H**/atm</th>
<th>H**/kPa§</th>
<th>X₂CO₂ at P₂ CO₂ = 101.3 kPa†</th>
</tr>
</thead>
<tbody>
<tr>
<td>Methanol‡</td>
<td>248.0</td>
<td>42.2</td>
<td>4276</td>
<td>41.5</td>
<td>4205</td>
<td>0.0241</td>
</tr>
<tr>
<td></td>
<td>238.2</td>
<td>29.5</td>
<td>2989</td>
<td>27.5</td>
<td>2762</td>
<td>0.0364</td>
</tr>
<tr>
<td></td>
<td>228.1</td>
<td>20.9</td>
<td>2118</td>
<td>19.8</td>
<td>2006</td>
<td>0.0505</td>
</tr>
<tr>
<td>2-Butanone</td>
<td>248.0</td>
<td>15.7</td>
<td>1591</td>
<td>15.3</td>
<td>1550</td>
<td>0.0654</td>
</tr>
<tr>
<td></td>
<td>238.2</td>
<td>11.5</td>
<td>1165</td>
<td>11.6</td>
<td>1175</td>
<td>0.0862</td>
</tr>
<tr>
<td></td>
<td>228.1</td>
<td>8.0</td>
<td>811</td>
<td>7.7</td>
<td>780</td>
<td>0.1299</td>
</tr>
<tr>
<td>Ethyl acetate</td>
<td>248.0</td>
<td>12.2</td>
<td>1236</td>
<td>12.3</td>
<td>1246</td>
<td>0.0813</td>
</tr>
<tr>
<td></td>
<td>238.2</td>
<td>9.1</td>
<td>922</td>
<td>9.0</td>
<td>912</td>
<td>0.1111</td>
</tr>
<tr>
<td></td>
<td>228.1</td>
<td>6.3</td>
<td>638</td>
<td>6.2</td>
<td>628</td>
<td>0.1613</td>
</tr>
<tr>
<td>Methylbenzene</td>
<td>248.0</td>
<td>41.4</td>
<td>4195</td>
<td>40.5</td>
<td>4104</td>
<td>0.0247</td>
</tr>
<tr>
<td></td>
<td>238.2</td>
<td>33.2</td>
<td>3364</td>
<td>32.3</td>
<td>3273</td>
<td>0.0310</td>
</tr>
<tr>
<td></td>
<td>228.1</td>
<td>24.8</td>
<td>2513</td>
<td>23.7</td>
<td>2401</td>
<td>0.0422</td>
</tr>
</tbody>
</table>

* Values of Henry's constant based upon measurements made in the pressure range 101-1621 kPa and calculated by a graphical method from the relationship

\[ \frac{RT\ln(f_2/x_2)}{\sum \frac{V_2}{P}} = RT\ln H + \frac{P}{V_2} - \frac{A}{2} \]

where \( f_2 \) is the fugacity of the carbon dioxide at temperature \( T \)
\( V_2 \) is the partial molar volume of carbon dioxide at infinite dilution
\( H \) is equal to the limiting value of \( P_2/x_2 \) at \( P_2=0 \)
\( A \) is a constant.

** Values of Henry's constant based upon measurements of the solubility of carbon dioxide at a partial pressure of 101.3 kPa.
† calculated by the compiler and equal to the reciprocal of \( H**/atm \)
§ calculated by the compiler
‡ the authors used data for methanol which they had published earlier (1).

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
A static method was used. A glass (low pressure) section of the apparatus was connected to a high pressure section made of metal. Carbon dioxide in the low pressure section was allowed to condense in a cooled metal bulb in the high pressure section. The quantity of gas collected was found from pressure changes in the glass section. The valve connecting the two sections was then closed and the condensed gas allowed to evaporate to generate the required pressure and to come in contact with the solvent under test which was held in an absorption cell in a thermostat bath. The cell was stirred magnetically. The quantity of unabsorbed gas when equilibrium was reached was calculated from the final pressure and volume of the gas in the high pressure section.

SOURCE AND PURITY OF MATERIALS:
No information

ESTIMATED ERROR
\[ \delta X_{CO₂} = \pm 5\% \] (compiler)

REFERENCES:
COMPONENTS:
(1) Carbon dioxide; CO₂; [124-38-9]
(2) Methylbenzene or toluene; C₇H₈; [108-88-3]

ORIGINAL MEASUREMENTS:
Field, L. R.; Wilhelm, E.; Battino, R.

VARIABLES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>P/kPa: 101.325 (1 atm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>283.67</td>
<td>283.67 - 313.24</td>
</tr>
<tr>
<td>298.43</td>
<td></td>
</tr>
<tr>
<td>313.24</td>
<td></td>
</tr>
</tbody>
</table>

PREPARED BY:
H. L. Clever

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>Mol Fraction</th>
<th>Bunsen Coefficient a/cm³(STP)cm⁻³atm⁻¹</th>
<th>Ostwald Coefficient L/cm³cm⁻³</th>
</tr>
</thead>
<tbody>
<tr>
<td>283.67</td>
<td>1.257</td>
<td>2.71</td>
<td>2.816</td>
</tr>
<tr>
<td>298.43</td>
<td>1.013</td>
<td>2.15</td>
<td>2.343</td>
</tr>
<tr>
<td>313.24</td>
<td>0.861</td>
<td>1.79</td>
<td>2.054</td>
</tr>
</tbody>
</table>

The gas solubility values were adjusted to a CO₂ partial pressure of 101.325 kPa (1 atm) by Henry's law.
The Bunsen coefficients were calculated by the compiler.

Smoothed Data: For use between 283.15 and 313.24 K.

\[ \ln x_1 = -8.3963 + 11.3873/(T/100 K) \]

The standard error about the regression line is 1.48 x 10⁻⁴.

<table>
<thead>
<tr>
<th>T/K</th>
<th>Mol Fraction</th>
</tr>
</thead>
<tbody>
<tr>
<td>283.15</td>
<td>1.259</td>
</tr>
<tr>
<td>293.15</td>
<td>1.098</td>
</tr>
<tr>
<td>298.15</td>
<td>1.029</td>
</tr>
<tr>
<td>303.15</td>
<td>0.966</td>
</tr>
<tr>
<td>313.15</td>
<td>0.857</td>
</tr>
</tbody>
</table>

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
The solubility apparatus is based on the design of Morrison and Billett (1) and the version used is described by Battino, Evans, and Danforth (2).
The degassing apparatus is that described by Battino, Banzhof, Bogan, and Wilhelm (3).

Degassing. Up to 500 cm³ of solvent is placed in a flask of such size that the liquid is about 4 cm deep. The liquid is rapidly stirred, and vacuum is applied intermittently through a liquid N₂ trap until the permanent gas residual pressure drops to 5 microns.

Solubility Determination. The degassed solvent is passed in a thin film down a glass spiral tube containing solute gas plus the solvent vapor at a total pressure of one atm. The volume of gas absorbed is found by difference between the initial and final volumes in the buret system. The solvent is collected in a tared flask and weighed.

SOURCE AND PURITY OF MATERIALS:
(1) Carbon dioxide. Either Matheson Co., Inc. or Air Products and Chemicals, Inc. Purest grade available, minimum purity greater than 99 mole per cent.

ESTIMATED ERROR:
\[ \delta T/K = 0.03 \]
\[ \delta P/mmHg = 0.5 \]
\[ \delta x_1/x_1 = 0.005 \]

REFERENCES:
COMPONENTS:
1. Carbon dioxide; \( \text{CO}_2; [124-38-9] \)
2. Methylbenzene, (Toluene), \( \text{C}_9\text{H}_8; [108-88-3] \)

VARIABLES:
\[ T/\text{K} = 283.15-313.15 \]

EXPERIMENTAL VALUES:
<table>
<thead>
<tr>
<th>( T/\text{K} )</th>
<th>Solubility ( +, \text{S/mol dm}^{-3} \text{bar}^{-1} )</th>
<th>Mole fraction ( + ) of carbon dioxide in liquid, ( x_{\text{CO}_2} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>283.15</td>
<td>0.1262</td>
<td>0.0133</td>
</tr>
<tr>
<td>293.15</td>
<td>0.1087</td>
<td>0.0113</td>
</tr>
<tr>
<td>303.15</td>
<td>0.09461</td>
<td>0.0102</td>
</tr>
<tr>
<td>313.15</td>
<td>0.08305</td>
<td>0.00906</td>
</tr>
</tbody>
</table>

\( + \) at a partial pressure of 101.325 kPa.

METHOD/APPARATUS/PROCEDURE:
Volumetric apparatus in which gas was dissolved in liquid in glass cell. Pressure measured Amount of gas dissolved estimated from pressure measurements when gas was repeatedly expanded into known volume. Details in source. Values of solubility calculated from equations and graphs in original.

SOURCE AND PURITY OF MATERIALS:
No details given.

ESTIMATED ERROR:
\[ \delta T/\text{K} = \pm 0.1; \delta x_{\text{CO}_2} = \pm 1-2\% . \]

REFERENCES:
## COMPONENTS:
1. Carbon dioxide; CO$_2$; [124-38-9]
2. Methylbenzene, (toluene); C$_7$H$_8$; [108-88-3]

## VARIABLES:
\[ T/K = 298 \text{ or } 300 \]
\[ P/kPa = 101.3 \]

## EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>$T/K$</th>
<th>Henry's constant /atm</th>
<th>Mole fraction of carbon dioxide in liquid, $x_{CO_2}$ $^+$</th>
</tr>
</thead>
<tbody>
<tr>
<td>298</td>
<td>102</td>
<td>0.0098</td>
</tr>
<tr>
<td>300</td>
<td>106</td>
<td>0.0094</td>
</tr>
</tbody>
</table>

$^+$ at a partial pressure of carbon dioxide of 1 atmosphere calculated by compiler assuming $\phi = 0.995$.

## AUXILIARY INFORMATION

### METHOD/APPARATUS/PROCEDURE:
Gas chromatographic analysis of a saturated solution at barometric pressure. Henry's constants determined from formula
\[
H = (p - p_o)\phi(m + 1)/m
\]
where $p$ is the total pressure, $p_o$ the vapor pressure of the solvent and $\phi$ is the fugacity coefficient of the gas. The mole ratio, $m$, is defined by
\[
m = \frac{\text{Moles of carbon dioxide in gas phase}}{\text{Moles of carbon dioxide in liquid phase}}
\]

### SOURCE AND PURITY OF MATERIALS:
1. No details given.
2. Purity stated as "~ 100%".

### ESTIMATED ERROR:
\[
\delta T/K = \pm 0.25; \quad \delta P/\text{atm} = \pm 3\%
\]
(estimated by compiler).

### REFERENCES:
Horvath, M. J.; Sebastian, H. M.; Chao, K.-C.
COMPONENTS:

1. Carbon dioxide; CO₂; [124-38-9]  
2. Methylbenzene; C₇H₈; [108-88-3]

VARIABLES:

\[ T/K = 298.15-316.15 \]
\[ P/kPa = 101.3 \]

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>Henry's constant†</th>
<th>( x_{CO₂} ) at ( P_{CO₂} = 101.3 ) kPa*</th>
</tr>
</thead>
<tbody>
<tr>
<td>298.15</td>
<td>95.78</td>
<td>0.01044</td>
</tr>
<tr>
<td>303.15</td>
<td>101.25</td>
<td>0.00988</td>
</tr>
<tr>
<td>316.15</td>
<td>118.83</td>
<td>0.00842</td>
</tr>
</tbody>
</table>

† Henry's constant, \( H \), is based upon the relationship

\[ H = \frac{P_{CO₂}}{x_{CO₂}} \]

where \( P_{CO₂} \) is equal to barometric pressure.

* calculated by the compiler

ORIGINAL MEASUREMENTS:


PREPARED BY:

P.G.T. Fogg

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Solubilities were measured with a modified Novak and Conway apparatus. Details of the apparatus are given by the authors. The pressure was measured with a mercury manometer. The solvent in the absorption vessel was stirred with a magnetic stirrer. Gas was circulated through the apparatus by means of a gas pump until no further gas was absorbed (see ref. 1).

SOURCE AND PURITY OF MATERIALS:

1. purity 97.3%  
2. analytical grade supplied by Hongzhou Chlorophyll Plant.

ESTIMATED ERROR:

\[ \delta T/K = \pm 0.1 \text{ (absorption vessel) } \]
\[ \delta T/K = \pm 1.0 \text{ (entire system) } \]

(authors)

REFERENCES:

1. Novak-Adamic, D.M.; Conway, B.F.  
COMPONENTS:
(1) Carbon dioxide; CO₂ [124-38-9]
(2) Benzene; C₆H₆
  - 1,2-Dimethylbenzene; C₈H₁₀ [95-47-6]
  - 1,3-Dimethylbenzene; C₈H₁₀ [108-38-3]
  - 1,4-Dimethylbenzene; C₈H₁₀ [106-42-3]

ORIGINAL MEASUREMENTS:
Rosenthal, W.
Thes. fac. sci. Univ. Strasbourg (France) 1954.

VARIABLES:
T/K = 293.15
p/kPa = 101.325

PREPARED BY:
H. L. Clever

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>Ostwald Coefficient</th>
<th>Bunsen Coefficient</th>
<th>Mole Fraction</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>L/cm³ cm⁻³</td>
<td>a/cm³(STP)cm⁻³atm⁻¹</td>
<td>x₁</td>
</tr>
<tr>
<td>Benzene</td>
<td>293.15</td>
<td>2.66</td>
<td>2.47</td>
</tr>
<tr>
<td>1,2-Dimethylbenzene</td>
<td>293.15</td>
<td>2.085</td>
<td>1.940</td>
</tr>
<tr>
<td>1,3-Dimethylbenzene</td>
<td>293.15</td>
<td>2.19</td>
<td>2.04</td>
</tr>
<tr>
<td>1,4-Dimethylbenzene</td>
<td>293.15</td>
<td>2.20</td>
<td>2.05</td>
</tr>
</tbody>
</table>

a Original data.
b Calculated by compiler using real gas molar volumes.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
The prepared solvent solution was charged into an evacuated cell after degassing, and the mass of solvent was determined by weight. Gas was introduced into the cell from a measuring burette in which the gas was stored over mercury. The cell was agitated while the gas pressure was maintained by adjusting the gas volume. The Ostwald coefficient was determined from the mass of solvent and volume of gas used. Solubilities were measured at pressures above and below atmospheric.

SOURCE AND PURITY OF MATERIALS:
(1) Carbon dioxide. Source and purity not given. An aqueous "soda" solution absorbed 99.8% of the gas.
(2) Aromatic hydrocarbons.

ESTIMATED ERROR:
δT/K = ± 0.2
δp/kPa = ± 0.1
δL/L = ± 0.02 (compiler)

REFERENCES:
Some data in the thesis have been published. See:
1. Maillard, A.; Rosenthal, W.
COMPONENTS:
(1) Carbon dioxide; CO₂; [124-38-9]
(2) 1,2-Dimethylbenzene or o-xylene; C₈H₁₀; [95-47-6]

ORIGINAL MEASUREMENTS:
Byrne, J. E.; Battino, R.; Wilhelm, E.

VARIABLES:

<table>
<thead>
<tr>
<th>Variable</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>T/K</td>
<td>283.08 - 313.17</td>
</tr>
<tr>
<td>p₀/kPa</td>
<td>101.325 (1 atm)</td>
</tr>
</tbody>
</table>

PREPARED BY:
H. L. Clever
A. L. Cramer

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>Mol Fraction 10⁻³ x₁</th>
<th>Bunsen Coefficient a/cm³(STP)cm⁻³atm⁻¹</th>
<th>Ostwald Coefficient L/cm³cm⁻³</th>
</tr>
</thead>
<tbody>
<tr>
<td>283.08</td>
<td>12.30</td>
<td>2.335</td>
<td>2.420</td>
</tr>
<tr>
<td>283.21</td>
<td>12.34</td>
<td>2.344</td>
<td>2.430</td>
</tr>
<tr>
<td>298.19</td>
<td>9.94</td>
<td>1.855</td>
<td>2.026</td>
</tr>
<tr>
<td>313.06</td>
<td>8.34</td>
<td>1.533</td>
<td>1.757</td>
</tr>
<tr>
<td>313.17</td>
<td>8.30</td>
<td>1.526</td>
<td>1.750</td>
</tr>
</tbody>
</table>

The Bunsen coefficients were calculated by the compiler. The solubility values were adjusted to a carbon dioxide partial pressure of 101.325 kPa (1 atm) by Henry's law.

Smoothed Data: For use between 283.08 and 313.17 K.

\[ \ln x₁ = -8.5010 + 11.6175/(T/100 K) \]

The standard error about the regression line is 4.91 x 10⁻⁵.

**AUXILIARY INFORMATION**

METHOD/APPARATUS/PROCEDURE:
The solubility apparatus is based on the design of Morrison and Billett (1) and the version used is described by Battino, Evans, and Danforth (2). The degassing apparatus is that described by Battino, Banzhof, Bogan, and Wilhelm (3).

Degassing. Up to 500 cm³ of solvent is placed in a flask of such size that the liquid is about 4 cm deep. The liquid is rapidly stirred, and vacuum is intermittently applied through a liquid N₂ trap until the permanent gas residual pressure drops to 5 microns.

Solubility Determination. The degassed solvent is passed in a thin film down a glass helical tube containing solute gas plus the solvent vapor at a total pressure of one atm. The volume of gas absorbed is found by difference between the initial and final volumes in the buret system. The solvent is collected in a tared flask and weighed.

SOURCE AND PURITY OF MATERIALS:
(1) Carbon dioxide. Either Air Products & Chemicals, Inc., or Matheson Co., Inc. 99 mol per cent or better.
(2) 1,2-Dimethylbenzene. Phillips Petroleum Co. Pure grade.

ESTIMATED ERROR:

\[ \delta T/K = 0.03 \]
\[ \delta P/mmHg = 0.5 \]
\[ \delta x₁/x₁ = 0.005 \]

REFERENCES:
COMPONENTS:
(1) Carbon dioxide; CO₂; [124-38-9]
(2) 1,3-Dimethylbenzene or m-xylene; C₈H₁₀; [108-38-3]

ORIGINAL MEASUREMENTS:
Just, G.
Z. Phys. Chem. 1901, 37, 342 - 367.

VARIABLES:
\[ T/K = 288.15 - 298.15 \]
\[ P_1/kPa = 101.325 \text{ (1 atm)} \]

PREPARED BY:
M. E. Derrick
H. L. Clever

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>Mol Fraction</th>
<th>Bunsen Coefficient ( \alpha/\text{cm}^3 \text{(STP)} \text{cm}^{-3} \text{atm}^{-1} )</th>
<th>Ostwald Coefficient ( L/\text{cm}^3 \text{cm}^{-3} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>288.15</td>
<td>1.20</td>
<td>2.22</td>
<td>2.346</td>
</tr>
<tr>
<td>293.15</td>
<td>1.12</td>
<td>2.06</td>
<td>2.216</td>
</tr>
<tr>
<td>298.15</td>
<td>1.04</td>
<td>1.91</td>
<td>2.090</td>
</tr>
</tbody>
</table>

The author measured the Ostwald coefficient at a pressure of about 746 mmHg. The compiler assumed the Ostwald coefficient to be independent of pressure, and calculated the mole fraction and Bunsen coefficient values at 101.325 kPa (1 atm) partial pressure of the gas.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
An Ostwald apparatus as modified by Timofejew (1), and Steiner (2) is used. The apparatus consists of a gas buret, an absorption flask, and a mercury manometer. The system is thermostated with a water jacket.

The gas is introduced into the degassed liquid. The gas volume absorbed is determined by the gas buret. The solvent volume is determined at the end of the experiment by pouring the solvent into a graduated flask.

SOURCE AND PURITY OF MATERIALS:
(1) Carbon dioxide. Generated in a Kipp apparatus using marble and hydrochloric acid.
(2) 1,3-Dimethylbenzene. No information.

ESTIMATED ERROR:
\[ \delta \frac{L}{L} = 0.03 \text{ (compiler)} \]

REFERENCES:
1. Timofejew, W.
Z. Phys. Chem. 1890, 6, 141.

2. Steiner, P.
COMPONENTS:
(1) Carbon dioxide; CO₂; [124-38-9]
(2) 1,3-Dimethylbenzene or m-xylene; C₈H₁₀; [108-38-3]

ORIGINAL MEASUREMENTS:
Byrne, J. E.; Battino, R.; Wilhelm, E.

VARIABLES:
T/K: 283.01 - 313.14
p₁/kPa: 101.325 (1 atm)

PREPARED BY:
H. L. Clever
A. L. Cramer

EXPERIMENTAL VALUES:
\[
\begin{array}{cccc}
T/K & \text{Mol Fraction} & \text{Bunsen Coefficient} & \text{Ostwald Coefficient} \\
& 10^3x_J & a/cm^3(\text{STP})cm^{-3}atm^{-1} & L/cm^3cm^{-1} \\
283.01 & 12.99 & 2.425 & 2.513 \\
283.13 & 13.21 & 2.466 & 2.556 \\
283.13 & 13.23 & 2.471 & 2.561 \\
298.17 & 10.63 & 1.949 & 2.127 \\
313.14 & 8.89 & 1.603 & 1.838 \\
\end{array}
\]

The Bunsen coefficients were calculated by the compiler. The solubility values were adjusted to a carbon dioxide partial pressure of 101.325 kPa (1 atm) by Henry's law.

Smoothed Data: For use between 283.01 and 313.15 K.
\[
\ln x_J = -8.4234 + 11.5806/(T/100)K
\]
The standard error about the regression line is 1.24 x 10⁻⁴.

\[
\begin{array}{c}
T/K \\
283.15 \\
293.15 \\
298.15 \\
303.15 \\
313.15 \\
\end{array}
\begin{array}{c}
13.12 \\
11.41 \\
10.68 \\
10.02 \\
8.87 \\
\end{array}
\]

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
The solubility apparatus is based on the design of Morrison and Billett (1) and the version used is described by Battino, Evans, and Danforth (2). The degassing apparatus is that described by Battino, Banzhof, Bogan, and Wilhelm (3).

Degassing. Up to 500 cm³ of solvent is placed in a flask of such size that the liquid is about 4 cm deep. The liquid is rapidly stirred, and vacuum is applied intermittently through a liquid N₂ trap until the permanent gas residual pressure drops to 5 microns.

Solubility Determination. The degassed solvent is passed in a thin film down a glass helical tube containing solute gas plus the solvent vapor at a total pressure of one atm. The volume of gas absorbed is found by difference between the initial and final volumes in the buret system. The solvent is collected in a tared flask and weighed.

SOURCE AND PURITY OF MATERIALS:
(1) Carbon dioxide. Either Air Products & Chemicals, Inc., or Matheson Co., Inc. 99 mol per cent or better.
(2) 1,3-Dimethylbenzene. Phillips Petroleum Co. Pure grade.

ESTIMATED ERROR:
\[
\begin{align*}
\delta T/K &= 0.03 \\
\delta P/mmHg &= 0.5 \\
\delta x_J/x_J &= 0.005
\end{align*}
\]

REFERENCES:
COMPONENTS:

1. Carbon dioxide; CO₂; [124-38-9]
2. 1,3-Dimethylbenzene (m-xylene); C₆H₁₀; [108-38-3]

VARIABLES:

\[ T/K = 298 \text{ or } 300 \]
\[ P/kPa = 101.3 \]

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>Henry's constant /atm</th>
<th>Mole fraction of carbon dioxide in liquid, ( \chi_{CO₂} )†</th>
</tr>
</thead>
<tbody>
<tr>
<td>298</td>
<td>94</td>
<td>0.0106</td>
</tr>
<tr>
<td>300</td>
<td>95</td>
<td>0.0105</td>
</tr>
</tbody>
</table>

†at a partial pressure of carbon dioxide of 1 atmosphere calculated by compiler assuming \( \phi = 0.995 \).

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Gas chromatographic analysis of a saturated solution at barometric pressure. Henry's constants determined from formula

\[ H = (p - pₚ)\phi(m + 1)/m \]

where \( p \) is the total pressure, \( pₚ \) the vapor pressure of the solvent and \( \phi \) is the fugacity coefficient of the gas. The mole ratio, \( m \), is defined by

\[ m = \frac{\text{Moles of carbon dioxide in gas phase}}{\text{Moles of carbon dioxide in liquid phase}} \]

SOURCE AND PURITY OF MATERIALS:

1. No details given.
2. Purity 99.93 mole per cent.

ESTIMATED ERROR:

\[ \delta T/K = \pm 0.25; \quad \delta p/\text{atm} = \pm 3\% \]

(estimated by compiler).

REFERENCES:
COMPONENTS:
(1) Carbon dioxide; CO₂; [124-38-9]
(2) 1,4-Dimethylbenzene or p-xylene; C₈H₁₀; [106-42-3]

ORIGINAL MEASUREMENTS:
Byrne, J. E.; Battino, R.; Wilhelm, E.

VARIABLES:
T/K: 288.17 - 313.13
p₁/kPa: 101.325 (1 atm)

PREPARED BY:
H. L. Clever

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>Mol Fraction 10³x₁</th>
<th>Bunsen Coefficient a/cm³(STP)cm⁻³ atm⁻¹</th>
<th>Ostwald Coefficient L/cm³ cm⁻³</th>
</tr>
</thead>
<tbody>
<tr>
<td>288.17</td>
<td>12.54</td>
<td>2.319</td>
<td>2.447</td>
</tr>
<tr>
<td>288.23</td>
<td>12.33</td>
<td>2.280</td>
<td>2.406</td>
</tr>
<tr>
<td>288.55</td>
<td>12.53</td>
<td>2.317</td>
<td>2.448</td>
</tr>
<tr>
<td>298.12</td>
<td>10.87</td>
<td>1.987</td>
<td>2.169</td>
</tr>
<tr>
<td>313.13</td>
<td>9.10</td>
<td>1.636</td>
<td>1.876</td>
</tr>
</tbody>
</table>

The Bunsen coefficients were calculated by the compiler.
The solubility values were adjusted to a carbon dioxide partial pressure of 101.325 kPa (1 atm) by Henry’s law.

Smoothed Data: For use between 288.17 and 313.15 K.

\[ \ln x_1 = -8.3698 + 11.4868/(T/100 \, K) \]

The standard error about the regression line is \(1.15 \times 10^{-4}\).

<table>
<thead>
<tr>
<th>T/K</th>
<th>Mol Fraction 10³x₁</th>
</tr>
</thead>
<tbody>
<tr>
<td>293.15</td>
<td>11.66</td>
</tr>
<tr>
<td>298.15</td>
<td>10.92</td>
</tr>
<tr>
<td>303.15</td>
<td>10.25</td>
</tr>
<tr>
<td>313.15</td>
<td>9.08</td>
</tr>
</tbody>
</table>

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
The solubility apparatus is based on the design of Morrison and Billett (1) and the version used is described by Battino, Evans, and Danforth (2). The degassing apparatus is that described by Battino, Banzhof, Bogan, and Wilhelm (3).

Degassing. Up to 500 cm³ of solvent is placed in a flask of such size that the liquid is about 4 cm deep. The liquid is rapidly stirred, and vacuum is intermittently applied through a liquid N₂ trap until the permanent gas residual pressure drops to 5 microns.

Solubility Determination. The degassed solvent is passed in a thin film down a glass helical tube containing solute gas plus the solvent vapor at a total pressure of one atm. The volume of gas absorbed is found by difference between the initial and final volumes in the buret system. The solvent is collected in a tared flask and weighed.

SOURCE AND PURITY OF MATERIALS:
(1) Carbon dioxide. Either Air Products & Chemicals, Inc., or Matheson Co., Inc. 99 mol per cent or better.
(2) 1,4-Dimethylbenzene. Phillips Petroleum Co. Pure grade. Used as received.

ESTIMATED ERROR:
\[ \delta T/K = 0.01 \]
\[ \delta P/mmHg = 0.5 \]
\[ \delta x₁/x₁ = 0.001 \]

REFERENCES:
1. Carbon dioxide; CO₂; [124-38-9]
2. Dimethylbenzene; C₆H₁₀; [1330-20-7]

VARIABLES:

\[ P/kPa = 101.3 \]
\[ T/K = 293.15 \]

EXPERIMENTAL VALUES:

\[
\begin{array}{ccc}
T/K & \text{Absorption} & x_{CO₂} \text{ at } P_{CO₂} = 101.3 \text{ kPa}^* \\
293.15 & 3.96 & 0.0109
\end{array}
\]

*calculated by the compiler.

The compiler has assumed that a mixture of dimethylbenzene isomers was used for the experiment and has taken the density of the solvent to be the average of the values for the three isomers.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The solubility of carbon dioxide was measured by a saturation method as described in ref. (1). Carbon dioxide was passed through the solvent and the final concentration in the solution was measured by a titration method as described in ref. (2).

SOURCE AND PURITY OF MATERIALS:

1. Obtained from a pressure vessel. Purity at least 99%.
2. Technical grade material.

REFERENCES:

COMPONENTS:
(1) Carbon dioxide; CO₂; [124-38-9]
(2) (1-Methylethyl)-benzene or isopropyl benzene or cumene; C₉H₁₂; [98-82-8]

ORIGINAL MEASUREMENTS:
Just, G.
Z. Phys. Chem. 1901, 37, 342 - 367.

VARIABLES:
T/K = 288.15 - 298.15
p₁/kPa = 101.325 (1 atm)

PREPARED BY:
M. E. Derrick
H. L. Clever

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>Mol Fraction 10⁻³x₁</th>
<th>Bunsen Coefficient a/cm³ (STP)cm⁻³ atm⁻¹</th>
<th>Ostwald Coefficient L/cm³ cm⁻³</th>
</tr>
</thead>
<tbody>
<tr>
<td>288.15</td>
<td>11.48</td>
<td>1.88</td>
<td>1.978</td>
</tr>
<tr>
<td>293.15</td>
<td>10.78</td>
<td>1.75</td>
<td>1.879</td>
</tr>
<tr>
<td>298.15</td>
<td>10.11</td>
<td>1.63</td>
<td>1.782</td>
</tr>
</tbody>
</table>

The author measured the Ostwald coefficient at a pressure of about 746 mmHg. The compiler assumed the Ostwald coefficient to be independent of pressure, and calculated the mole fraction and Bunsen coefficient values at 101.325 kPa (1 atm) partial pressure of the gas.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
An Ostwald apparatus as modified by Timofejew (1), and Steiner (2) is used. The apparatus consists of a gas buret, an absorption flask, and a mercury manometer. The system is thermostated with a water jacket.

The gas is introduced into the degassed liquid. The gas volume absorbed is determined by the gas buret. The solvent volume is determined at the end of the experiment by pouring the solvent into a graduated flask.

SOURCE AND PURITY OF MATERIALS:
(1) Carbon dioxide. Generated in a Kipp apparatus using marble and hydrochloric acid.
(2) (1-Methylethyl)-benzene. No information.

ESTIMATED ERROR:
δ L/L = 0.03 (compiler)

REFERENCES:
1. Timofejew, W.
Z. Phys. Chem. 1890, 6, 141.
2. Steiner, P.
COMPONENTS:
1. Carbon dioxide; CO₂; [124-38-9]
2. 1,1'-Methylenebisbenzene;
   (Diphenyl methane); C₁₃H₁₂;
   [101-81-5]

VARIABLES:
\[ T/K = 300-475 \]

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>Henry's Constant [^{a}] /atm</th>
<th>Mole fraction [^{b}] of carbon dioxide at 1 atm partial pressure, [^{c}]CO₂</th>
</tr>
</thead>
<tbody>
<tr>
<td>300</td>
<td>123.0</td>
<td>0.00813</td>
</tr>
<tr>
<td>325</td>
<td>161.0</td>
<td>0.00621</td>
</tr>
<tr>
<td>350</td>
<td>196.0</td>
<td>0.00510</td>
</tr>
<tr>
<td>375</td>
<td>228.0</td>
<td>0.00439</td>
</tr>
<tr>
<td>400</td>
<td>259.0</td>
<td>0.00386</td>
</tr>
<tr>
<td>425</td>
<td>287.0</td>
<td>0.00348</td>
</tr>
<tr>
<td>450</td>
<td>309.0</td>
<td>0.00324</td>
</tr>
<tr>
<td>475</td>
<td>306.0</td>
<td>0.00327</td>
</tr>
</tbody>
</table>

\[^{a}\] Authors stated measurements were made at several pressures and values of solubility used were all within the Henry's-Law region.

\[^{b}\] Calculated by compiler assuming linear relationship between mole fraction and pressure.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE
Volumetric apparatus similar to that described by Dymond and Hildebrand (1). Pressure measured with a null detector and precision gauge. Details in ref. (2).

SOURCE AND PURITY OF MATERIALS:
Solvent degassed, no other details given.

ESTIMATED ERROR:
\[ \delta T/K = \pm 0.1; \delta x_{CO₂} = \pm 1\% . \]

REFERENCES:
1. Dymond, J.; Hildebrand J.H.
2. Cukor, P.M.; Prausnitz, J.M.
### COMPONENTS:
1. Carbon dioxide; CO₂; [124-38-9]
2. Diphenylmethane (1,1'-methylene-bisbenzene); C₁₂H₁₂; [101-81-5]

### ORIGINAL MEASUREMENTS:
Horvath, M. J.; Sebastian, H. M.; Chao, K.-C.

### VARIABLES:
- \( T/K = 300 \)
- \( P/kPa = 101.3 \)

### EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>( T/K )</th>
<th>Henry's constant /atm</th>
<th>Mole fraction of carbon dioxide in liquid, ( x_{CO₂} )†</th>
</tr>
</thead>
<tbody>
<tr>
<td>300</td>
<td>124</td>
<td>0.0080</td>
</tr>
</tbody>
</table>

† at a partial pressure of carbon dioxide of 1 atmosphere calculated by compiler assuming \( \phi = 0.995 \).

### AUXILIARY INFORMATION

**METHOD/APPARATUS/PROCEDURE:**
Gas chromatographic analysis of a saturated solution at barometric pressure. Henry's constants determined from formula

\[
H = (p - p_o)\phi(m + 1)/m
\]

where \( p \) is the total pressure, \( p_o \) the vapor pressure of the solvent and \( \phi \) is the fugacity coefficient of the gas. The mole ratio, \( m \), is defined by

\[
m = \frac{\text{Moles of carbon dioxide in gas phase}}{\text{Moles of carbon dioxide in liquid phase}}
\]

**SOURCE AND PURITY OF MATERIALS:**
1. No details given.
2. Purity 99.06 mole per cent.

**ESTIMATED ERROR:**
\( \delta T/K = \pm 0.25; \delta P/atm = \pm 3\% \)
(estimated by compiler).

**REFERENCES:**
COMPONENTS:
1. Carbon dioxide; CO\textsubscript{2}; [124-38-9]
2. 1,1'-Methylenebis(methylbenzene), (ditolyl methane); C\textsubscript{14}H\textsubscript{16}; [1335-47-3]

VARIABLES:

\begin{align*}
T/\text{K} &= 293-393 \\
P/\text{kPa} &= 101.3
\end{align*}

EXPERIMENTAL VALUES:

\begin{tabular}{cccc}
\text{t/°C} & \text{T/K} & \text{Bunsen coefficient} & \text{Mole fraction at partial pressure of 1 atm.}^* \\
20 & 293 & 131.63 & 0.01165 \\
50 & 323 & 93.63 & 0.008314 \\
70 & 343 & 77.40 & 0.006883 \\
120 & 393 & 47.83 & 0.004265 \\
\end{tabular}

\* Calculated by compiler assuming the ideal gas law and the molar volume of component 2 is 200.7 cm\textsuperscript{3} mol\textsuperscript{-1}

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE

Single pass flow system. In which sample of solvent was saturated with gas at or near atmospheric pressure. Sample of solvent withdrawn and analysed using gas chromatography fitted with thermal conductivity detector.

SOURCE AND PURITY OF MATERIALS:

1. Purity at least 99.8 per cent by volume.
2. Technical grade to TU 3810298-76 standard.

ESTIMATED ERROR:

$\delta T/\text{K} = \pm 0.5$; $\delta x/x = \pm 0.10$

REFERENCES:

ORIGINAL MEASUREMENTS:
Glazunova, T.V.; Ryabov, M.I.; Lipshtein, R.A.
COMPONENTS:
1. Carbon dioxide; $\text{CO}_2$; [124-38-9]
2. (1-Methylethyl)-1,1'-biphenyl, (monoisopropylbiphenyl); $\text{C}_{14}\text{H}_{17}$; [25640-78-2]

VARIABLES:
$T/\text{K} = 293-473$
$P/\text{kPa} = 500-6000$

EXPERIMENTAL VALUES:
The author has plotted graphs of absorption of gas (vol. of gas*/vol. solvent) against pressure at temperatures of 20, 100 and 200°C. The points for 20°C fall on a straight line passing through the origin. Points for the other temperatures are scattered. The compiler has estimated absorption at a pressure of 101.3 kPa and 20°C from the graph.

<table>
<thead>
<tr>
<th>$P/\text{kPa}$</th>
<th>$T/\text{K}$</th>
<th>vol.gas/vol.solvent</th>
<th>$X_{\text{CO}_2}$*</th>
</tr>
</thead>
<tbody>
<tr>
<td>101.3</td>
<td>293.2</td>
<td>1.35</td>
<td>0.0113</td>
</tr>
</tbody>
</table>

* the compiler considers that volumes of gas have been corrected to 1.013 kPa and 273.15 K.

† calculated by the compiler. The density of the solvent was assumed to be 1.048 g cm$^{-3}$. This is the value for 3-ethylbiphenyl at 273.2 K.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
The author has given details of absorption apparatus for use at high pressures. Gas under test was introduced from a gas cylinder into the absorption cell containing the liquid under test. A sample of solution could be withdrawn and the volume of absorbed gas measured when the system had reached equilibrium.

SOURCE AND PURITY OF MATERIALS:
No information

ESTIMATED ERROR:
Experimental points on graph accurate to ±10% (author)

REFERENCES:
COMPONENTS:

1. Carbon dioxide; CO₂; [124-38-9]
2. 1-Methylnaphthalene; C₁₁H₁₀; [90-12-0]

VARIABLES:

\[ T/K = 298.6-330.2 \]

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>Henry’s constant /atm of carbon dioxide</th>
<th>Mole fraction a of carbon dioxide</th>
<th>T/K</th>
<th>Henry’s constant /atm of carbon dioxide</th>
<th>Mole fraction a of carbon dioxide</th>
</tr>
</thead>
<tbody>
<tr>
<td>298.6</td>
<td>147.75</td>
<td>0.0067682</td>
<td>316.2</td>
<td>180.78</td>
<td>0.0055316</td>
</tr>
<tr>
<td>298.6</td>
<td>149.80</td>
<td>0.0066756</td>
<td>316.2</td>
<td>183.29</td>
<td>0.0054558</td>
</tr>
<tr>
<td>298.6</td>
<td>149.24</td>
<td>0.0067006</td>
<td>316.2</td>
<td>181.10</td>
<td>0.0052268</td>
</tr>
<tr>
<td>302.7</td>
<td>157.04</td>
<td>0.0063678</td>
<td>320.2</td>
<td>191.32</td>
<td>0.0051337</td>
</tr>
<tr>
<td>304.3</td>
<td>159.32</td>
<td>0.0062767</td>
<td>323.6</td>
<td>194.79</td>
<td>0.0051337</td>
</tr>
<tr>
<td>307.1</td>
<td>163.75</td>
<td>0.0061069</td>
<td>323.6</td>
<td>198.42</td>
<td>0.0050398</td>
</tr>
<tr>
<td>307.1</td>
<td>165.48</td>
<td>0.0060430</td>
<td>323.6</td>
<td>195.13</td>
<td>0.0051248</td>
</tr>
<tr>
<td>307.1</td>
<td>164.18</td>
<td>0.0060909</td>
<td>330.2</td>
<td>210.85</td>
<td>0.0047427</td>
</tr>
<tr>
<td>311.0</td>
<td>172.37</td>
<td>0.0058015</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\[ a \]

Calculated by compiler for a partial pressure of 1 atm.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Volumetric apparatus similar to that described in ref.(1). Known amount of carbon dioxide brought into contact with known amount of solvent. Reduction in pressure measured.

SOURCE AND PURITY OF MATERIALS:

1. Linde "bone dry" grade.
2. Fisher certified grade.

ESTIMATED ERROR:

REFERENCES:

COMPONENTS:
1. Carbon dioxide; CO₂; [124-38-9]
2. 1-Methylnaphthalene; C₁₁H₁₀; [90-12-0]

ORIGINAL MEASUREMENTS:
Horvath, M. J.; Sebastian, H. M.; Chao, K.-C.

VARIABLES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>P/kPa</th>
</tr>
</thead>
<tbody>
<tr>
<td>300</td>
<td>101.3</td>
</tr>
</tbody>
</table>

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>Henry's constant /atm</th>
<th>Mole fraction of carbon dioxide in liquid, x_CO₂</th>
</tr>
</thead>
<tbody>
<tr>
<td>300</td>
<td>151</td>
<td>0.00659</td>
</tr>
</tbody>
</table>

† at a partial pressure of carbon dioxide of 1 atmosphere calculated by compiler assuming φ = 0.995.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Gas chromatographic analysis of a saturated solution at barometric pressure. Henry's constants determined from formula

\[ H = (p - p_o)\phi(m + 1)/m \]

where p is the total pressure, pₒ the vapor pressure of the solvent and φ is the fugacity coefficient of the gas. The mole ratio, m, is defined by

\[ m = \frac{\text{Moles of carbon dioxide in gas phase}}{\text{Moles of carbon dioxide in liquid phase}} \]

SOURCE AND PURITY OF MATERIALS:

1. No details given.
2. Purity 99.51 mole per cent.

ESTIMATED ERROR:

\[ \delta T/K = \pm 0.25; \quad \delta P/\text{atm} = \pm 3\% \]

(estimated by compiler).

REFERENCES:
COMPONENTS:

1. Carbon dioxide; $\text{CO}_2$; [124-38-9]
2. Alcohols

EVALUATOR:

Peter G.T. Fogg,
School of Applied Chemistry,
Polytechnic of North London,
Holloway Road, London, N7 8DB, U.K.
July 1991

CRITICAL EVALUATION:

Solubility of carbon dioxide in alcohols.

Measurements by Makranczy et al. (1) indicate that mole fraction solubilities in straight chain primary alkanols at 298.2 K and a partial pressure of carbon dioxide of 101.3 kPa increase linearly with carbon number from methanol to dodecanol. This trend has not been confirmed by other workers. In cases where comparison is possible, the higher the carbon number the greater the divergence of Makranczy's data from other data which are available (Fig. 1).

Shenderei et al. (2) published values of the solubility in methanol from 13.33 kPa to 101.3 kPa at 194.5 K to 273.2 K. These measurements show linear variation of mole fraction solubility with pressure at every temperature even to a value of 0.25 at 194.5 K and 93.33 kPa. Linear variation to such a high value appears to be inconsistent with the measurements at high pressures and higher temperatures by Krichevskii and Lobedeva (3). These authors found that mole fraction solubility curves at constant temperature were convex towards the pressure axis.

Values of the mole fraction solubility at a partial pressure of 101.3 kPa may be found from published data for 202.6 K to 307.2 K (1-14). Values for 293.2 range from 0.00602 (6) to 0.00719 (7) and for 298.2 from 0.00560 (6) to 0.00635 (10). The evaluator recommends the smoothing equation for mole fraction solubilities at a partial pressure of 101.3 kPa which is given below. This is based upon ten of the papers (2-4,7-10,13,14).

$$\ln x_{\text{CO}_2} = -49.919 + 3484.7/(T/K) + 5.8265 \ln (T/K)$$

Temperature range = 202.6-323.0 K
Standard deviation in $x_{\text{CO}_2}$ = 0.00139

Solubility in ethanol at a partial pressure of 101.3 kPa in the temperature range 212.7 K to 333.4 K has been published in at least nine papers (1,2,4,6,10-12,15,16). Shenderei et al. (2) measured the solubility in ethanol from 13.33 kPa to 101.3 kPa at 212.7 K to 248.0 K. Data are self consistent and there is no reason to doubt the reliability. The value of the mole fraction solubility at 298.15 ranges from 0.00624 (Takahashi et al. (16)) to 0.00728 (Won et al. (11)). Takahashi calculated solubility from the rate of absorption of gas. The method is an interesting one but is likely to be less reliable than conventional methods. Kunerth's measurements (6) from 291.2 K to 307.2 K may again be too low. The evaluator considers that measurements by Cargill and MacPhee (15) to be the most reliable in the temperature range 277.9 K to 333.4 K. These measurements agree with the solubility at 298.15 K measured by Won et al. (11) and are close to measurements by Kosakewitsch (12), Makranczy et al. (1) and by Luhring and Schumpe (4). The only measurements below 277 K are by Shenderei et al. (2). These appear to be consistent with measurements at higher temperatures and can be tentatively recommended.

The following equation for mole fraction solubility at a partial pressure of 101.3 kPa is based upon measurements by Cargill and MacPhee and by Won et al.

$$\ln x_{\text{CO}_2} = -22.278 + 2027.1/(T/K) + 1.8521 \ln (T/K)$$

Temperature range = 277.9-333.4 K
Standard deviation in $x_{\text{CO}_2}$ = 1.56 x 10^-5
Fig. 1  Values from various sources of the mole fraction solubility of carbon dioxide in straight chain primary alkanols at 298.15 K and a partial pressure of gas of 101.3 kPa.

- □ from the smoothing equations given by the evaluator
- X Makranczy et al. (1)
- ▲ Dim et al. (21)
- △ Wilcock et al. (20)
CRITICAL EVALUATION:

The equation given below for mole fraction solubility at a partial pressure of 101.3 kPa is based upon measurements by Cargill and MacPhee, by Won et al., and by Shenderei et al.

\[ \ln x_{CO_2} = -56.735 + 3560.0/(T/K) + 6.9952 \ln(T/K) \]

temperature range = 212.7-333.4 K
standard deviation in \( x_{CO_2} \) = 0.00038

Solubility in 1-propanol was measured by Shenderei et al.(2) from 13.3 kPa to 101.3 kPa at 212.7 K to 248.0 K. There is no reason to doubt the reliability but no similar measurements in this temperature and pressure range are available for comparison. Tokunaga (17) reported Ostwald coefficients and Henry's constants measured at or close to 101.3 kPa from 283.2 K to 313.2 K. Mole fraction solubility at 298.2 K is available from work by Macranczy et al.(1), Takahashi et al.(16) and Just (10). These values range from 0.00470 (Takahashi) to 0.00782 (Makranczy). The interpolated value from Tokunaga's work is 0.00679. Takahashi used a method which depended upon measuring absorption rates and the value is much too low. Measurements by Makranczy et al. for primary alkanols show a trend which differs from that shown by other measurements. The equation for mole fraction solubility given below and based upon measurements by Shenderei et al. and by Tokunaga et al. is recommended on a provisional basis, i.e.

\[ \ln x_{CO_2} = -52.708 + 3312.9/(T/K) + 6.4248 \ln(T/K) \]

temperature range = 212.7-313.2 K
standard deviation in \( x_{CO_2} \) = 0.00028

Solubility in 2-propanol was also measured by Shenderei et al.(2) from 13.3 kPa to 101.3 kPa at 212.7 K to 248.0 K. Again there is no reason to doubt the reliability of these measurements but no other measurements in this temperature and pressure range are available for comparison. Tokunaga (17) measured the solubility in this solvent at about 101.3 kPa in the temperature range 283.2 K to 313.2 K. A measurement at 293.2 K by Luhring and Schumpe (4) corresponds to a mole fraction solubility of 0.00720. The value from Tokunaga's work is 0.00685.

An equation for mole fraction solubility at a partial pressure of 101.3 kPa which is based upon measurements by Shenderei et al. and by Tokunaga is recommended on a provisional basis, i.e.

\[ \ln x_{CO_2} = -83.277 + 4450.3/(T/K) + 11.112 \ln(T/K) \]

temperature range = 212.7-313.2 K
standard deviation in \( x_{CO_2} \) = 0.00032

Shenderei et al.(2) measured solubility in 1-butanol from 13.3 kPa to 101.3 kPa at 212.7 K to 248.0 K. The data is self consistent but no other measurements under these conditions are available for comparison. The solubility reported by Makranczy et al.(1) corresponds to a mole fraction of 0.008832 at 298.15 K and a partial pressure of 101.3 kPa. Luhring and Schumpe's data (4) correspond to a mole fraction solubility of 0.00781 at 293.15 K and a partial pressure of 101.3 kPa. This latter value is not compatible with Makranczy's data. The evaluator considers that Luhring's value is more likely to be reliable. The following smoothing equation based upon measurements by Shenderei et al. and by Luhring and Schumpe is
COMPONENTS:

1. Carbon dioxide; CO₂; [124-38-9]
2. Alcohols

EVALUATOR:

Peter G.T. Fogg,
School of Applied Chemistry,
Polytechnic of North London,
Holloway Road, London, N7 8DB, U.K.
July 1991

CRITICAL EVALUATION:

recommended on a tentative basis until further measurements on the system are available.

\[ \ln x_{CO_2} = -52.475 + \frac{3272.5}{(T/K)} + 6.4171 \ln(T/K) \]

temperature range = 212.7-293.2 K
standard deviation in \( x_{CO_2} \) = 0.00038

Shenderei et al.(2) measured the solubility in 2-methyl-1-propanol from 13.3 kPa to 101.3 kPa at 212.7 K to 248.0 K. The data is self consistent but no other measurements at these temperatures and pressures are available for comparison. Battino et al.(18) measured solubility at 101.3 kPa from 274.0 K to 328.0 K. Battino's measurements are in satisfactory agreement with earlier measurements by Just (10) from 288.2 K to 298.2 K. Takahashi et al.(16) estimated the solubility from absorption studies. Their data correspond to a mole fraction solubility of 0.00628 at 298.2 compared with a value of 0.00697 from Battino and 0.0698 from Just.

The following equation based upon data from Battino et al. and from Just is recommended as likely to be reliable.

\[ \ln x_{CO_2} = -7.5561 + \frac{1195.7}{(T/K)} - 0.24941 \ln(T/K) \]

temperature range = 274.0-328.0 K
standard deviation in \( x_{CO_2} \) = 9.7 \times 10^{-5}

The following equation based upon data from Shenderei et al., Battino et al. and from Just can be accepted on a tentative basis.

\[ \ln x_{CO_2} = -75.542 + \frac{4061.4}{(T/K)} + 9.9928 \ln(T/K) \]

temperature range = 212.7-328.0 K
standard deviation in \( x_{CO_2} \) = 0.00055

Shenderei et al.(2) measured solubility in 2-butanol from 13.3 kPa to 101.3 kPa at 211.7 K to 248.0 K. The data is self consistent. No other measurements of solubility of carbon dioxide in this solvent are available for comparison.

Solubility in 1-pentanol has been measured by Just (10) in the range 288.2 K to 298.2 K and by Pedrosa et al.(19) in the range 288.2 K to 318.2 K. There is good agreement between the two sets of measurements. A smoothing equation for mole fraction solubility at a partial pressure of 101.3 kPa based on these two sets of measurements is given below.

Solubility reported by Makranczy et al.(1) for 298.15 K seems to be too high.

\[ \ln x_{CO_2} = -119.31 + \frac{6103.7}{(T/K)} + 16.5011 \ln(T/K) \]

temperature range = 288.3-318.2 K
standard deviation in \( x_{CO_2} \) = 5.9 \times 10^{-5}

Kunerth (6) published values of the solubility in 3-methyl-1-butanol at 101.3 kPa for 293.2 K to 307.2 K. These are close to values for 1-pentanol discussed above. A smoothing equation for mole fraction solubility at a partial pressure of 101.3 kPa is given below. It should be noted that values of solubility in methanol and in ethanol published in
COMPONENTS:
1. Carbon dioxide; \(\text{CO}_2\);
   \([124-38-9]\)
2. Alcohols

EVALUATOR:
Peter G.T. Fogg,
School of Applied Chemistry,
Polytechnic of North London,
Holloway Road, London, N7 8DB, U.K.
July 1991

CRITICAL EVALUATION:

the same paper are slightly low in comparison with values measured more recently.

\[
\ln x_{\text{CO}_2} = 9.5281 + 390.83/(T/\text{K}) - 2.7484\ln(T/\text{K})
\]

temperature range = 293.2-307.2 K
standard deviation in \(x_{\text{CO}_2}\) = 3.6 \times 10^{-5}

Solubilities in 1-hexanol and 1-heptanol have been published by Makranczy \(\text{et al.}\). \(\text{Solubility in 1-heptanol has also been measured by Dim \text{et al.}\). Values from both sources are high compared with solubilities in other alkanols (Fig 1).

The solubility in 1-octanol at a partial pressure of 101.3 kPa was measured by Wilcock \(\text{et al.}\) from 282.7 K to 313.6 K. Solubilities at 298.2 K reported by Makranczy \(\text{et al.}\) and by Dim \(\text{et al.}\) are high in comparison with Wilcock's measurements. Takahashi \(\text{et al.}\) published a value at 298 K from a study of the rate of absorption of gas. This value is unlikely to be reliable and is low relative to Wilcock's values. Measurements by Wilcock \(\text{et al.}\) are recommended on a provisional basis.

The solubility in 1-nonanol has been published by Makranczy \(\text{et al.}\). Solubility of 1-octanol was measured by Wilcock \(\text{et al.}\) from 282.7 K to 313.5 K and a partial pressure of 101.3 kPa. The data can be recommended on a provisional basis. Makranczy \(\text{et al.}\) published a value for 298.2 K which is very high in comparison with Wilcock's value (Fig 1).

Makranczy \(\text{et al.}\) measured solubility in 1-undecanol and 1-dodecanol at 298.2 K (Fig 1).

Solubility in an equimolar mixture of 1-decanol and 1-dodecanol was measured by Luther and Hiemenz (22) from 293.2 K to 355.2 K. The mole fraction solubility at 293.2 K and a partial pressure of 101.3 kPa is given as 0.0107 compared with a value for the solubility in pure 1-decanol of 0.0106 from measurements by Wilcock \(\text{et al.}\).

The solubility in cyclohexanol was measured by Begley \(\text{et al.}\) at a partial pressure of 101.3 kPa from 298.3 K to 321.0 K. The value of the mole fraction solubility at 298.3 K is 0.0044 which may be compared with a value of 0.00286 from much earlier measurements by Cauquil (24). Begley's measurements are likely to be the more reliable. It is clear that mole fraction solubility in cyclohexanol is much lower than solubility in 1-hexanol or in cyclohexane under similar conditions.

The solubility in benzene methanol to high pressures was measured by Emel'yanova \(\text{et al.}\) over the temperature range 323.2 K to 398.2 K. Solubility at a partial pressure of 101.3 kPa can be estimated from the data. Extrapolation to 298.2 K and a partial pressure of 101.3 kPa gives a value of the mole fraction solubility of about 0.0044. This is in contrast to the value of 0.00781 estimated from measurements of the limiting value of Henry's constant measured by gas-liquid chromatography and reported by Lencox \(\text{et al.}\). Surface adsorption can give erroneous values of Henry's constants measured by chromatography. Mole fraction solubility at a partial pressure of 101.3 kPa from Emel'yanova's measurements can be provisionally recommended in the absence of measurements conducted at barometric pressure.

Mole fraction solubilities in dihydric alkanols are lower than in monohydric alkanols. The mole fraction solubility at a partial pressure of 101.3 kPa in 1,2-ethanediol from work by Byeseda \(\text{et al.}\) is 0.0031 at 297.1 K and from work by Hayduk and Malik (29) is 0.0022 at 298.2 K.
COHPONENTS:

1. Carbon dioxide; CO₂; [124-38-9]
2. Alcohols

EVALUATOR:
Peter G.T. Fogg,
School of Applied Chemistry,
Polytechnic of North London,
Holloway Road, London, N7 8DB, U.K.
July 1991

CRITICAL EVALUATION:
The value at 298.2 K from chromatographic measurements by Lenoir et al. (26) is 0.00382. The corresponding value for ethanol is 0.00725. Further work on the system is required before a solubility value can be recommended.

Semenova et al. (28) measured the solubility in butane-1,4-diol to high pressures at 323.2 K to 398.2 K. Data can be extrapolated to 101.3 kPa. Further extrapolation to 298.2 K and 101.3 kPa indicates a mole fraction solubility of about 0.00395 compared with a value of 0.00717 for 1-butanol. Semenova's data may be accepted on a provisional basis until there is confirmation by other workers.

Just (10) measured solubility in 1,2,3-propanetriol at 298.2 K. Measurements indicate a mole fraction solubility of 0.0000903 at 101.3 kPa. Such a low value must be treated with suspicion until it has been confirmed by other workers.

A selection of mole fraction solubilities in alcohols is given in Table 1.

REFERENCES
COMPONENTS:

1. Carbon dioxide; CO₂; [124-38-9]
2. Alcohols

CRITICAL EVALUATION:


EVALUATOR:

Peter G.T. Fogg, School of Applied Chemistry, Polytechnic of North London, Holloway Road, London, N7 8DB, U.K.
July 1991
COMPONENTS:

1. Carbon dioxide; CO₂; [124-38-9]
2. Alcohols

EVALUATOR:

Peter G.T. Fogg,
School of Applied Chemistry,
Polytechnic of North London,
Holloway Road, London, N7 8DB, U.K.

July 1991

CRITICAL EVALUATION:

Table 1.
Solubility of carbon dioxide at a partial pressure of 101.3 kPa in alcohols.

<table>
<thead>
<tr>
<th>Solvent</th>
<th>T/K</th>
<th>X_{CO₂}</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Methanol</td>
<td>298.15</td>
<td>0.006511 ±0.00139</td>
<td>*</td>
</tr>
<tr>
<td>Ethanol</td>
<td>298.15</td>
<td>0.007251 ±0.000016</td>
<td>*</td>
</tr>
<tr>
<td>1-Propanol</td>
<td>298.15</td>
<td>0.00680 ±0.00038</td>
<td>*</td>
</tr>
<tr>
<td>2-Propanol</td>
<td>298.15</td>
<td>0.00654</td>
<td>17</td>
</tr>
<tr>
<td>1-Butanol</td>
<td>298.15</td>
<td>0.00718 ±0.00038</td>
<td>* †</td>
</tr>
<tr>
<td>2-Methyl-1-propanol</td>
<td>298.15</td>
<td>0.006966 ±0.000097</td>
<td>*</td>
</tr>
<tr>
<td>1-Pentanol</td>
<td>298.15</td>
<td>0.008050 ±0.000059</td>
<td>*</td>
</tr>
<tr>
<td>3-Methyl-1-butanol</td>
<td>298.15</td>
<td>0.008064 ±0.000036</td>
<td>6</td>
</tr>
<tr>
<td>1-Octanol</td>
<td>298.15</td>
<td>0.00938</td>
<td>20</td>
</tr>
<tr>
<td>1-Decanol</td>
<td>298.15</td>
<td>0.00973</td>
<td>20</td>
</tr>
<tr>
<td>Cyclohexanol</td>
<td>298.25</td>
<td>0.00442</td>
<td>23</td>
</tr>
<tr>
<td>1,2-Ethanediol</td>
<td>298.15</td>
<td>0.00382</td>
<td>26</td>
</tr>
<tr>
<td></td>
<td>297.1</td>
<td>0.00306</td>
<td>27</td>
</tr>
<tr>
<td></td>
<td>298.15</td>
<td>0.00220</td>
<td>29</td>
</tr>
</tbody>
</table>

* from the equation given by the evaluator on a previous page
† extrapolated.
COMPONENTS:
(1) Carbon dioxide; CO₂; [124-38-9]
(2) Methanol; CH₄O; [67-56-1]

ORIGINAL MEASUREMENTS:
Just, G.
Z. Phys. Chem. 1901, 37, 342 - 367.

VARIABLES:
\[ T/K = 288.15 - 298.15 \]
\[ P_j/kPa = 101.325 \text{ (1 atm)} \]

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>( T/K )</th>
<th>Mol Fraction ( 10^{-3} \xi_j )</th>
<th>Bunsen Coefficient ( a/cm^3 \text{(STP)}cm^{-3} \text{atm}^{-1} )</th>
<th>Ostwald Coefficient ( L/cm^3 \text{cm}^{-3} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>288.15</td>
<td>7.78</td>
<td>4.37</td>
<td>4.606</td>
</tr>
<tr>
<td>293.15</td>
<td>7.03</td>
<td>3.92</td>
<td>4.205</td>
</tr>
<tr>
<td>298.15</td>
<td>6.35</td>
<td>3.52</td>
<td>3.837</td>
</tr>
</tbody>
</table>

The author measured the Ostwald coefficient at a pressure of about 746 mmHg. The compiler assumed the Ostwald coefficient to be independent of pressure, and calculated the mole fraction and Bunsen coefficient values at 101.325 kPa (1 atm) partial pressure of the gas.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
An Ostwald apparatus as modified by Timofejew (1), and Steiner (2) is used. The apparatus consists of a gas buret, an absorption flask, and a mercury manometer. The system is thermostated with a water jacket.

The gas is introduced into the degassed liquid. The gas volume absorbed is determined by the gas buret. The solvent volume is determined at the end of the experiment by pouring the solvent into a graduated flask.

SOURCE AND PURITY OF MATERIALS:
(1) Carbon dioxide. Generated in a Kipp apparatus using marble and hydrochloric acid.
(2) Methanol. No information.

ESTIMATED ERROR:
\[ \delta L/L = 0.03 \text{ (compiler)} \]

REFERENCES:
1. Timofejew, W.
   Z. Phys. Chem. 1890, 8, 141.
2. Steiner, P.
COMPONENTS:
1. Carbon dioxide; CO₂; [124-38-9]
2. Alkanols

VARIABLES:
T/K = 291.15-307.15  P/kPa = 101.3

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>Solvent</th>
<th>T/K</th>
<th>Ostwald coefficient</th>
<th>x_CO₂ at P_CO₂ = 101.3 kPa*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Methanol; CH₄O; [67-56-1]</td>
<td>291.15</td>
<td>3.63</td>
<td>0.00614</td>
</tr>
<tr>
<td></td>
<td>293.15</td>
<td>3.57</td>
<td>0.00602</td>
</tr>
<tr>
<td></td>
<td>295.15</td>
<td>3.51</td>
<td>0.00589</td>
</tr>
<tr>
<td></td>
<td>297.15</td>
<td>3.44</td>
<td>0.00575</td>
</tr>
<tr>
<td></td>
<td>299.15</td>
<td>3.37</td>
<td>0.00561</td>
</tr>
<tr>
<td></td>
<td>301.15</td>
<td>3.28</td>
<td>0.00544</td>
</tr>
<tr>
<td></td>
<td>303.15</td>
<td>3.19</td>
<td>0.00527</td>
</tr>
<tr>
<td></td>
<td>305.15</td>
<td>3.09</td>
<td>0.00508</td>
</tr>
<tr>
<td></td>
<td>307.15</td>
<td>2.97</td>
<td>0.00486</td>
</tr>
<tr>
<td>Ethanol; C₂H₆O; [64-17-5]</td>
<td>291.15</td>
<td>2.95</td>
<td>0.00719</td>
</tr>
<tr>
<td></td>
<td>293.15</td>
<td>2.87</td>
<td>0.00697</td>
</tr>
<tr>
<td></td>
<td>295.15</td>
<td>2.80</td>
<td>0.00677</td>
</tr>
<tr>
<td></td>
<td>297.15</td>
<td>2.73</td>
<td>0.00657</td>
</tr>
<tr>
<td></td>
<td>299.15</td>
<td>2.66</td>
<td>0.00637</td>
</tr>
<tr>
<td></td>
<td>301.15</td>
<td>2.58</td>
<td>0.00615</td>
</tr>
<tr>
<td></td>
<td>303.15</td>
<td>2.48</td>
<td>0.00589</td>
</tr>
<tr>
<td></td>
<td>305.15</td>
<td>2.41</td>
<td>0.00570</td>
</tr>
<tr>
<td></td>
<td>307.15</td>
<td>2.31</td>
<td>0.00544</td>
</tr>
<tr>
<td>3-Methyl-1-butanol, (isooamy alcohol); C₅H₁₂O; [123-51-3]</td>
<td>293.15</td>
<td>1.91</td>
<td>0.00861</td>
</tr>
<tr>
<td></td>
<td>295.15</td>
<td>1.88</td>
<td>0.00842</td>
</tr>
<tr>
<td></td>
<td>297.15</td>
<td>1.85</td>
<td>0.00823</td>
</tr>
<tr>
<td></td>
<td>299.15</td>
<td>1.81</td>
<td>0.00800</td>
</tr>
<tr>
<td></td>
<td>301.15</td>
<td>1.76</td>
<td>0.00773</td>
</tr>
<tr>
<td></td>
<td>303.15</td>
<td>1.72</td>
<td>0.00750</td>
</tr>
<tr>
<td></td>
<td>305.15</td>
<td>1.69</td>
<td>0.00733</td>
</tr>
<tr>
<td></td>
<td>307.15</td>
<td>1.67</td>
<td>0.00719</td>
</tr>
</tbody>
</table>

* calculated by the compiler

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
The method is based upon that described by McDaniel (1). The apparatus consisted of a gas buret attached to a levelling tube containing mercury and to the absorption cell containing the solvent under test. The volume of gas absorbed by a measured volume of liquid was measured at a total pressure equal to barometric pressure. The mercury in the gas buret was covered with a layer of solvent so that the gas in the buret was saturated with solvent vapor. Buret and absorption cell were surrounded by heating wire and water jackets fitted with thermometers.

SOURCE AND PURITY OF MATERIALS:
1. produced by heating NaHCO₃; dried with CaCl₂; frozen in liquid air and volatile impurities pumped away; passed over P₂O₅.
2. commercial sample; purity attested by boiling point and density.

ESTIMATED ERROR:
δx_CO₂ = ±5% (compiler)

REFERENCES:
1. McDaniel, A.S.;
COMPONENTS:
1. Carbon dioxide; CO₂; [124-38-9]
2. Methanol; CH₄O; [67-56-1]
   Ethanol; C₂H₆O; [64-17-5]

VARIABLES:
\[ T/K = 288.15-296.15 \]
\[ P/kPa = 101.3 \]

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>Solvent</th>
<th>T/K</th>
<th>P/kPa</th>
<th>Solubilityt</th>
<th>Mole fraction 100n(CO₂)/n(alkanol)</th>
<th>Mole fraction solubility* x CO₂</th>
</tr>
</thead>
<tbody>
<tr>
<td>Methanol</td>
<td>288.15</td>
<td>101.3</td>
<td>0.825</td>
<td>0.00818</td>
<td></td>
</tr>
<tr>
<td>ethanol</td>
<td>289.90</td>
<td>101.3</td>
<td>0.813</td>
<td>0.00762</td>
<td></td>
</tr>
<tr>
<td></td>
<td>290.40</td>
<td></td>
<td>0.802</td>
<td>0.00796</td>
<td></td>
</tr>
<tr>
<td></td>
<td>291.65</td>
<td></td>
<td>0.788</td>
<td>0.00782</td>
<td></td>
</tr>
<tr>
<td></td>
<td>294.40</td>
<td></td>
<td>0.750</td>
<td>0.00744</td>
<td></td>
</tr>
<tr>
<td></td>
<td>295.40</td>
<td></td>
<td>0.739</td>
<td>0.00734</td>
<td></td>
</tr>
<tr>
<td></td>
<td>296.15</td>
<td></td>
<td>0.736</td>
<td>0.00731</td>
<td></td>
</tr>
</tbody>
</table>

\[ t \text{ 100} \times \frac{\text{number of moles of CO₂}}{\text{number of moles of alkanol}} \]

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
Carbon dioxide was bubbled through the solvent for two to four days. A portion of the saturated solution was then added to CO₂-free water containing a measured quantity of sodium hydroxide. The mixture of sodium hydroxide and carbonate was then titrated against hydrochloric acid using phenolphthalein as indicator.

Solubilities were corrected to a partial pressure of carbon dioxide of 101.3 kPa.

SOURCE AND PURITY OF MATERIALS:
1. Carbon dioxide was prepared by the action of hydrochloric acid on calcium carbonate. The gas was purified and dried by the usual methods.
2. Alcohols were said to be free of water.

ESTIMATED ERROR:

REFERENCES:
COMPONENTS:

1. Carbon dioxide; CO₂; [124-38-9]
2. Methanol; CH₃OH; [67-56-1]

VARIABLES:

\[ T/K = 273.2 - 323.0 \]
\[ P/kPa = 101.3 \]

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>( T/K )</th>
<th>( P_{CO₂}/kPa )</th>
<th>Solubility of CO₂ ( \text{cm}^3 \text{g}^{-1} ) *</th>
<th>Mole fraction solubility ( x_{CO₂} ) †</th>
</tr>
</thead>
<tbody>
<tr>
<td>273.15</td>
<td>101.3</td>
<td>8.13</td>
<td>0.01157</td>
</tr>
<tr>
<td>298.15</td>
<td>101.3</td>
<td>4.33</td>
<td>0.00620</td>
</tr>
<tr>
<td>322.95</td>
<td>101.3</td>
<td>3.11</td>
<td>0.00446</td>
</tr>
</tbody>
</table>

* volume of gas corrected to 101.3 kPa, 273.15 K dissolved by one gram of methanol
† calculated by the compiler

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Apparatus described in an earlier paper (1). The measurements at 101.3 kPa were part of a study which extended to 6970 kPa.

SOURCE AND PURITY OF MATERIALS:

1. From a commercial source; purity 99.9%
2. Synthetic purified sample; density indicated that the water content did not exceed several tenths of a percent.

ESTIMATED ERROR:

\[ \delta(\text{solubility}) = \pm 1\% \]

REFERENCES:

1. Krichevskii, I.R.; Lebedeva, E.S.
COMPONENTS:
1. Carbon dioxide; CO₂
   [124-38-9]
2. Methanol; CH₄O; [67-56-1]

ORIGINAL MEASUREMENTS:
Gaz. Prom. 1958, 12, 36-42.

VARIABLES:
\[ P/kPa = 13.3-101.3 \]
\[ T/K = 212.7-298.2 \]

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>P/mmHg</th>
<th>P/kPa*</th>
<th>Solubility** ( x_{CO₂} ) cm³g⁻¹</th>
</tr>
</thead>
<tbody>
<tr>
<td>194.5</td>
<td>100</td>
<td>13.33</td>
<td>25.745 0.0358</td>
</tr>
<tr>
<td>300</td>
<td>40.00</td>
<td>83.343</td>
<td>0.1073</td>
</tr>
<tr>
<td>500</td>
<td>66.66</td>
<td>138.647</td>
<td>0.1785</td>
</tr>
<tr>
<td>700</td>
<td>93.33</td>
<td>231.130</td>
<td>0.2500</td>
</tr>
<tr>
<td>202.6</td>
<td>100</td>
<td>13.33</td>
<td>15.743 0.0222</td>
</tr>
<tr>
<td>300</td>
<td>40.00</td>
<td>49.475</td>
<td>0.0666</td>
</tr>
<tr>
<td>500</td>
<td>66.66</td>
<td>90.282</td>
<td>0.1138</td>
</tr>
<tr>
<td>760</td>
<td>101.32</td>
<td>142.523</td>
<td>0.1705</td>
</tr>
<tr>
<td>212.7</td>
<td>100</td>
<td>13.33</td>
<td>9.132 0.0130</td>
</tr>
<tr>
<td>300</td>
<td>40.00</td>
<td>24.383</td>
<td>0.0388</td>
</tr>
<tr>
<td>500</td>
<td>66.66</td>
<td>48.129</td>
<td>0.0649</td>
</tr>
<tr>
<td>760</td>
<td>101.32</td>
<td>74.909</td>
<td>0.0975</td>
</tr>
<tr>
<td>227.9</td>
<td>100</td>
<td>13.33</td>
<td>4.607 0.0066</td>
</tr>
<tr>
<td>300</td>
<td>40.00</td>
<td>13.790</td>
<td>0.0195</td>
</tr>
<tr>
<td>500</td>
<td>66.66</td>
<td>24.034</td>
<td>0.0335</td>
</tr>
<tr>
<td>760</td>
<td>101.32</td>
<td>36.879</td>
<td>0.0505</td>
</tr>
<tr>
<td>240.7</td>
<td>100</td>
<td>13.33</td>
<td>2.715 0.0039</td>
</tr>
<tr>
<td>300</td>
<td>40.00</td>
<td>8.209</td>
<td>0.0117</td>
</tr>
<tr>
<td>500</td>
<td>66.66</td>
<td>14.064</td>
<td>0.0199</td>
</tr>
<tr>
<td>760</td>
<td>101.32</td>
<td>28.870</td>
<td>0.0306</td>
</tr>
<tr>
<td>248.0</td>
<td>100</td>
<td>13.33</td>
<td>1.212 0.00318</td>
</tr>
<tr>
<td>300</td>
<td>40.00</td>
<td>6.672</td>
<td>0.00953</td>
</tr>
<tr>
<td>500</td>
<td>66.66</td>
<td>11.196</td>
<td>0.01589</td>
</tr>
<tr>
<td>760</td>
<td>101.32</td>
<td>17.123</td>
<td>0.02410</td>
</tr>
<tr>
<td>273.2</td>
<td>100</td>
<td>13.33</td>
<td>1.090 0.00157</td>
</tr>
<tr>
<td>300</td>
<td>40.00</td>
<td>3.274</td>
<td>0.00470</td>
</tr>
<tr>
<td>500</td>
<td>66.66</td>
<td>5.371</td>
<td>0.00763</td>
</tr>
<tr>
<td>760</td>
<td>101.32</td>
<td>8.351</td>
<td>0.01190</td>
</tr>
</tbody>
</table>

* calculated by the compiler.

** defined as the volume of gas, corrected to 273.15 K and 101.325 kPa, dissolved by one gram of solvent at the stated temperature and pressure.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
A static method was used. A weighed quantity of solvent was placed in the absorption pipet which was subsequently cooled in a cryostat with automatic temperature control. The solvent was then degassed under vacuum. Liquid lost during this process was collected in an absorption column and weighed so appropriate correction could be made to the weight of solvent. Carbon dioxide was then supplied from a calibrated gas buret. The liquid was stirred by an electromagnetic stirrer until equilibrium was reached.

SOURCE AND PURITY OF MATERIALS:
1. from commercial solid carbon dioxide; purified twice by evaporation, freezing and pumping with a vacuum pump.
2. No information

ESTIMATED ERROR:

REFERENCES:
COMPONENTS:

1. Carbon dioxide; CO₂; [124-38-9]
2. Methanol; CH₄O; [67-56-1]

ORIGINAL MEASUREMENTS:
Usyukin, I.P.; Shleynikov, V.M. 

VARIABLES:

T/K = 203.2-293.2
P/kPa = 101.3

PREPARED BY:
P.G.T. Fogg

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>P/kPa</th>
<th>Volume of gas* /vol. of solvent</th>
<th>Mole fraction solubility xₐₐ₂</th>
</tr>
</thead>
<tbody>
<tr>
<td>293.15</td>
<td>101.3</td>
<td>3.56</td>
<td>0.00644</td>
</tr>
<tr>
<td>283.15</td>
<td></td>
<td>4.86</td>
<td>0.00867</td>
</tr>
<tr>
<td>273.15</td>
<td></td>
<td>6.67</td>
<td>0.01172</td>
</tr>
<tr>
<td>263.15</td>
<td></td>
<td>9.25</td>
<td>0.01598</td>
</tr>
<tr>
<td>253.15</td>
<td></td>
<td>12.30</td>
<td>0.02089</td>
</tr>
<tr>
<td>243.15</td>
<td></td>
<td>17.76</td>
<td>0.02952</td>
</tr>
<tr>
<td>233.15</td>
<td></td>
<td>26.30</td>
<td>0.04259</td>
</tr>
<tr>
<td>223.15</td>
<td></td>
<td>40.00</td>
<td>0.06261</td>
</tr>
<tr>
<td>213.15</td>
<td></td>
<td>65.50</td>
<td>0.09741</td>
</tr>
<tr>
<td>203.15</td>
<td></td>
<td>124.00</td>
<td>0.1677</td>
</tr>
</tbody>
</table>

* volume of gas corrected to 273.15 K and 101.3 kPa
** calculated by the compiler

AUXILIARY INFORMATION

METHOD APPARATUS/PROCEDURE:
No information

SOURCE AND PURITY OF MATERIALS:
No information

ESTIMATED ERROR:

REFERENCES:
COMPONENTS:
1. Carbon dioxide; CO₂; [124-38-9]
2. Methanol; CH₄O; [67-56-1]

ORIGINAL MEASUREMENTS:
Vitovec, J.

VARIABLES:
P/kPa = 101.3
T/K = 293.15

PREPARED BY:
P.G.T. Fogg

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>Absorption /kg m⁻³</th>
<th>x₃CO₂ at P₃CO₂ = 101.3 kPa*</th>
</tr>
</thead>
<tbody>
<tr>
<td>293.15</td>
<td>7.87</td>
<td>0.00719</td>
</tr>
</tbody>
</table>

*calculated by the compiler.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
The solubility of carbon dioxide was measured by a saturation method as described in ref.(1). Carbon dioxide was passed through the solvent and the final concentration in the solution was measured by a titration method as described in ref.(2).

SOURCE AND PURITY OF MATERIALS:
1. Obtained from a pressure vessel. Purity at least 99%.
2. Chemically pure reagent.

ESTIMATED ERROR:
\( \delta x_{CO₂} = \pm 0.5\% \)

REFERENCES:
1. Vitovec, J.; Fried, V.
2. Emmert, R.E.; Pigford, R.L.
COMPONENTS:
1. Carbon dioxide; \( \text{CO}_2 \); [124-38-9]
2. Methanol; \( \text{CH}_4\text{O} \); [67-56-1]

ORIGINAL MEASUREMENTS:
Yorizane, M.; Sadamoto, S.; Masuoka, H.; Eto, Y.
Kogyo Kagaku Zasshi 1969, 72, 2174-7

VARIABLES:
\( T/\text{K} = 243.15-273.15 \)
\( P/\text{kPa} = 202.7-3333.6 \)

EXPERIMENTAL VALUES:

Solubility measurements were made over pressure ranges to a maximum of 3333.6 kPa. Limiting values of Henry's law constants, \( H \), were given by the authors. The compiler has estimated the mole fraction solubility at a partial pressure of 101.3 kPa by extrapolation of the solubility data by use of a simplified Krichevsky-Il'inskaya equation of the form

\[
\log_{10}(P_2/x_2) = \log_{10}H - \beta(1-x_2^2)
\]

where \( P_2 \) is the partial pressure of carbon dioxide, \( x_2 \) the mole fraction of carbon dioxide in the liquid phase, \( \beta \) a constant and \( x_1 \) the mole fraction of solvent in the liquid phase.

<table>
<thead>
<tr>
<th>( T/\text{K} )</th>
<th>( H/\text{atm}^* )</th>
<th>( H/\text{kPa} )</th>
<th>( x_2 ) at ( P_2 = 101.3 \text{ kPa}^{**} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>243.15</td>
<td>38</td>
<td>3850</td>
<td>0.0233</td>
</tr>
<tr>
<td>258.15</td>
<td>59</td>
<td>5978</td>
<td>0.0179</td>
</tr>
<tr>
<td>273.15</td>
<td>92</td>
<td>9322</td>
<td>0.0118</td>
</tr>
</tbody>
</table>

* defined by the authors as \( H = \lim_{x_2 \to 0} \frac{f_2}{x_2} \) where \( f_2 \) is the fugacity of \( \text{CO}_2 \).

** calculated by the compiler as indicated above.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
Vapor-liquid equilibrium cell.
Diagram given in source.
(Original in Japanese)

SOURCE AND PURITY OF MATERIALS:
1. purity 99.0 mol%

ESTIMATED ERROR:

REFERENCES:
COMPONENTS:
1. Carbon dioxide; CO₂; [124-38-9]
2. Methanol; CH₄O; [67-56-1]

ORIGINAL MEASUREMENTS:
Makranczy, J.; Rusz, L.; Balog-Megyery, K.
Hung. J. Ind. Chem. 1979, ?, 41-6

VARIABLES:
T/K = 298.15
P/kPa = 101.3

PREPARED BY:
C.L. Young

EXPERIMENTAL VALUES:
<table>
<thead>
<tr>
<th>T/K</th>
<th>P⁺/kPa</th>
<th>Ostwald coefficient</th>
<th>Mole fraction of carbon dioxide*&lt;sub&gt;CO₂&lt;/sub&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>298.15</td>
<td>101.3</td>
<td>3.547</td>
<td>0.005871</td>
</tr>
</tbody>
</table>

* calculated by compiler
+ partial pressure of carbon dioxide.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
Volumetric method. The apparatus of Bodor, Bor, Mohai, and Sipos (1) was used.

SOURCE AND PURITY OF MATERIALS:
No details given.

ESTIMATED ERROR:
δx<sub>CO₂</sub> = ±3%

REFERENCES:
1. Bodor, E.; Bor, Gy.; Mohai, B.; Sipos. G.
   Chem. Abstr. 1961, 55, 3175h
COMPONENTS:
(1) Carbon dioxide; CO\textsubscript{2}; [124-38-9]  
(2) Methanol; CH\textsubscript{4}O; [64-56-1]

ORIGINAL MEASUREMENTS:
Won, Y. S.; Chung, D. K.; Mills, A. F.  

VARIABLES:
\[ T/K = 298.15 \]
\[ p_1/kPa = 101.325 \text{ (1 atm)} \]

PREPARED BY:
H. L. Clever

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>Temperature (t/°C)</th>
<th>Solubility ((c_1/\text{kmol m}^{-3}\text{atm}^{-1}))</th>
<th>Mol Fraction (10^3x_1)</th>
<th>Ostwald Coefficient (L/\text{cm}^3 \text{cm}^{-3})</th>
</tr>
</thead>
<tbody>
<tr>
<td>25</td>
<td>298.15</td>
<td>0.159</td>
<td>6.43</td>
</tr>
</tbody>
</table>

The mole fraction and Ostwald coefficient were calculated by the compiler.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
The carbon dioxide solubility was determined by saturating the liquid phase in a gas bubbler immersed in an isothermal bath. The liquid phase carbon dioxide concentration was determined by using a standard wet chemistry technique (1). The partial pressure of the carbon dioxide over the liquid was calculated by subtracting the vapor pressure of the liquid from the measured total pressure.

The diffusivity of carbon dioxide was measured. \(10^3D/m^2 \text{s}^{-1} = 8.37\)

SOURCE AND PURITY OF MATERIALS:
(1) Carbon dioxide. No information.  
(2) Methanol. Source not given. The density, kinematic viscosity, and surface tension were measured and reported in the paper. Values are \(\rho/\text{kg m}^{-3} = 786.6\), \(10^6\nu/\text{m}^2 \text{s}^{-1} = 0.695\), and \(10^3\sigma/\text{N m}^{-1} = 22.2\).

ESTIMATED ERROR:
\[ \delta c_1/c_1 = \pm 0.02 \]

REFERENCES:
1. Chung, D. K.  
Ph. D. Dissertation, 1974  
University of California, Los Angeles
COMPONENTS:
1. Carbon dioxide; CO₂; [124-38-9]
2. Alcohols

ORIGINAL MEASUREMENTS:
Luhring, P.; Schumpe, A.

VARIABLES:
\( T/K = 293.2 \)

PREPARED BY:
C.L. Young; P.G.T. Fogg

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>( T/K )</th>
<th>( \text{Henry's Constant}^* )</th>
<th>Mole fraction of CO₂ at 1 atm ( ^\dagger ) ( / (\text{Pa m}^3/\text{mol}^{-1}) )</th>
<th>\text{Mole fraction of CO₂ at partial pressure}</th>
</tr>
</thead>
<tbody>
<tr>
<td>293.2</td>
<td>601</td>
<td>0.00683</td>
<td>Methanol; CH₃OH; [67-56-1]</td>
</tr>
<tr>
<td>293.2</td>
<td>802</td>
<td>0.00737</td>
<td>Ethanol; C₂H₅OH; [64-17-5]</td>
</tr>
<tr>
<td>293.2</td>
<td>1070</td>
<td>0.00720</td>
<td>2-Propanol; C₃H₇OH; [67-63-0]</td>
</tr>
<tr>
<td>293.2</td>
<td>1179</td>
<td>0.00781</td>
<td>1-Butanol; C₄H₁₀OH; [71-36-3]</td>
</tr>
</tbody>
</table>

* referred to as Henry's constant in source but appears to be the usual Henry's constant multiplied by the molar volume calculated by the compilers using density data taken from ref. (1).

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
Little information is given in source. Method consisted of equilibrating known amounts of degassed liquid and gas and measuring the change in pressure. Equilibration was reached in 3 to 6 minutes. Some details given in ref. 2.

SOURCE AND PURITY OF MATERIALS:
2. Obtained from Merck at the highest available purity. No other details given.

ESTIMATED ERROR:
\( \delta T/K = \pm 0.1 \) (authors)
\( \delta x/x = \pm 0.01 \) to 0.15 (compilers)

REFERENCES:
1. International Critical Tables

COMPONENTS:
(1) Carbon dioxide; \( \text{CO}_2 \) [124-38-9]
(2) Ethanol; \( \text{C}_2\text{H}_6\text{O} \) [64-17-5]

ORIGINAL MEASUREMENTS:
Just, G.
Z. Phys. Chem. 1901, 37, 342 - 367.

VARIABLES:
\[ T/\text{K} = 288.15 - 298.15 \]
\[ p/k\text{Pa} = 101.325 \text{ (1 atm)} \]

PREPARED BY:
M. E. Derrick
H. L. Clever

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>( T/\text{K} )</th>
<th>Mol Fraction ( 10^3x_1 )</th>
<th>Bunsen ( \alpha/\text{cm}^2(\text{STP})\text{cm}^{-3}\text{atm}^{-1} )</th>
<th>Ostwald ( L/\text{cm}^3\text{cm}^{-3} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>288.15</td>
<td>7.38</td>
<td>2.97</td>
<td>3.130</td>
</tr>
<tr>
<td>293.15</td>
<td>7.04</td>
<td>2.72</td>
<td>2.973</td>
</tr>
<tr>
<td>298.15</td>
<td>6.45</td>
<td>2.48</td>
<td>2.706</td>
</tr>
</tbody>
</table>

The author measured the Ostwald coefficient at a pressure of about 746 \( \text{mmHg} \). The compiler assumed the Ostwald coefficient to be independent of pressure, and calculated the mole fraction and Bunsen coefficient values at 101.325 \( k\text{Pa} \) (1 atm) partial pressure of the gas.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
An Ostwald apparatus as modified by Timofejew (1), and Steiner (2) is used. The apparatus consists of a gas buret, an absorption flask, and a mercury manometer. The system is thermostated with a water jacket.

The gas is introduced into the degassed liquid. The gas volume absorbed is determined by the gas buret. The solvent volume is determined at the end of the experiment by pouring the solvent into a graduated flask.

SOURCE AND PURITY OF MATERIALS:
(1) Carbon dioxide. Generated in a Kipp apparatus using marble and hydrochloric acid.
(2) Ethanol. Source not given. Stated to be 97 per cent.

ESTIMATED ERROR:
\[ \delta L/L = 0.03 \text{ (compiler)} \]

REFERENCES:
1. Timofejew, W.
Z. Phys. Chem. 1890, 6, 141.
2. Steiner, P.
COMPONENTS:
1. Carbon dioxide; CO₂
   [124-38-9]
2. Alkanols

VARIABLES:
\[ P/KPa = 13.3-101.3 \]
\[ T/K = 212.7-298.2 \]

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>Solvent</th>
<th>T/K</th>
<th>P/mmHg</th>
<th>P/kPa*</th>
<th>Solubility** x CO₂ cm³ g⁻¹</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ethanol; C₂H₅O; [64-17-5]</td>
<td>248.0</td>
<td>100</td>
<td>13.33</td>
<td>1.37 0.00282</td>
</tr>
<tr>
<td></td>
<td></td>
<td>300</td>
<td>40.00</td>
<td>1.10 0.00842</td>
</tr>
<tr>
<td></td>
<td></td>
<td>500</td>
<td>66.66</td>
<td>6.89 0.01400</td>
</tr>
<tr>
<td></td>
<td></td>
<td>760</td>
<td>101.32</td>
<td>10.52 0.02130</td>
</tr>
<tr>
<td></td>
<td>227.9</td>
<td>100</td>
<td>13.33</td>
<td>2.78 0.00572</td>
</tr>
<tr>
<td></td>
<td></td>
<td>300</td>
<td>40.00</td>
<td>8.43 0.01715</td>
</tr>
<tr>
<td></td>
<td></td>
<td>500</td>
<td>66.66</td>
<td>14.23 0.02860</td>
</tr>
<tr>
<td></td>
<td></td>
<td>760</td>
<td>101.32</td>
<td>21.97 0.04350</td>
</tr>
<tr>
<td></td>
<td>212.7</td>
<td>100</td>
<td>13.33</td>
<td>5.30 0.01085</td>
</tr>
<tr>
<td></td>
<td></td>
<td>300</td>
<td>40.00</td>
<td>16.28 0.03260</td>
</tr>
<tr>
<td></td>
<td></td>
<td>500</td>
<td>66.66</td>
<td>27.80 0.05440</td>
</tr>
<tr>
<td></td>
<td></td>
<td>760</td>
<td>101.32</td>
<td>43.50 0.08260</td>
</tr>
<tr>
<td>1-Propanol; C₃H₇O; [71-23-8]</td>
<td>248.0</td>
<td>100</td>
<td>13.33</td>
<td>0.836 0.00255</td>
</tr>
<tr>
<td></td>
<td></td>
<td>300</td>
<td>40.00</td>
<td>2.852 0.00764</td>
</tr>
<tr>
<td></td>
<td></td>
<td>500</td>
<td>66.66</td>
<td>4.785 0.01275</td>
</tr>
<tr>
<td></td>
<td></td>
<td>760</td>
<td>101.32</td>
<td>7.315 0.01936</td>
</tr>
<tr>
<td></td>
<td>227.9</td>
<td>100</td>
<td>13.33</td>
<td>1.851 0.00497</td>
</tr>
<tr>
<td></td>
<td></td>
<td>300</td>
<td>40.00</td>
<td>5.604 0.01490</td>
</tr>
<tr>
<td></td>
<td></td>
<td>500</td>
<td>66.66</td>
<td>9.445 0.02486</td>
</tr>
<tr>
<td></td>
<td></td>
<td>760</td>
<td>101.32</td>
<td>14.538 0.03776</td>
</tr>
<tr>
<td></td>
<td>212.7</td>
<td>100</td>
<td>13.33</td>
<td>3.345 0.00895</td>
</tr>
<tr>
<td></td>
<td></td>
<td>300</td>
<td>40.00</td>
<td>10.065 0.02645</td>
</tr>
<tr>
<td></td>
<td></td>
<td>500</td>
<td>66.66</td>
<td>17.011 0.04390</td>
</tr>
<tr>
<td></td>
<td></td>
<td>760</td>
<td>101.32</td>
<td>26.774 0.06740</td>
</tr>
</tbody>
</table>

* calculated by the compiler.
** defined as the volume of gas, corrected to 273.15 K and 101.325 kPa, dissolved by one gram of solvent at the stated temperature and pressure.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
A static method was used. A weighed quantity of solvent was placed in the absorption pipet which was subsequently cooled in a cryostat with automatic temperature control. The solvent was then degassed under vacuum. Liquid lost during this process was collected in an absorption column and weighed so appropriate correction could be made to the weight of solvent. Carbon dioxide was then supplied from a calibrated gas buret. The liquid was stirred by an electromagnetic stirrer until equilibrium was reached.

SOURCE AND PURITY OF MATERIALS:
1. from commercial solid carbon dioxide; purified twice by evaporation, freezing and pumping with a vacuum pump.
2. No information

ESTIMATED ERROR:

REFERENCES:
### COMPONENTS: ORIGINAL MEASUREMENTS:
1. Carbon dioxide; CO₂  
   [124-38-9]  

2. Alkanols  
   Gaz. Prom. 1958, 12, 36-42.

### EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>Solvent</th>
<th>T/K</th>
<th>P/mmHg</th>
<th>P/kPa*</th>
<th>Solubility**</th>
<th>x₂CO₂</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-Propanol; C₃H₆O; [67-63-0]</td>
<td>248.0</td>
<td>100</td>
<td>13.33</td>
<td>0.817</td>
<td>0.00220</td>
</tr>
<tr>
<td></td>
<td>300</td>
<td>40.00</td>
<td>2.461</td>
<td>0.00660</td>
<td></td>
</tr>
<tr>
<td></td>
<td>500</td>
<td>66.66</td>
<td>4.121</td>
<td>0.01100</td>
<td></td>
</tr>
<tr>
<td></td>
<td>760</td>
<td>101.32</td>
<td>6.280</td>
<td>0.01667</td>
<td></td>
</tr>
<tr>
<td></td>
<td>227.9</td>
<td>100</td>
<td>13.33</td>
<td>1.626</td>
<td>0.00437</td>
</tr>
<tr>
<td></td>
<td>300</td>
<td>40.00</td>
<td>4.922</td>
<td>0.01311</td>
<td></td>
</tr>
<tr>
<td></td>
<td>500</td>
<td>66.66</td>
<td>8.276</td>
<td>0.02185</td>
<td></td>
</tr>
<tr>
<td></td>
<td>760</td>
<td>101.32</td>
<td>12.719</td>
<td>0.03319</td>
<td></td>
</tr>
<tr>
<td></td>
<td>212.7</td>
<td>100</td>
<td>13.33</td>
<td>3.013</td>
<td>0.00806</td>
</tr>
<tr>
<td></td>
<td>300</td>
<td>40.00</td>
<td>9.188</td>
<td>0.02420</td>
<td></td>
</tr>
<tr>
<td></td>
<td>500</td>
<td>66.66</td>
<td>15.540</td>
<td>0.04025</td>
<td></td>
</tr>
<tr>
<td></td>
<td>760</td>
<td>101.32</td>
<td>24.090</td>
<td>0.06101</td>
<td></td>
</tr>
<tr>
<td>1-Butanol; C₄H₁₀O; [71-36-3]</td>
<td>248.0</td>
<td>100</td>
<td>13.33</td>
<td>0.786</td>
<td>0.00261</td>
</tr>
<tr>
<td></td>
<td>300</td>
<td>40.00</td>
<td>2.374</td>
<td>0.00781</td>
<td></td>
</tr>
<tr>
<td></td>
<td>500</td>
<td>66.66</td>
<td>3.373</td>
<td>0.01305</td>
<td></td>
</tr>
<tr>
<td></td>
<td>760</td>
<td>101.32</td>
<td>6.076</td>
<td>0.01982</td>
<td></td>
</tr>
<tr>
<td></td>
<td>227.9</td>
<td>100</td>
<td>13.33</td>
<td>1.586</td>
<td>0.00525</td>
</tr>
<tr>
<td></td>
<td>300</td>
<td>40.00</td>
<td>4.591</td>
<td>0.01505</td>
<td></td>
</tr>
<tr>
<td></td>
<td>500</td>
<td>66.66</td>
<td>7.736</td>
<td>0.02510</td>
<td></td>
</tr>
<tr>
<td></td>
<td>760</td>
<td>101.32</td>
<td>11.931</td>
<td>0.03819</td>
<td></td>
</tr>
<tr>
<td></td>
<td>212.7</td>
<td>100</td>
<td>13.33</td>
<td>2.715</td>
<td>0.00895</td>
</tr>
<tr>
<td></td>
<td>300</td>
<td>40.00</td>
<td>8.175</td>
<td>0.02650</td>
<td></td>
</tr>
<tr>
<td></td>
<td>500</td>
<td>66.66</td>
<td>13.820</td>
<td>0.04400</td>
<td></td>
</tr>
<tr>
<td></td>
<td>760</td>
<td>101.32</td>
<td>21.740</td>
<td>0.06750</td>
<td></td>
</tr>
<tr>
<td>2-Methyl-1-propanol; C₄H₁₀O; [78-83-1]</td>
<td>248.0</td>
<td>100</td>
<td>13.33</td>
<td>0.618</td>
<td>0.00205</td>
</tr>
<tr>
<td></td>
<td>300</td>
<td>40.00</td>
<td>1.843</td>
<td>0.00610</td>
<td></td>
</tr>
<tr>
<td></td>
<td>500</td>
<td>66.66</td>
<td>3.125</td>
<td>0.01030</td>
<td></td>
</tr>
<tr>
<td></td>
<td>760</td>
<td>101.32</td>
<td>4.728</td>
<td>0.01550</td>
<td></td>
</tr>
<tr>
<td></td>
<td>227.9</td>
<td>100</td>
<td>13.33</td>
<td>1.236</td>
<td>0.00401</td>
</tr>
<tr>
<td></td>
<td>300</td>
<td>40.00</td>
<td>3.679</td>
<td>0.01210</td>
<td></td>
</tr>
<tr>
<td></td>
<td>500</td>
<td>66.66</td>
<td>6.190</td>
<td>0.02020</td>
<td></td>
</tr>
<tr>
<td></td>
<td>760</td>
<td>101.32</td>
<td>9.480</td>
<td>0.03060</td>
<td></td>
</tr>
<tr>
<td></td>
<td>212.7</td>
<td>100</td>
<td>13.33</td>
<td>2.178</td>
<td>0.00720</td>
</tr>
<tr>
<td></td>
<td>300</td>
<td>40.00</td>
<td>6.786</td>
<td>0.02210</td>
<td></td>
</tr>
<tr>
<td></td>
<td>500</td>
<td>66.66</td>
<td>11.571</td>
<td>0.03710</td>
<td></td>
</tr>
<tr>
<td></td>
<td>760</td>
<td>101.32</td>
<td>18.010</td>
<td>0.05660</td>
<td></td>
</tr>
<tr>
<td>2-Butanol; C₄H₁₀O; [78-92-2]</td>
<td>248.0</td>
<td>100</td>
<td>13.33</td>
<td>0.568</td>
<td>0.00189</td>
</tr>
<tr>
<td></td>
<td>300</td>
<td>40.00</td>
<td>1.71</td>
<td>0.00566</td>
<td></td>
</tr>
<tr>
<td></td>
<td>500</td>
<td>66.66</td>
<td>2.87</td>
<td>0.00943</td>
<td></td>
</tr>
<tr>
<td></td>
<td>760</td>
<td>101.32</td>
<td>4.38</td>
<td>0.01435</td>
<td></td>
</tr>
<tr>
<td></td>
<td>227.9</td>
<td>100</td>
<td>13.33</td>
<td>1.01</td>
<td>0.00334</td>
</tr>
<tr>
<td></td>
<td>300</td>
<td>40.00</td>
<td>3.05</td>
<td>0.01000</td>
<td></td>
</tr>
<tr>
<td></td>
<td>500</td>
<td>66.66</td>
<td>5.08</td>
<td>0.01665</td>
<td></td>
</tr>
<tr>
<td></td>
<td>760</td>
<td>101.32</td>
<td>7.82</td>
<td>0.02355</td>
<td></td>
</tr>
<tr>
<td></td>
<td>212.7</td>
<td>100</td>
<td>13.33</td>
<td>1.70</td>
<td>0.00562</td>
</tr>
<tr>
<td></td>
<td>300</td>
<td>40.00</td>
<td>5.17</td>
<td>0.01685</td>
<td></td>
</tr>
<tr>
<td></td>
<td>500</td>
<td>66.66</td>
<td>7.75</td>
<td>0.02810</td>
<td></td>
</tr>
<tr>
<td></td>
<td>760</td>
<td>101.32</td>
<td>13.40</td>
<td>0.04270</td>
<td></td>
</tr>
</tbody>
</table>

* calculated by the compiler.  
** defined as the volume of gas, corrected to 273.15 K and 101.325 kPa, dissolved by one gram of solvent at the stated temperature and pressure.
COMPONENTS:
1. Carbon dioxide; \( \text{CO}_2; [124-38-9] \)
2. Ethanol; \( \text{C}_2\text{H}_6\text{O}; [64-17-5] \)

VARIABLES:
\[
T/\text{K} = 298.15 \\
P/\text{kPa} = 101.3
\]

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>( T/\text{K} )</th>
<th>( P/\text{kPa} )</th>
<th>Ostwald coefficient</th>
<th>( x_{\text{CO}_2} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>298.15</td>
<td>101.3</td>
<td>2.892</td>
<td>0.006889</td>
</tr>
</tbody>
</table>

* calculated by compiler
+ partial pressure of carbon dioxide

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
Volumetric method. The apparatus of Bodor, Bor, Mohai, and Sipos (1) was used.

SOURCE AND PURITY OF MATERIALS:
No details given

ESTIMATED ERROR:
\[
\delta x_{\text{CO}_2} = \pm 3\%
\]

REFERENCES:
1. Bodor, E.; Bor, Gy.; Mohai, B.; Sipos, G.
   1957, 7, 55.
COMPONENTS:

1. Carbon dioxide; CO₂; [124-38-9]
2. Ethanol; C₂H₅O; [64-17-5]

ORIGINAL MEASUREMENTS:

Cargill, R.W.; MacPhee, D.E.
J. Chem. Research (S) 1981, 232;

PREPARED BY:
P.G.T. Fogg

VARIABLES:

\[ \frac{T}{K} = 277.9-334.6 \]
\[ P_{CO₂}/kPa = 101.3 \]

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>( P_{CO₂}/kPa )</th>
<th>( T/K )</th>
<th>( S₀/cm^3kg^{-1} )</th>
<th>( x_{CO₂}^* )</th>
</tr>
</thead>
<tbody>
<tr>
<td>101.3</td>
<td>277.9</td>
<td>4820</td>
<td>0.010451</td>
</tr>
<tr>
<td>284.8</td>
<td>285.8</td>
<td>294.2</td>
<td>294.3</td>
</tr>
<tr>
<td>294.3</td>
<td>3720</td>
<td>0.008977</td>
<td></td>
</tr>
<tr>
<td>3010</td>
<td>0.007729</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3010</td>
<td>0.007729</td>
<td></td>
<td></td>
</tr>
<tr>
<td>312.6</td>
<td>0.006670</td>
<td></td>
<td></td>
</tr>
<tr>
<td>312.7</td>
<td>0.005770</td>
<td></td>
<td></td>
</tr>
<tr>
<td>322.7</td>
<td>0.005002</td>
<td></td>
<td></td>
</tr>
<tr>
<td>323.7</td>
<td>0.004346</td>
<td></td>
<td></td>
</tr>
<tr>
<td>333.4</td>
<td>0.004346</td>
<td></td>
<td></td>
</tr>
<tr>
<td>334.6</td>
<td>0.004346</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\( S₀ \) is the volume of gas, reduced to 1.013 bar and 273.15 K, which is dissolved by 1 kg of solvent.

* smoothed data given by the authors.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The authors measured solubilities by the flowing film method as described by Morrison (1) and modified by Cargill (2). Solubilities were corrected to a partial pressure of carbon dioxide of 1.013 bar (3).

SOURCE AND PURITY OF MATERIALS:

1. Supplied by British Oxygen Company; purity 99.9%.
2. Purity 99.9%

ESTIMATED ERROR:

REFERENCES:

1. Morrison, T.J.; Billett, F.
   J. Chem. Soc. 1948, 2033;
   J. Chem. Soc. 1952, 3819

2. Cargill, R.W.; Morrison, T.J.

3. Private communication.
COMPONENTS:
(1) Carbon dioxide; CO₂; [124-38-9]
(2) Ethanol; C₂H₆O; [64-17-5]

VARIABLES:
T/K = 298.15
p₁/kPa = 101.325 (1 atm)

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>Temperature</th>
<th>Solubility</th>
<th>Mol Fraction</th>
<th>Ostwald Coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>t/°C</td>
<td>T/K</td>
<td>a_j/kmol m⁻³ atm⁻¹</td>
<td>10²x_j</td>
</tr>
<tr>
<td>25</td>
<td>298.15</td>
<td>0.125</td>
<td>7.28</td>
</tr>
</tbody>
</table>

The mole fraction and Ostwald coefficients were calculated by the compiler.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
The carbon dioxide solubility was determined by saturating the liquid phase in a gas bubbler immersed in an isothermal bath. The liquid phase carbon dioxide concentration was determined by using a standard wet chemistry technique (1). The partial pressure of the carbon dioxide over the liquid was calculated by subtracting the vapor pressure of the liquid from the measured total pressure.

The diffusivity of carbon dioxide was measured. 10⁹ C/m² s⁻¹ = 3.88.

SOURCE AND PURITY OF MATERIALS:
(1) Carbon dioxide. No information.
(2) Ethanol. Source not given.
The density, kinematic viscosity, and surface tension were measured and reported in the paper. Values are ρ/kg m⁻³ = 785.0, 10⁶ν/m² s⁻¹ = 1.400, and 10³σ/N m⁻¹ = 22.7.

ESTIMATED ERROR:
δσ_j/σ_j = ± 0.02

REFERENCES:
1. Chung, D. K.
   Ph.D. Dissertation, 1974
   University of California, Los Angeles

PREPARED BY:
H. L. Clever
COMPONENTS:
(1) Carbon dioxide; CO₂; [124-38-9]
(2) Ethanol; C₂H₆O; [64-17-5]
(3) 1-Propanol; C₃H₈O; [71-23-8]

VARIABLES:
T/K = 298
P/kPa = 101.3
Composition.

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>Ethanol Mol Fraction</th>
<th>Viscosity a</th>
<th>Diffusion Coefficient</th>
<th>Solubility</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>x₂</td>
<td>10³ μm/Pa s</td>
<td>10⁸ Dₐ/m² s⁻¹</td>
<td>aₒ/mol m⁻³</td>
</tr>
<tr>
<td>298</td>
<td>0.00</td>
<td>1.97</td>
<td>3.06</td>
<td>62.9</td>
</tr>
<tr>
<td></td>
<td>0.20</td>
<td>1.71</td>
<td>3.26</td>
<td>71.8</td>
</tr>
<tr>
<td></td>
<td>0.40</td>
<td>1.55</td>
<td>3.33</td>
<td>76.5</td>
</tr>
<tr>
<td></td>
<td>0.60</td>
<td>1.39</td>
<td>3.50</td>
<td>76.6</td>
</tr>
<tr>
<td></td>
<td>0.80</td>
<td>1.24</td>
<td>3.72</td>
<td>88.8</td>
</tr>
<tr>
<td></td>
<td>1.00</td>
<td>1.08</td>
<td>3.86</td>
<td>107.</td>
</tr>
</tbody>
</table>

a Literature values taken from Ishikawa, T. "Kogoeki Nendo no Riron" (Theories of Viscosity for Mixed Solvents); Maruzen, Tokyo, 1968.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
An indirect method (1) was used in which the absorption rate of carbon dioxide into the mixed solvent was measured as a function of time.

It was assumed that the film-theory model of the gas absorption process applied. A plot of ln (absorption rate) vs. time is linear. The slope is a function of the diffusion coefficient and the intercept is a function of both the diffusion coefficient and the solubility.

A diaphram cell with interfacial area 5.81 cm² and lower compartment volume for the liquid was 53.5 cm³. The diaphram was Millipore Teflon of mean pore size 10.0 μm, thickness 125 ± 15 μm, and porosity 0.68. The liquid was stirred at a constant rate of 1.33 rotations s⁻¹.

The solutions were prepared and then degassed by refluxing for five hours. Their compositions were determined by density or refractive index. The CO₂ was pre saturated with solvent vap.

SOURCE AND PURITY OF MATERIALS:
(1) Carbon dioxide. Source not identified. From cylinder.
(2, 3) Ethanol and 1-Propanol.
It was stated that the chemicals were of special grade.

ESTIMATED ERROR:
δT/K = ± 0.1
δaₒ/aₒ = ± 0.05 - 0.10 (compiler).

REFERENCES:
COMPONENTS:
(1) Carbon dioxide; CO₂; [124-38-9]
(2) 1-Propanol; C₃H₈O; [71-23-8]

ORIGINAL MEASUREMENTS:
Just, G. 
Z. Phys. Chem. 1901, 37, 342 - 367.

VARIABLES:
\[ T/K = 298.15 \]
\[ P_1/\text{kPa} = 101.325 \text{ (1 atm)} \]

PREPARED BY:
M. E. Derrick
H. L. Clever

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>( T/K )</th>
<th>( 10^3x_1 )</th>
<th>Bunsen ( a/\text{cm}^3\text{(STP)}\text{cm}^{-3}\text{atm}^{-1} )</th>
<th>Ostwald ( L/\text{cm}^3\text{cm}^{-3} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>298.15</td>
<td>7.62</td>
<td>2.29</td>
<td>2.498</td>
</tr>
</tbody>
</table>

The author measured the Ostwald coefficient at a pressure of about 746 mmHg. The compiler assumed the Ostwald coefficient to be independent of pressure, and calculated the mole fraction and Bunsen coefficient values at 101.325 kPa (1 atm) partial pressure of the gas.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
An Ostwald apparatus as modified by Timofejew (1), and Steiner (2) is used. The apparatus consists of a gas buret, an absorption flask, and a mercury manometer. The system is thermostated with a water jacket.

The gas is introduced into the degassed liquid. The gas volume absorbed is determined by the gas buret. The solvent volume is determined at the end of the experiment by pouring the solvent into a graduated flask.

SOURCE AND PURITY OF MATERIALS:
(1) Carbon dioxide. Generated in a Kipp apparatus using marble and hydrochloric acid.
(2) 1-Propanol. No information.

ESTIMATED ERROR:
\[ \delta L/L = 0.03 \text{ (compiler)} \]

REFERENCES:
1. Timofejew, W. 
Z. Phys. Chem. 1890, 6, 141.
2. Steiner, P. 
COMPONENTS:
1. Carbon dioxide; CO₂; [124-38-9]
2. 1-Propanol; C₃H₆O; [71-23-8]
2-Propanol; C₃H₇O; [67-63-0]

VARIABLES:
\[ T/K = 283.15-313.15 \]
\[ P_{CO₂} = 101.3 \text{ kPa} \]

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>Solvent</th>
<th>T/K</th>
<th>Ostwald coef. L</th>
<th>H/atm</th>
<th>H/kPa*</th>
<th>( x_{CO₂} ) at ( P_{CO₂} = 101.3 \text{ kPa} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-Propanol</td>
<td>283.15</td>
<td>2.76</td>
<td>113</td>
<td>11450</td>
<td>0.00877</td>
</tr>
<tr>
<td></td>
<td>293.15</td>
<td>2.27</td>
<td>137</td>
<td>13882</td>
<td>0.00725</td>
</tr>
<tr>
<td></td>
<td>303.15</td>
<td>2.1</td>
<td>157</td>
<td>15908</td>
<td>0.00633</td>
</tr>
<tr>
<td></td>
<td>313.15</td>
<td>1.88</td>
<td>179</td>
<td>18137</td>
<td>0.00556</td>
</tr>
<tr>
<td>2-Propanol</td>
<td>283.15</td>
<td>2.53</td>
<td>122</td>
<td>12362</td>
<td>0.00813</td>
</tr>
<tr>
<td></td>
<td>293.15</td>
<td>2.18</td>
<td>145</td>
<td>14692</td>
<td>0.00685</td>
</tr>
<tr>
<td></td>
<td>303.15</td>
<td>1.95</td>
<td>166</td>
<td>16820</td>
<td>0.00599</td>
</tr>
<tr>
<td></td>
<td>313.15</td>
<td>1.86</td>
<td>178</td>
<td>18036</td>
<td>0.00559</td>
</tr>
</tbody>
</table>

Henry's constant, \( H \), was taken to be given by
\[ H = \frac{\text{mole ratio solubility of } CO₂}{\text{partial pressure of } CO₂, \ P_{CO₂}} \]

* calculated by the compiler

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
Solvents were refluxed for several hours to remove dissolved gases. A measured volume of the solvent was then transferred to an absorption chamber fitted with a magnetic stirrer and connected to a system of gas burets, vacuum line and mercury reservoir. A measured volume of the gas then came in contact with the liquid which was agitated until equilibrium was reached. The final volume of the gas was then measured.

SOURCE AND PURITY OF MATERIALS:
1. super pure grade from Nippon Tansan Co. Ltd.; 98.96% pure.
2. from Wako Pure Chemicals Ind.; fractionated before use.
1-propanol:
\[ \rho_{2₅} = 0.7990; \ \eta_{2₅} = 1.38345 \]
2-propanol:
\[ \rho_{2₅} = 0.78087; \ \eta_{2₅} = 1.37500 \]

ESTIMATED ERROR:

REFERENCES:
COMPONENTS:
1. Carbon dioxide; CO₂; [124-38-9]
2. 1-Propanol; C₃H₇O; [71-23-8]

ORIGINAL MEASUREMENTS:
Makranczy, J.; Rusz, L.; Balog-Megyery, K.
Hung. J. Ind. Chem. 1979, 7, 41-6

VARIABLES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>P/kPa</th>
<th>Ostwald coefficient</th>
<th>Mole fraction of carbon dioxide* x_CO₂</th>
</tr>
</thead>
<tbody>
<tr>
<td>298.15</td>
<td>101.3</td>
<td>2.565</td>
<td>0.007817</td>
</tr>
</tbody>
</table>

* calculated by compiler
+ partial pressure of carbon dioxide.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
volumetric method. The apparatus of Bodor, Bor, Mohai, and Sipos (1) was used.

SOURCE AND PURITY OF MATERIALS:
No details given

ESTIMATED ERROR:

δx_CO₂ = ±3%

REFERENCES:
1. Bodor, E.; Bor, Gy.; Mohai, B.; Sipos, G.
   Chem. Abstr. 1961, 55, 3175h
### COMPONENTS:
1. Carbon dioxide; \( \text{CO}_2 \); [124-38-9]
2. 1-Butanol; \( \text{C}_4\text{H}_{10}\text{O} \); [71-36-3]

### VARIABLES:
- \( T/\text{K} = 298.15 \)
- \( P/\text{kPa} = 101.3 \)

### EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>( T/\text{K} )</th>
<th>( P^+/\text{kPa} )</th>
<th>Ostwald coefficient</th>
<th>Mole fraction of carbon dioxide, * ( x_{\text{CO}_2} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>298.15</td>
<td>101.3</td>
<td>2.369</td>
<td>0.008827</td>
</tr>
</tbody>
</table>

* calculated by compiler
+ partial pressure of carbon dioxide

### ORIGINAL MEASUREMENTS:
Makranczy, J.; Rusz, L.; Balog-Megyery, K.

### PREPARED BY:
C.L. Young

### AUXILIARY INFORMATION

#### METHOD/APPARATUS/PROCEDURE:
Volumetric method. The apparatus of Bodor, Bor, Mohai, and Sipos (1) was used.

#### SOURCE AND PURITY OF MATERIALS:
No details given.

#### ESTIMATED ERROR:
\[ \delta x_{\text{CO}_2} = \pm 3\% \]

#### REFERENCES:
1. Bodor, E.; Bor, Gy.; Mohai, B.; Sipos, G.
   *Chem. Abstr.* **1961**, *55*, 3175h
COMPONENTS:
(1) Carbon dioxide; CO$_2$; [124-38-9]
(2) 2-Methyl-1-propanol; C$_4$H$_{10}$O; [78-83-1]

ORIGINAL MEASUREMENTS:
Just, G.
Z. Phys. Chem. 1901, 37, 342 - 367.

VARIABLES:
\[ T/K = 288.15 - 298.15 \]
\[ p_\text{g}/\text{kPa} = 101.325 \text{ (1 atm)} \]

PREPARED BY:
M. E. Derrick
H. L. Clever

EXPERIMENTAL VALUES:

\[
\begin{array}{cccc}
T/K & x_i & Bunsen \text{ Coefficient} & Ostwald \text{ Coefficient} \\
288.15 & 8.06 & 1.98 & 2.088 \\
293.15 & 7.49 & 1.83 & 1.964 \\
298.15 & 6.98 & 1.69 & 1.849 \\
\end{array}
\]

The author measured the Ostwald coefficient at a pressure of about 746 mmHg. The compiler assumed the Ostwald coefficient to be independent of pressure, and calculated the mole fraction and Bunsen coefficient values at 101.325 kPa (1 atm) partial pressure of the gas.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
An Ostwald apparatus as modified by Timofejew (1), and Steiner (2) is used. The apparatus consists of a gas buret, an absorption flask, and a mercury manometer. The system is thermostated with a water jacket.

The gas is introduced into the degassed liquid. The gas volume absorbed is determined by the gas buret. The solvent volume is determined at the end of the experiment by pouring the solvent into a graduated flask.

SOURCE AND PURITY OF MATERIALS:
(1) Carbon dioxide. Generated in a Kipp apparatus using marble and hydrochloric acid.
(2) 2-Methyl-1-propanol. No information.

ESTIMATED ERROR:
\[ \delta L/L = 0.03 \text{ (compiler)} \]

REFERENCES:
1. Timofejew, W.
   Z. Phys. Chem. 1890, 6, 141.
2. Steiner, P.
COMPONENTS:
(1) Carbon dioxide; CO₂; [124-38-9]
(2) 2-Methyl-1-propanol or isobutyl alcohol; C₄H₉OH; [78-83-1]

ORIGINAL MEASUREMENTS:
Battino, R.; Evans, F. D.; Danforth, W. F.; Wilhelm, E.

VARIABLES:
T/K: 273.98 - 328.00
P/kPa: 101.325 (1 atm)

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>Mol Fraction</th>
<th>Bunsen Coefficient</th>
<th>Ostwald Coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>10⁻³x₁</td>
<td>a/cm³(STP) cm⁻³ atm⁻¹</td>
<td>L/cm³ cm⁻³</td>
</tr>
<tr>
<td>273.98</td>
<td>10.24</td>
<td>2.55</td>
<td>2.56</td>
</tr>
<tr>
<td>283.01</td>
<td>8.50</td>
<td>2.09</td>
<td>2.17</td>
</tr>
<tr>
<td>297.71</td>
<td>6.96</td>
<td>1.69</td>
<td>1.84</td>
</tr>
<tr>
<td>297.77</td>
<td>7.01</td>
<td>1.71</td>
<td>1.86</td>
</tr>
<tr>
<td>298.17</td>
<td>7.11</td>
<td>1.73</td>
<td>1.89</td>
</tr>
<tr>
<td>298.22</td>
<td>7.04</td>
<td>1.72</td>
<td>1.87</td>
</tr>
<tr>
<td>312.75</td>
<td>5.71</td>
<td>1.36</td>
<td>1.56</td>
</tr>
<tr>
<td>312.77</td>
<td>5.72</td>
<td>1.37</td>
<td>1.57</td>
</tr>
<tr>
<td>328.00</td>
<td>4.68</td>
<td>1.09</td>
<td>1.32</td>
</tr>
</tbody>
</table>

The Bunsen coefficients were calculated by the compiler with the assumption the gas was ideal.

Smoothed Data: For 273.15 to 328.15 K

\[
\ln x₁ = -9.2306 + 12.7124/(T/100 K)
\]

The standard error about the regression line is 1.22 x 10⁻⁴.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
The solubility apparatus is based on the design of Morrison and Billett (1) and the version used is described by Battino, Evans, and Danforth (2). The degassing apparatus is that described by Battino, Banzhof, Bogan, and Wilhelm (3).

Degassing. Up to 500 cm³ of solvent is placed in a flask of such size that the liquid is about 4 cm deep. The liquid is rapidly stirred, and vacuum is intermittently applied through a liquid N₂ trap until the permanent gas residual pressure drops to 5 microns.

Solubility Determination. The degassed solvent is passed in a thin film down a glass helical tube containing solute gas plus the solvent vapor at a total pressure of one atm. The volume of gas absorbed is found by difference between the initial and final volumes in the buret system. The solvent is collected in a tared flask and weighed.

SOURCE AND PURITY OF MATERIALS:
(1) Carbon dioxide. The Matheson Co. Inc. Commercial grade stated to be better than 99 mol per cent.
(2) 2-Methyl-1-propanol. Fisher Co. Certified grade (99 mol per cent).

ESTIMATED ERROR:
\[
\delta T/K = 0.03
\]
\[
\delta P/mmHg = 0.5
\]
\[
\delta x₁/x₁ = ±0.005
\]

REFERENCES:
COMPONENTS:
(1) Carbon dioxide; \( \text{CO}_2 \); \([124-38-9]\)
(2) 1-Pentanol or amyl alcohol; \( \text{C}_5\text{H}_{12}\text{O} \); \([71-41-0]\)

ORIGINAL MEASUREMENTS:
Just, G.


VARIABLES:
\[
\begin{align*}
T/K &= 288.15 - 298.15 \\
P_1/kPa &= 101.325 \text{ (1 atm)}
\end{align*}
\]

PREPARED BY:
M. E. Derrick
H. L. Clever

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>(T/K)</th>
<th>(x_1\times 10^3)</th>
<th>Bunsen Coefficient (a/(\text{cm}^3\text{ (STP)}\text{cm}^{-3}\text{ atm}^{-1}))</th>
<th>Ostwald Coefficient (L/\text{cm}^2\text{cm}^{-3})</th>
</tr>
</thead>
<tbody>
<tr>
<td>288.15</td>
<td>9.29</td>
<td>1.95</td>
<td>2.058</td>
</tr>
<tr>
<td>293.15</td>
<td>8.65</td>
<td>1.81</td>
<td>1.941</td>
</tr>
<tr>
<td>298.15</td>
<td>8.07</td>
<td>1.68</td>
<td>1.831</td>
</tr>
</tbody>
</table>

The author measured the Ostwald coefficient at a pressure of about 746 mmHg. The compiler assumed the Ostwald coefficient to be independent of pressure, and calculated the mole fraction and Bunsen coefficient values at 101.325 kPa (1 atm) partial pressure of the gas.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
An Ostwald apparatus as modified by Timofejew (1), and Steiner (2) is used. The apparatus consists of a gas buret, an absorption flask, and a mercury manometer. The system is thermostated with a water jacket.

The gas is introduced into the degassed liquid. The gas volume absorbed is determined by the gas buret. The solvent volume is determined at the end of the experiment by pouring the solvent into a graduated flask.

SOURCE AND PURITY OF MATERIALS:
(1) Carbon dioxide. Generated in a Kipp apparatus using marble and hydrochloric acid.
(2) 1-Pentanol. No information.

ESTIMATED ERROR:
\( \delta L/L = 0.03 \) (compiler)

REFERENCES:
1. Timofejew, W.
   Z. Phys. Chem. 1890, 6, 141.
2. Steiner, P.
COMPONENTS:
1. Carbon dioxide; CO₂; [124-38-9]
2. 1-Pentanol; C₅H₁₂O; [71-41-0]
or
1-Hexanol; C₆H₁₄O; [111-27-3]

ORIGINAL MEASUREMENTS:
Makranczy, J.; Rusz, L.; Balog-Megyery, K.

VARIABLES:
T/K  = 298.15
P/kPa = 101.3

EXPERIMENTAL VALUES:
<table>
<thead>
<tr>
<th>T/K</th>
<th>P⁺/kPa</th>
<th>Ostwald coefficient</th>
<th>Mole fraction of carbon dioxide*, xCO₂</th>
</tr>
</thead>
<tbody>
<tr>
<td>298.15</td>
<td>101.3</td>
<td>2.216</td>
<td>0.00974</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2.128</td>
<td>0.0108</td>
</tr>
</tbody>
</table>

* calculated by compiler
+ partial pressure of carbon dioxide

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
Volumetric method. The apparatus of Bodor, Bor, Mohai, and Sipos (1) was used.

SOURCE AND PURITY OF MATERIALS:
No details given.

ESTIMATED ERROR:

δxCO₂ = ±3%

REFERENCES:
1. Bodor, E.; Bor, Gy.; Mohai, B.; Sipos, G.
Chem. Abstr. 1961, 55, 3175h
COMPONENTS:
1. Carbon dioxide; CO₂; [124-38-9]
2. 1-Pentanol; C₅H₁₂O; [71-41-0]

VARIABLES:
\[ T/K = 288.15-318.15 \]
\[ P/kPa = 101.3 \]

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>density of solvent /kg m⁻³</th>
<th>Bunsen coeff. α</th>
<th>Ostwald coeff. L</th>
<th>Henry's constant+ xCO₂</th>
<th>CO₂ at P CO₂</th>
</tr>
</thead>
<tbody>
<tr>
<td>288.15</td>
<td>818.4</td>
<td>1.957</td>
<td>2.065</td>
<td>10.87</td>
<td>0.00924</td>
</tr>
<tr>
<td>298.15</td>
<td>811.5</td>
<td>1.657</td>
<td>1.809</td>
<td>12.72</td>
<td>0.00790</td>
</tr>
<tr>
<td>308.15</td>
<td>804.8</td>
<td>1.472</td>
<td>1.660</td>
<td>14.19</td>
<td>0.00709</td>
</tr>
<tr>
<td>318.15</td>
<td>800.6</td>
<td>1.324</td>
<td>1.542</td>
<td>15.58</td>
<td>0.00646</td>
</tr>
</tbody>
</table>

\[ P_{CO₂} = 101.3 \text{ kPa} \]

†Henry's constant, \( H \), was assumed by the compiler to be given by:
\[ H = P_{CO₂}/N \]
where \( N \) is the mole ratio solubility of carbon dioxide.

*calculated by the compiler

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Densities of the pure solvent were measured using a digital densitometer AP, model DMA 45 with temperatures controlled to 0.01 K with a Haake thermostat and measured to 0.01 K by a Digtec thermometer. The densitometer was first calibrated with distilled water.

The method and details of apparatus for measuring the absorption of gas are given in ref. (1). An Erlenmeyer flask connected to a pressure transducer was used. The transducer was first calibrated against a manometer containing dibutyl phthalate.

SOURCE AND PURITY OF MATERIALS:
1. from a cylinder; purity 99.5%
2. Merck p.a. grade was used without further purification apart from degasification by boiling.

ESTIMATED ERROR:
\[ \delta p / \text{kg m}^{-3} = \pm 0.1 \]
\[ \delta L = \pm 1\% \quad (\text{authors}) \]

REFERENCES:
1. Postigo, M.A.; Pedrosa, G.C.; Katz, M.
COMPONENTS:
1. Carbon dioxide; CO₂; [124-38-9]
2. 1-Heptanol; C₇H₁₆O; [111-70-6]
   or 1-Octanol; C₈H₁₈O; [111-87-5]

ORIGINAL MEASUREMENTS:
Makranczy, J.; Rusz, L.; Balog-Megyery, K.

VARIABLES:
\[ T/K = 298.15 \]
\[ P/kPa = 101.3 \]

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>P*/kPa</th>
<th>Ostwald coefficient</th>
<th>Mole fraction of carbon dioxide, ( x_{CO₂} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>298.15</td>
<td>101.3</td>
<td>2.052</td>
<td>0.01175</td>
</tr>
<tr>
<td>298.15</td>
<td>101.3</td>
<td>1.997</td>
<td>0.01277</td>
</tr>
</tbody>
</table>

* calculated by compiler
+ partial pressure of carbon dioxide.

SOURCE AND PURITY OF MATERIALS:
- No details given.

REFERENCES:
1. Bodor, E.; Bor, Gy.; Mohai, B.; Sipos, G.
   Chem. Abstr. 1961, 55, 3175h.
COMPONENTS:

1. Carbon dioxide; CO$_2$; [124-38-9]
2. 1-Heptanol; C$_7$H$_{16}$O; [111-70-6]
   1-Octanol; C$_{8}$H$_{18}$O; [111-87-5]

ORIGINAL MEASUREMENTS:

Dim, A.; Gardner, G.R.; Ponter, A.B.; Wood, T.

VARIABLES:

T/K = 298.2
P/kPa = 101.3

PREPARED BY:

P.G.T. Fogg

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>Solvent</th>
<th>$P_{CO_2}$/kPa$^+$</th>
<th>T/K</th>
<th>Solubility /mol cm$^{-3}$</th>
<th>$x_{CO_2}$*</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-heptanol</td>
<td>101.3</td>
<td>298.15</td>
<td>$7.63 \times 10^{-5}$</td>
<td>0.01069</td>
</tr>
<tr>
<td>1-octanol</td>
<td>101.3</td>
<td>298.15</td>
<td>$7.42 \times 10^{-5}$</td>
<td>0.01166</td>
</tr>
</tbody>
</table>

$^+$ the pressure of gas is not stated in the paper. It has been assumed by the compiler that the pressure was equal to barometric.

* calculated by the compiler.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Barium carbonate precipitated from a saturated solution of carbon dioxide was subsequently back titrated with hydrochloric acid. Details of the method have been given in refs (1) and (2). Densities of solvents were measured with a calibrated pycnometer.

SOURCE AND PURITY OF MATERIALS:

2. 1-Heptanol;
   density = 0.8209 g cm$^{-3}$
1-octanol;
   density = 0.8190 g cm$^{-3}$

REFERENCES:

COMPONENTS:
(1) Carbon dioxide; CO₂; \([124-38-9]\)
(2) 1-Octanol; C₈H₁₇OH; \([111-87-5]\)

ORIGINAL MEASUREMENTS:
Wilcock, R. J.; Battino, R.; Danforth, W. F.; Wilhelm, E.

VARIABLES:
\(T/K: \ 282.66 - 313.64\)
\(p/kPa: \ 101.325 \text{ (1 atm)}\)

PREPARED BY:
H. L. Clever

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>(T/K)</th>
<th>Mol Fraction</th>
<th>Bunsen Coefficient</th>
<th>Ostwald Coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(10^3x_1)</td>
<td>(a/cm^3\text{(STP)} cm^{-3} atm^{-1})</td>
<td>(L/cm^3\text{ cm}^{-3})</td>
</tr>
<tr>
<td>282.66</td>
<td>11.53</td>
<td>1.662</td>
<td>1.720</td>
</tr>
<tr>
<td>298.12</td>
<td>9.301</td>
<td>1.322</td>
<td>1.443</td>
</tr>
<tr>
<td>313.64</td>
<td>7.849</td>
<td>1.100</td>
<td>1.263</td>
</tr>
</tbody>
</table>

The Bunsen coefficients were calculated by the compiler.
It is assumed that the gas is ideal and that Henry's law is obeyed.

Smoothed Data: For use between 283.15 to 313.15 K

\[\ln x_1 = -8.3646 + 11.0172/(T/100K)\]

The standard error about the regression line is \(9.97 \times 10^{-5}\).

<table>
<thead>
<tr>
<th>(T/K)</th>
<th>Mol Fraction</th>
</tr>
</thead>
<tbody>
<tr>
<td>283.15</td>
<td>11.41</td>
</tr>
<tr>
<td>293.15</td>
<td>9.99</td>
</tr>
<tr>
<td>298.15</td>
<td>9.38</td>
</tr>
<tr>
<td>303.15</td>
<td>8.82</td>
</tr>
<tr>
<td>313.15</td>
<td>7.86</td>
</tr>
</tbody>
</table>

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
The solubility apparatus is based on the design of Morrison and Billett (1) and the version used is described by Battino, Evans, and Danforth (2).
The degassing apparatus is that described by Battino, Banzhof, Bogan, and Wilhelm (3).

Degassing. Up to 500 cm³ of solvent is placed in a flask of such size that the liquid is about 4 cm deep. The liquid is rapidly stirred, and vacuum is intermittently applied through a liquid N₂ trap until the permanent gas residual pressure drops to 5 microns.

Solubility Determination. The degassed solvent is passed in a thin film down a glass helical tube containing solute gas plus the solvent vapor at a total pressure of one atm. The volume of gas absorbed is found by difference between the initial and final volumes in the buret system. The solvent is collected in a tared flask and weighed.

SOURCE AND PURITY OF MATERIALS:
(1) Carbon dioxide. Air Products and Chemicals, Inc. Minimum mole per cent purity stated to be 99.8.
(2) 1-Octanol. Eastman Organic Chemicals. Distilled, density at 298.15 K, \(\rho = 0.8247\).

ESTIMATED ERROR:
\[\delta T/K = 0.02\]
\[\delta p/mmHg = 0.5\]
\[\delta x_1/x_1 = 0.01\]

REFERENCES:
COMPONENTS:
1. Carbon dioxide; CO₂; [124-38-9]
2. 1-Nonanol; C₉H₂₀O; [143-08-8]
   or
   1-Decanol; C₁₀H₂₂O; [112-30-1]

VARIABLES:
\[ T/K = 298.15 \]
\[ P/kPa = 101.3 \]

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>P/kPa</th>
<th>Ostwald coefficient</th>
<th>Mole fraction of carbon dioxide*, ( x_{CO₂} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>298.15</td>
<td>101.3</td>
<td>1.954</td>
<td>0.01378</td>
</tr>
<tr>
<td>298.15</td>
<td>101.3</td>
<td>1.910</td>
<td>0.01473</td>
</tr>
</tbody>
</table>

* calculated by compiler
+ partial pressure of carbon dioxide

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
Volumetric method. The apparatus of Bodor, Bor, Mohai and Sipos (1) was used.

SOURCE AND PURITY OF MATERIALS:
No details given

ESTIMATED ERROR:
\[ \delta x_{CO₂} = \pm 3\% \]

REFERENCES:
COMPONENTS:
(1) Carbon dioxide; CO₂; [124-38-9]
(2) 1-Decanol; C₁₀H₂₁OH; [112-30-1]

ORIGINAL MEASUREMENTS:
Wilcock, R. J.; Battino, R.; Danforth, W. F.; Wilhelm, E.

VARIABLES:
\( T/K: \) 284.01 - 313.49
\( p/kPa: \) 101.325 (1 atm)

PREPARED BY:
H. L. Clever

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>( T/K )</th>
<th>Mol Fraction ( 10³ x_1 )</th>
<th>Bunsen Coefficient ( a/cm³ ) (STP) cm⁻¹ atm⁻¹</th>
<th>Ostwald Coefficient ( L/cm³ ) cm⁻³</th>
</tr>
</thead>
<tbody>
<tr>
<td>284.01</td>
<td>12.32</td>
<td>1.468</td>
<td>1.526</td>
</tr>
<tr>
<td>298.15</td>
<td>9.733</td>
<td>1.144</td>
<td>1.249</td>
</tr>
<tr>
<td>313.49</td>
<td>7.914</td>
<td>0.917</td>
<td>1.053</td>
</tr>
</tbody>
</table>

The Bunsen coefficients were calculated by the compiler.
It is assumed that the gas is ideal and that Henry's law is obeyed.

Smoothed Data: For use between 283.15 to 313.15 K
\[ \ln x_1 = -9.1079 + \frac{13.3691}{T/100K} \]
The standard error about the regression line is \( 1.01 \times 10^{-4} \).

<table>
<thead>
<tr>
<th>( T/K )</th>
<th>Mol Fraction ( 10³ x_1 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>283.15</td>
<td>12.45</td>
</tr>
<tr>
<td>293.15</td>
<td>10.59</td>
</tr>
<tr>
<td>298.15</td>
<td>9.81</td>
</tr>
<tr>
<td>303.15</td>
<td>9.11</td>
</tr>
<tr>
<td>313.15</td>
<td>7.92</td>
</tr>
</tbody>
</table>

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
The solubility apparatus is based on the design of Morrison and Billett (1) and the version used is described by Battino, Evans, and Danforth (2).
The degassing apparatus is that described by Battino, Banzhof, Bogan, and Wilhelm (3).

Degassing. Up to 500 cm³ of solvent is placed in a flask of such size that the liquid is about 4 cm deep. The liquid is rapidly stirred, and vacuum is intermittently applied through a liquid N₂ trap until the permanent gas residual pressure drops to 5 microns.

Solubility Determination. The degassed solvent is passed in a thin film down a glass helical tube containing solute gas plus the solvent vapor at a total pressure of one atm. The volume of gas absorbed is found by difference between the initial and final volumes in the buret system. The solvent is collected in a tared flask and weighed.

SOURCE AND PURITY OF MATERIALS:
(1) Carbon dioxide. Air Products and Chemicals, Inc. Minimum mole percent purity stated to be 99.8.
(2) 1-Decanol. Eastman Organic Chemicals. Distilled, density at 298.15 K, \( \rho/g cm^{-3} \) 0.8206.

ESTIMATED ERROR:
\[ \delta T/K = 0.02 \]
\[ \delta p/mmHg = 0.5 \]
\[ \delta x_1/x_1 = 0.01 \]

REFERENCES:
COMPONENTS:
1. Carbon dioxide; CO$_2$; [124-38-9]
2. 1-Undecanol; C$_{11}$H$_{22}$O$_2$; [112-42-5] or
   1-Dodecanol; C$_{12}$H$_{26}$O$_2$; [112-53-8]

VARIABLES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>P/kPa</th>
<th>x$_{CO_2}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>298.15</td>
<td>101.3</td>
<td>0.01571</td>
</tr>
<tr>
<td>298.15</td>
<td>101.3</td>
<td>0.01664</td>
</tr>
</tbody>
</table>

* calculated by compiler
+ partial pressure of carbon dioxide.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
Volumetric method. The apparatus of Bodor, Bor, Mohai, and Sipos (1) was used.

SOURCE AND PURITY OF MATERIALS:
No details given.

ESTIMATED ERROR:

$\delta x_{CO_2} = \pm 3\%$

REFERENCES:
1. Bodor, E.; Bor, Gy.; Mohai, B.; Sipos, G.
   Chem. Abstr. 1961, 55, 3175h.
COMPONENTS:

1. Carbon dioxide; CO$_2$; [124-38-9]
2. 1-Decanol; C$_{10}$H$_{22}$O; [112-30-1]
3. 1-Dodecanol; C$_{12}$H$_{26}$O; [112-53-8]

ORIGINAL MEASUREMENTS:

Luther, H.; Hiemenz, W.

VARIABLES:

$T/K = 293.15-355.15$
$P/kPa = 0-80$ kPa

EXPERIMENTAL VALUES:

The solvent consisted of an equimolar mixture of 1-decanol and 1-dodecanol.

<table>
<thead>
<tr>
<th>$T/K$</th>
<th>Concentration of CO$_2$ /mol m$^{-3}$</th>
<th>Ostwald coeff. $L$</th>
<th>Henry's law constant /atm</th>
<th>Mole fraction solubility at 101.3 kPa /kPa**</th>
</tr>
</thead>
<tbody>
<tr>
<td>293.15</td>
<td>7.56 5.61</td>
<td>1.35</td>
<td>93.7±1.9</td>
<td>9490±190 0.0107</td>
</tr>
<tr>
<td>314.15</td>
<td>5.43 5.25</td>
<td>1.03</td>
<td>94.9±1.6</td>
<td>9490±200 0.0107</td>
</tr>
<tr>
<td>334.65</td>
<td>4.30 5.00</td>
<td>0.850</td>
<td>95.1±1.7</td>
<td>9490±210 0.0107</td>
</tr>
<tr>
<td>355.15</td>
<td>3.48 4.75</td>
<td>0.733</td>
<td>95.3±1.8</td>
<td>9490±220 0.0107</td>
</tr>
</tbody>
</table>

At 293.15 K the mole fraction solubility was shown to be proportional to the partial pressure of carbon dioxide to a pressure of at least 600 Torr (80 kPa).

* concentrations correspond to partial pressures of carbon dioxide of about 13 kPa.

** calculated by the compiler.

EXPERIMENTAL VALUES:

METHOD/APPARATUS/PROCEDURE:

A spectroscopic method was used. The gas and solution under test was circulated through cuvettes. The concentration of carbon dioxide in the gas and liquid phases were calculated from the integrated extinction coefficient due to the infra-red band at 2350 cm$^{-1}$.

SOURCE AND PURITY OF MATERIALS:

1. from a cylinder; purified by the usual methods.

ESTIMATED ERROR:

$\delta L \leq \pm 7.5\%$ (authors)

REFERENCES:
COMPONENTS:

(1) Carbon dioxide; CO$_2$; [124-38-9]
(2) Cyclohexanol; C$_6$H$_{12}$O; [108-93-0]

ORIGINAL MEASUREMENTS:

Cauquil, G.


VARIABLES:

T/K = 299
P$_1$/kPa = 102

EXPERIMENTAL VALUES:

The author states that one liter of cyclohexanol absorbs 677 cm$^3$ carbon dioxide at 26 $^\circ$C and 766 mmHg.

The compiler calculates an Ostwald coefficient of $L$/cm$^3$ cm$^{-3}$ = 0.677 and a mole fraction solubility of $x_I = 2.86 \times 10^{-3}$ at 299 K and a gas partial pressure of 101.325 kPa (1 atm).

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The apparatus appears to be of the Bunsen type.

The initial and final volumes of gas in contact with the liquid were measured. The vapor pressure of the liquid was ignored.

SOURCE AND PURITY OF MATERIALS:

(1) Carbon dioxide.
   No information.

(2) Cyclohexanol; Distilled, boiling point 160.9 $^\circ$C at 766 mmHg.
   Degassed and tested to be air free.

ESTIMATED ERROR:

$\delta L/L = \pm 0.05$ (compiler)

REFERENCES:
COMPONENTS:
1. Carbon dioxide; CO₂; [124-38-9]
2. Cyclohexanol; C₆H₁₂O; [108-93-0]

ORIGINAL MEASUREMENTS:
Begley, J.W.; Maget, J.R.; Williams, B.

VARIABLES:
P/kPa = 101.3
T/K = 298.25-320.95

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>Ostwald coefficient L</th>
<th>Mole fraction solubility x CO₂ at P CO₂ = 101.3 kPa*</th>
</tr>
</thead>
<tbody>
<tr>
<td>298.25</td>
<td>1.017</td>
<td>0.00442</td>
</tr>
<tr>
<td>301.45</td>
<td>0.990</td>
<td>0.00427</td>
</tr>
<tr>
<td>303.75</td>
<td>0.980</td>
<td>0.00420</td>
</tr>
<tr>
<td>306.75</td>
<td>0.957</td>
<td>0.00408</td>
</tr>
<tr>
<td>309.45</td>
<td>0.925</td>
<td>0.00391</td>
</tr>
<tr>
<td>312.75</td>
<td>0.910</td>
<td>0.00382</td>
</tr>
<tr>
<td>314.95</td>
<td>0.887</td>
<td>0.00370</td>
</tr>
<tr>
<td>320.95</td>
<td>0.830</td>
<td>0.00342</td>
</tr>
</tbody>
</table>

*calculated by the compiler using the expression for the density of the solvent given in The International Critical Tables.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
The solvent was boiled to remove any gases in solution and was then introduced into the absorption vessel without coming into contact with the air. The volume of carbon dioxide absorbed by the liquid from gas buret was then measured. The composition of the solution after equilibrium was attained was measured by chemical analysis. This enabled a check to be made of solubility as calculated from the volume of gas absorbed. The absorption vessel and the gas buret were kept at constant temperature by circulation of water from a thermostat bath.

SOURCE AND PURITY OF MATERIALS:
2. Cyclohexanol - technical grade from Dow Chemical Company. Impurities were phenol max. 0.5 wt%; cyclohexanone max. 0.1 wt%; water max. 0.5 wt%

ESTIMATED ERROR:
δT/K = ±0.1 Solubility measurements reproducible to about ±0.5% (authors).

REFERENCES:
COMPONENTS:
1. Carbon dioxide; CO\textsubscript{2}; [124-38-9]
2. Benzenemethanol (Benzyl alcohol); C\textsubscript{7}H\textsubscript{8}O; [100-51-6]
1,2-Ethanediol (Ethylene glycol); C\textsubscript{2}H\textsubscript{6}O\textsubscript{2}; [107-21-1]

ORIGINAL MEASUREMENTS:

VARIABLES:
\( T/K = 298.2 \)

PREPARED BY:
C. L. Young

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>Solvent</th>
<th>( T/K )</th>
<th>Henry's constant ( H_{CO_2}/\text{atm} )</th>
<th>Mole fraction at 1 atm* ( x_{CO_2} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Benzenemethanol</td>
<td>298.2</td>
<td>128</td>
<td>0.00781</td>
</tr>
<tr>
<td>1,2-Ethanediol</td>
<td>298.2</td>
<td>262</td>
<td>0.00382</td>
</tr>
</tbody>
</table>

* Calculated by the compiler assuming a linear function of \( P_{CO_2} \) vs \( x_{CO_2} \), i.e. \( x_{CO_2}(1 \text{ atm}) = 1/H_{CO_2} \)

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
A conventional gas-liquid chromatographic unit fitted with a thermal conductivity detector was used. The carrier gas was helium. The value of Henry's law constant was calculated from the retention time. The value applies to very low partial pressures of gas and there may be a substantial difference from that measured at 1 atm. pressure. There is also considerable uncertainty in the value of Henry's constant since surface adsorption was not allowed for although its possible existence was noted.

SOURCE AND PURITY OF MATERIALS:
(1) L'Air Liquide sample, minimum purity 99.9 mole per cent.
(2) Touzart and Matignon or Serlabo sample, purity 99 mole per cent.

ESTIMATED ERROR:
\( \delta T/K = \pm 0.1 \); \( \delta H/\text{atm} = \pm 6\% \)
(estimated by compiler).

REFERENCES:
COMPONENTS:

1. Carbon dioxide; CO₂; [124-38-9]

2. Benzenemethanol, (benzyl alcohol); C₇H₈O; [100-51-6]

VARIABLES:

\[ T/K = 323.15-398.25 \]
\[ P/kPa = 500-14000 kPa \]

EXPERIMENTAL VALUES:

Measurements were made over the pressure range 500-14000 kPa. Mole fraction solubilities were interpreted by the Krichevskii-Il'inskaya equation in the form

\[ \log \frac{f_2}{x_2} - \frac{\nu_2 P}{2.303RT} = \log H - \frac{A}{2.303RT} (1 - x_2) \]

where \( f_2 \) is the fugacity of carbon dioxide, \( x_2 \) is the mole fraction of carbon dioxide in the liquid phase, \( \nu_2 \) is the partial molar volume of carbon dioxide as \( x_2 \to 0 \), \( H \) is the limiting value of Henry's constant at zero pressure and \( A \) is a constant. Henry's constant is defined as the ratio of pressure of carbon dioxide to mole fraction solubility.

<table>
<thead>
<tr>
<th>( T/K )</th>
<th>( \bar{\nu}_2/cm^3mol^{-1} )</th>
<th>( H/bar )</th>
<th>( A/cm^3mol^{-1}bar^{-1} )</th>
<th>( H/kPa* )</th>
<th>( x_2 ) at ( P_2 = 101.3 ) kPa*</th>
</tr>
</thead>
<tbody>
<tr>
<td>323.15</td>
<td>38.7</td>
<td>282</td>
<td>2708</td>
<td>28200</td>
<td>0.00360</td>
</tr>
<tr>
<td>348.15</td>
<td>51.1</td>
<td>336</td>
<td>30200</td>
<td>33600</td>
<td>0.00303</td>
</tr>
<tr>
<td>373.15</td>
<td>63.5</td>
<td>392</td>
<td>31800</td>
<td>39200</td>
<td>0.00260</td>
</tr>
<tr>
<td>398.15</td>
<td>75.9</td>
<td>443</td>
<td>34870</td>
<td>44300</td>
<td>0.00230</td>
</tr>
</tbody>
</table>

* calculated by the compiler

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Carbon dioxide and benzenemethanol were allowed to reach equilibrium at various pressures to a maximum of 14000 kPa. Samples of the liquid phase were removed and analysed.

Partial molar volumes of carbon dioxide were found by measuring the volume of the liquid phase at different temperatures in sealed glass tubes.

SOURCE AND PURITY OF MATERIALS:

1. From a cylinder; dried and freed from gaseous impurities by repeated refreezing with liquid nitrogen.

2. Purified by vacuum distillation; m.pt. 15.2-15.4°C.

ESTIMATED ERROR:

<table>
<thead>
<tr>
<th>( \Delta T/K )</th>
<th>±0.5</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \Delta x_2 )</td>
<td>±5%</td>
</tr>
</tbody>
</table>

REFERENCES:
**COMPONENTS:**
1. Carbon dioxide; CO₂ [124-38-9]
2. 1,2-Ethanediol or ethylene glycol; C₉H₁₈O₂ [107-21-1]
3. Water; H₂O [7732-18-5]

**ORIGINAL MEASUREMENTS:**
Hayduk, W.; Malik, V.K.

**VARIABLES:**
- **T/K:** 298.15
- **P/kPa:** 101.325
- **x₂:** 0-1.00

**PREPARED BY:**
W. Hayduk

**EXPERIMENTAL VALUES:**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0</td>
<td>0.825</td>
<td>0.756</td>
<td>6.08</td>
</tr>
<tr>
<td>0.072</td>
<td>0.721</td>
<td>0.661</td>
<td>6.08</td>
</tr>
<tr>
<td>0.165</td>
<td>0.660</td>
<td>0.605</td>
<td>6.48</td>
</tr>
<tr>
<td>0.222</td>
<td>0.638</td>
<td>0.585</td>
<td>6.81</td>
</tr>
<tr>
<td>0.291</td>
<td>0.630</td>
<td>0.577</td>
<td>6.55</td>
</tr>
<tr>
<td>0.420</td>
<td>0.600</td>
<td>0.605</td>
<td>9.03</td>
</tr>
<tr>
<td>0.453</td>
<td>0.643</td>
<td>0.589</td>
<td>9.13</td>
</tr>
<tr>
<td>0.651</td>
<td>0.751</td>
<td>0.688</td>
<td>13.0</td>
</tr>
<tr>
<td>0.685</td>
<td>0.760</td>
<td>0.696</td>
<td>13.5</td>
</tr>
<tr>
<td>0.748</td>
<td>0.793</td>
<td>0.727</td>
<td>14.9</td>
</tr>
<tr>
<td>0.874</td>
<td>0.871</td>
<td>0.798</td>
<td>18.1</td>
</tr>
<tr>
<td>0.932</td>
<td>0.903</td>
<td>0.827</td>
<td>19.6</td>
</tr>
<tr>
<td>0.983</td>
<td>0.945</td>
<td>0.866</td>
<td>21.2</td>
</tr>
<tr>
<td>0.997</td>
<td>0.962</td>
<td>0.881</td>
<td>21.8</td>
</tr>
<tr>
<td>1.00</td>
<td>0.966[^3]</td>
<td>0.885</td>
<td>22.0[^3]</td>
</tr>
</tbody>
</table>

[^1] Original data
[^2] Calculated by compiler using solvent density data given
[^3] Extrapolated by authors allowing for water content of ethylene glycol used.

**AUXILIARY INFORMATION**

**METHOD/APPARATUS/PROCEDURE:**
The solubility was measured by saturating the solvent solution in a water-jacketed contactor at atmospheric pressure and using a fritted-glass bubbler to disperse the gas. Samples of saturated solution were allowed to drain by gravity into a 50-cm pipet for analysis. The analysis consisted of reacting the sample with an excess of standard sodium hydroxide and back-titrating with standard acid. The composition of solvent was determined from the mass of the components.

**SOURCE AND PURITY OF MATERIALS:**
1. Matheson Co. Specified as instrument grade of purity 99.5 per cent.
2. Fisher Chemical. Certified reagent grade of maximum water content 0.2 per cent.
3. Distilled.

**ESTIMATED ERROR:**
- δT/K = 0.1
- δx₁/x₁ = 0.015
- δx₂/x₂ = 0.005

**REFERENCES:**
### COMPONENTS:
- 1. Carbon dioxide; CO₂; [124-38-9]
- 2. Ethylene glycols

### VARIABLES:
- \( T/K = 297.1 \)
- \( P/kPa = 101.6 \)

### EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>Solvent</th>
<th>Ostwald coeff.</th>
<th>Mole fraction in liquid* ( x_{CO_2} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,2-Ethanediol, (ethylene glycol); C₂H₆O₂; [107-21-1]</td>
<td>1.33</td>
<td>0.0031</td>
</tr>
<tr>
<td>2,2'-[1,2-Ethanediylbis(oxy)]bis-ethanol, (triethylene glycol); C₆H₁₄O₄; [112-27-6]</td>
<td>1.70</td>
<td>0.0093</td>
</tr>
</tbody>
</table>

\( T/K = 297.1 \)

\( P_{CO_2}/psia = 14.73 \)

\( P_{CO_2}/kPa = 101.6 \)

* calculated by compiler

### AUXILIARY INFORMATION

**METHOD/APPARATUS/PROCEDURE:**

The CO₂ was contained in a thermostatted metal cylinder connected to a pressure gage, vacuum pump and supply of gas. A tight fitting internal piston sealed with an O-ring fitted into the cylinder so that the volume of gas could be changed by controlled movement of the piston. A measured volume of solvent was injected into the cylinder by a syringe. The absorption of gas was found from the movement of the piston which was necessary to maintain constant pressure.

**SOURCE AND PURITY OF MATERIALS:**

No information.

**ESTIMATED ERROR:**

**REFERENCES:**
COMPONENTS:
1. Carbon dioxide; CO₂; [124-38-9]
2. Butane-1,4-diol; C₄H₁₀O₂; [25265-75-2]

VARIABLES:
T/K = 323.2-398.2
P/kPa to 8000 kPa

EXPERIMENTAL VALUES:

| T/°C | T/K | Henry's law constant, H | x₂O₂ at | F₂O₂ = 101.3 kPa*
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Mpa</td>
<td>/kPa</td>
<td></td>
</tr>
<tr>
<td>50</td>
<td>323.2</td>
<td>36</td>
<td>36000</td>
<td>0.00280</td>
</tr>
<tr>
<td>75</td>
<td>348.2</td>
<td>46</td>
<td>46000</td>
<td>0.00219</td>
</tr>
<tr>
<td>100</td>
<td>373.2</td>
<td>56</td>
<td>56000</td>
<td>0.00180</td>
</tr>
<tr>
<td>125</td>
<td>398.2</td>
<td>76</td>
<td>76000</td>
<td>0.00133</td>
</tr>
</tbody>
</table>

* estimated by the compiler

The Henry's law constant, H is defined as

\[ H = p \frac{f}{x} \]

where \( f \) is the fugacity of CO₂ and \( x \) is the mole fraction of CO₂ in solution.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
Solubilities were measured at pressures to 8000 kPa by a method described in ref. (1). The liquid phase was sampled and analysed after the systems had reached equilibrium. Mole fraction solubilities of carbon dioxide fitted the Krichevskii-Ill'inskaya equation (3) from which limiting values of Henry's law were found.

SOURCE AND PURITY OF MATERIALS:
1. Obtained from a cylinder; frozen solid solid evacuated to remove gaseous impurities.
2. Purified by repeated freezing; M.pt 16.0-16.2°C; vapor pressure in the range 50-75°C measured with an isoteniscope and found to be consistent with literature data for a higher temperature (2).

ESTIMATED ERROR:

\( \delta T/K = \pm 0.5 \)
\( \delta H = \pm 5\% \) (authors)

REFERENCES:
COMPONENTS:
(1) Carbon dioxide; CO₂; [124-38-9]
(2) 1,2,3-Propanetriol or glycerol; C₃H₈O₃; [56-81-5]

ORIGINAL MEASUREMENTS:
Just, G.

VARIABLES:

\[\begin{align*}
T/K &= 298.15 \\
P_1/kPa &= 101.325 \text{ (1 atm)}
\end{align*}\]

PREPARED BY:
M. E. Derrick
H. L. Clever

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>Mol Fraction (10^5x_1)</th>
<th>Bunsen Coefficient (a/(cm^3\text{ (STP)}cm^-3\text{ atm}^-1)</th>
<th>Ostwald Coefficient (L/cm^3\text{ cm}^-3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>298.15</td>
<td>9.03</td>
<td>0.0277</td>
<td>0.0302</td>
</tr>
</tbody>
</table>

The author measured the Ostwald coefficient at a pressure of about 746 mmHg. The compiler assumed the Ostwald coefficient to be independent of pressure, and calculated the mole fraction and Bunsen coefficient values at 101.325 kPa (1 atm) partial pressure of the gas.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
An Ostwald apparatus as modified by Timofejew (1), and Steiner (2) is used. The apparatus consists of a gas buret, an absorption flask, and a mercury manometer. The system is thermostated with a water jacket.

The gas is introduced into the degassed liquid. The gas volume absorbed is determined by the gas buret. The solvent volume is determined at the end of the experiment by pouring the solvent into a graduated flask.

SOURCE AND PURITY OF MATERIALS:
(1) Carbon dioxide. Generated in a Kipp apparatus using marble and hydrochloric acid.
(2) 1,2,3-propanetriol. No information.

ESTIMATED ERROR:
\[\delta L/L = 0.03\] (compiler)

REFERENCES:
1. Timofejew, W.
Z. Phys. Chem. 1890, 6, 141.
2. Steiner, P.
COMPONENTS:

1. Carbon dioxide; CO₂; [124-38-9]
2. Solvents, other than Alcohols, Containing Carbon, Oxygen and Hydrogen

CRITICAL EVALUATION:

Solubility of carbon dioxide in solvents, other than alcohols, containing carbon, hydrogen and oxygen.

Bodor et al. (1) measured solubility in 2-propanone from 198 K to 318.2 K at partial pressures of carbon dioxide of 7.7 kPa to 97.2 kPa with extrapolation to 101.3 kPa. This data is self consistent and there is no reason to doubt its reliability. Solubility at a partial pressure of 101.3 kPa is given in nine papers (1-9) which together cover the range 198 K to 307.2 K. The general pattern of data is consistent except at 293.2 K and 298.2 K. At 293.2 K values for the mole fraction solubility range from 0.02022 (Felsing(7)) to 0.02317 (Koudelka(4)) and at 298.15 K from 0.01870 (Just(8)) to 0.02108 (Gjaldbaek(9)). The only measurements above 298.2 K are those of Kunerth (5). These need to be confirmed by further work. The following equation for mole fraction solubility at a partial pressure of 101.3 kPa is based upon all the data mentioned above.

\[
\ln x_{CO_2} = -10.599 + \frac{1980.7}{(T/K)} - 0.00280 \ln(T/K) \quad (I)
\]

temperature range = 198-318.2 K
standard deviation in \(x_{CO_2}\) = 0.0143

The following equation is based on data for the temperature range 200.0-298.2 K from (1,6-9).

\[
\ln x_{CO_2} = -10.313 + \frac{1905.1}{(T/K)} + 0.0017 \ln(T/K) \quad (II)
\]

temperature range = 200.1-298.2 K
standard deviation in \(x_{CO_2}\) = 0.0055

Shenderei (10) measured the solubility of carbon dioxide in various solutions of ethyne in 2-propanone at 217.2 K. Extrapolation of the mole fraction solubility for a partial pressure of carbon dioxide to zero concentration of ethyne gives a value of 0.234 for dissolution in pure 2-propanone. The value from equation II is 0.216.

Balog-Megyery et al. (2) have published solubilities in sixteen alkanones at 298.15 K and a partial pressure of gas of 101.3 kPa. These range from 2-propanone to 2-undecanone. There is very little change in the mole fraction solubilities calculated from the data. The value for 2-undecanone is 0.0212 and that for 2-propanone is 0.0192. This last value may be compared with the value of 0.0199 from equation II above.

Shenderei et al. (11) measured solubility in 2-butanoone to high pressures and reported Henry's constants. Estimated mole fraction solubilities at 228.1 K and 248.0 K are 0.1299 and 0.0654 compared with smoothed values of 0.142 and 0.073 for 2-propanone. No other data for 2-butanoone at these temperatures are available for comparison.

Mole fraction solubilities in cyclopentanone (12), cyclohexanone (13) and in 2,6-dimethylcyclohexanone (14) have been measured at a partial pressure of 101.3 kPa from 273.15 K to 303.15 K by Gallardo et al. Solubility curves lie below that for 2-propanone. There is very little difference in mole fraction solubilities under the same conditions in the three solvents. Mole fraction solubilities are also close to that for 2-methyl-5-[(1-methylethenyl)-2-cyclohexen-1-one from Just's data (8) (see Table 1). These measurements on cyclic ketones can be tentatively accepted as reliable.

Bodor et al. (1) measured solubilities in acetaldehyde at 33.2 kPa to 101.3 kPa from 198 K to 248.2 K. The data are self-consistent but no other measurements are available for comparison. Mole fraction solubility...
# Components:

<table>
<thead>
<tr>
<th>Component</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Carbon dioxide; CO₂;</td>
<td>[124-38-9]</td>
</tr>
<tr>
<td>2. Solvents, other than Alcohols, Containing Carbon, Oxygen and Hydrogen</td>
<td></td>
</tr>
</tbody>
</table>

# Critical Evaluation:

Values are lower than those for 2-propanone under the same conditions. At 248.2 K and a partial pressure of 1.013 kPa the value for acetaldehyde is 0.047 compared with a value of 0.072 for 2-propanone.

Just (8) measured solubility in benzaldehyde at about 101.3 kPa from 288.2 K to 298.2 K. These measurements are in close agreement with measurements by Kunerth (5) from 291.2 K to 309.2 K. An equation for mole fraction solubility at a partial pressure of 101.3 kPa given below is recommended. It is based on the two sets of data.

\[
\ln x_{CO_2} = -90.097 + \frac{5108.0}{(T/K)} + 12.023\ln(T/K)
\]

temperature range = 288.2-309.2 K

standard deviation in \( x_{CO_2} = 8.9 \times 10^{-5} \)

Solubility in 4-methyl-1,3-dioxolan-2-one (propylene carbonate) has been measured to high pressures by Mantor et al. (15), Zubchenko et al. (16), Shakhova et al. (17), Isaacs et al. (18) and by Murrieta-Guevara et al. (19). These authors have used the data to obtain limiting values of Henry's constant from which the solubility at 101.3 kPa may be estimated. Makranczy et al. (20) have also made measurements to high pressures but values of solubility at 101.3 kPa from these measurements are inconsistent with measurements by other groups. Lenoir et al. (21) have measured limiting values of Henry's constant by a chromatographic method. These values are high compared with other values and may be subject to the limitations of the chromatographic method. Limiting values of Henry's constant from chromatographic measurements by Sweeney (22) are in better agreement with other data. Rivas and Prausnitz (23,24) have reported values of Henry's constant at 263.2 K to 373.2 K calculated from volumes of gas absorbed. The solubility at 293.2 K is also given by Bratzer (25). The evaluator recommends an equation for mole fraction solubility at a partial pressure of gas of 101.3 kPa which is based upon data given in references (15-19,22-25). i.e.

\[
\ln x_{CO_2} = -36.218 + \frac{2856.7}{(T/K)} + 3.9003\ln(T/K)
\]

temperature range = 228.2-423.2 K

standard deviation in \( x_{CO_2} = 0.00060 \)

Meder et al. (26) measured the solubility at partial pressures from 9.3 kPa to 93.0 kPa at 293.2 K. Extrapolation to 101.3 kPa gives a value of \( x_{CO_2} \) of about 0.015 compared with a value of 0.0133 from the above equation. These measurements at lower pressures need confirmation by other workers.

Vilcu et al. (27) have reported the mole fraction solubility in 1,3-dioxolan-2-one (ethylene carbonate) to be 0.00703 at 101.3 kPa and 313.2 K. This compares with a value of 0.00926 for solubility in propylene carbonate under these conditions.

Just (8) measured solubilities in acetic, propanoic and butanoic acids at about 101.3 kPa from 286.2 K to 298.2 K. Kunerth (5) measured solubility in acetic acid at about the same pressure over the range 291.2 K to 309.2 K. These measurements are consistent with those of Just. A smoothing equation for solubility at a partial pressure of 101.3 kPa, based on the two sets of measurements, is given below.
COMPONENTS:
1. Carbon dioxide; CO$_2$; [124-38-9]
2. Solvents, other than Alcohols, Containing Carbon, Oxygen and Hydrogen

EVALUATOR:
Peter G.T. Fogg,
School of Applied Chemistry,
Polytechnic of North London,
Holloway Road, London, N7 8DB, U.K.
July 1991

CRITICAL EVALUATION:

\[
\ln x_{CO_2} = 76.937 - 2231.8/(T/K) - 12.978\ln(T/K)
\]

temperature range = 288.2-309.2 K
standard deviation in $x_{CO_2}$ = 0.00012

No other measurements are available to confirm Just's data for propanoic and butanoic acids.

Ouellet and Dubois (28) measured solubility in 9-octadecanoic acid at 11 kPa to 59 kPa from 296.2 K to 335.2 K. This work is self consistent but no measurements on this or other long chain carboxylic acids are available for comparison. These data for acetic, propanoic, butanoic and 9-octadecanoic acids indicate that mole fraction solubility at a partial pressure of 101.3 kPa increases with carbon number. (Table 1)

Just (8) measured solubility in acetic acid anhydride from 288.2 K to 298.2 K. No other data are available.

Mole fraction solubilities in alkyl esters of carboxylic acids from the literature are higher than in carboxylic acids or ketones under the same conditions. There is a tendency for values of mole fraction solubilities at 298.2 K and 101.3 kPa to increase with chain length of the parent alkanol and of the parent carboxylic acid. (see Table 1)

Just (8) measured solubility in pentyl formate from 288.2 K to 298.2 K. No other data on this system are available for comparison. The mole fraction solubility in methyl acetate at 298.2 K and 101.3 kPa from Just (8) is 0.02260 and from Gjaldbaek and Andersen (9) is 0.00207. The latter measurements are probably the more reliable.

Bodor et al. (29) measured solubility in ethyl acetate at partial pressures from 9.6 kPa to 102.4 kPa at 198 K to 318.2 K. The data is self-consistent. Shenderei et al. (11) measured solubility to high pressures at 228.0 K to 248.0 K. Bodor's value of mole fraction solubility at 248.2 K and a partial pressure of 101.3 kPa is 0.0890. The value at 248.0 K and 101.3 kPa from Shenderei is 0.0813. The following smoothing equation for mole fraction solubility at a partial pressure of 101.3 kPa is based upon data from both sources. Differences between the two sets of data must be borne in mind when this equation is used.

\[
\ln x_{CO_2} = 11.689 + 1063.1/(T/K) - 3.3435\ln(T/K)
\]

temperature range = 198-318.2 K
standard deviation in $x_{CO_2}$ = 0.0095

Solubility in propyl acetate at 298.2 K and a partial pressure of 101.3 kPa was measured by Gjaldbaek and Andersen (9). Solubility in 2-methylpropyl acetate at 293.2 K and 298.2 K was measured by Just (8). There is no reason to doubt the reliability of these measurements but confirmation by other workers is needed.

Solubility in pentyl acetate at or close to 101.3 kPa was measured by Just (8) from 288.2 K to 298.2 K and by Kunerth (5) from 291.2 K to 307.2 K. Values of mole fraction solubility at 293.2 K are 0.0266 (Just) and 0.0280 (Kunerth). The following smoothing equation is based on the two sets of data.
COMPONENTS:

1. Carbon dioxide; CO₂; [124-38-9]
2. Solvents, other than Alcohols, Containing Carbon, Oxygen and Hydrogen

EVALUATOR:

Peter G.T. Fogg,
School of Applied Chemistry,
Polytechnic of North London,
Holloway Road, London, N7 8DB, U.K.

July 1991

CRITICAL EVALUATION:

\[ \ln x_{CO₂} = -79.380 + 4337.8/(T/K) + 10.737ln(T/K) \]

temperature range = 288.2-307.2 K
standard deviation in \( x_{CO₂} \) = 0.00056

Ouellet and Dubois (28) measured solubility in ethyl stearate at 8 kPa to 78 kPa from 307.2 K to 347.2 K. The data are self-consistent but no other measurements are available for comparison.

Arai et al. (30) measured solubility in methyl, ethyl and butyl oleate at 30kPa to 90 kPa from 273.2 K to 343.2 K. There is very little difference between mole fraction solubilities in the three solvents. The data are self-consistent. No other measurements on these systems are available. Comparison with Oullet's measurements indicate that mole fraction solubility in oleates is greater than in stearates under the same conditions.

There are significant differences between solubilities in 1,2,3-propanetriol triacetate measured by Shakhova et al. (17) from 273.2 K to 328.2 K and those measured by Makranczy et al. (20) from 273.2 K to 303.2 K. Values of mole fraction solubility at a partial pressure of 101.3 kPa at 273.2 K are 0.0466 (Shakhova) and 0.0414 (Makranczy). At 298.2 K the two values are 0.0284 (Shakhova) and 0.0222 (Makranczy). Further measurements on this system are required.

The solubility in 1,1'-oxybisethane was measured by Christoff (31) in 1912 at barometric pressure from 273.2 K to 288.2 K. This work indicates that mole fraction solubility, corrected to a partial pressure of 101.3 kPa is close to that in 2-propanone under the same conditions. There is no recent work on the system under these conditions.

Bodor (32) measured solubility in tetrahydrofuran at 10.5 kPa to 97.7 kPa from 198 K to 318.2 K. Measurements are self-consistent and there is no reason to doubt their reliability. Mole fraction solubility is high compared with other solvents. No other work on the system is available for comparison.

Gallardo et al. (33) reported the mole fraction solubility in 1,4-dioxane at a partial pressure of 101.3 kPa from 265.2 K to 303.2 K. Kassim et al. (34) reported values from 303.2 K to 333.2 K. Values for 303.2 K are 0.01974 (Gallardo) and 0.0192 (Kassim). However Gallardo's measurements show a steep fall in mole fraction solubility with increase in temperature whereas Kassim's measurements show negligible change through the temperature range. The two sets of measurements are therefore not compatible. Further work on this system is required.

The limiting value of Henry's constant for dissolution in dipropylene glycol at 298.2-343.2 K was measured by Lenoir et al. (21) by gas-liquid chromatography. No other measurements are available for comparison. Jou et al. (35) measured solubility in triethylene glycol to high pressures at 29.8.15 K to 398.15 K. Mole fraction solubility at 101.3 kPa can be calculated from the data. Makranczy et al. (36) also investigated this system at 273.15-303.15 K to high pressures. Values of mole fraction solubility at 298.15 K; 101.3 kPa from the two sources are 0.00677 (Makranczy); 0.00846 (Jou). The data from Jou et al. shows greater consistency over the pressure range in which studies were carried out and are likely to be the more reliable. Byeseda et al. (37) measured the solubility in this solvent at 297.1 K and a pressure of 101.6 K. The corresponding value of the mole fraction solubility is 0.0093 compared with a value of 0.0086 by extrapolation of Jou's measurements.
COMPONENTS:

1. Carbon dioxide; CO₂; [124-38-9]
2. Solvents, other than Alcohols, Containing Carbon, Oxygen and Hydrogen

CRITICAL EVALUATION:

Makarov et al. (38) measured solubility to high pressures at 293.15 K in two samples of polyethylene glycol having average relative molecular masses of 280 and 400 respectively. In one case the degree of polymerisation was 6 and in the other case 8.7. Comparison with Jou's data shows that, at a partial pressure of gas of 101.3 K the mole fraction solubility of carbon dioxide increases with the average number of ether linkages in molecules of the solvent. A plot of mole ratio solubility of these compounds with two hydroxyl groups against the number of ether linkages is close to a straight line passing through the mole ratio solubility in ethylene glycol which has no ether linkages (Fig. 1). This indicates that Makarov's data is consistent with Jou's data. The solubility of hydrogen sulfide in polyethylene glycols shows a similar variation with the number of ether linkages (39).

Bodor et al. (40) measured solubility in 2-methoxyethanol (ethylene glycol monomethyl ether) at pressures to 99 kPa from 198 K to 318.2 K. Data can be extrapolated to give the solubility at 101.3 kPa. The measurements are self consistent and may be accepted on a tentative basis. Sciamanna and Lynn (41) measured solubility in diethylene glycol monomethyl ether and in triethylene glycol monobutyl ether at 3 to 100 kPa from 288.2 K to 373.2 K. Comparison of these measurements with Bodor's measurements on ethylene glycol monomethyl ether shows again that mole fraction solubility at a pressure of gas of 101.3 kPa increases with the number of ether linkages. When mole ratio solubilities in these compounds with one hydroxyl group are plotted against the number of ether linkages values lie close to a straight line. This line is close to the solubility in ethanol which has no ether linkages (Fig. 1).

Solubilities in polyethylene glycol diethers have been published by various authors. Makarov (38) measured solubilities in triethylene glycol diethyl ether, polyethylene glycol diethyl, dipropyl and methylpropyl ethers to high pressures at 293.2 K to 323.2 K. Sciamanna and Lynn (41) measured solubilities in di- and triethylene glycol dimethyl ethers at pressures to 100 kPa from 288.2 K to 373.2 K. Zubchenko and Shakhova (42) also measured the solubility in tetraethylene glycol dimethyl ether at 298.15 K. Sweeney (22) measured the limiting value of Henry's constant at 298.2 K and 323.2 K. Values from both these sources are close to those from Sciamanna's work. Wolfer (43) reported solubility data for polyethylene glycol methyl isopropyl ether. Mole fraction solubilities at 101.3 kPa in all these compounds are greater than in polyglycols having no alkoxy groups but the same number of ether links. Mole ratio solubilities plotted against the number of ether links lie close to a straight line passing through the solubility in diethyl ether which has one ether link (Fig 1).

Makranczy et al. (20) measured solubility in methoxytriethylene glycol acetate and butoxytriethylene glycol acetate. Makarov et al. (38) measured solubility in polyethylene glycol diacetate. No other measurements on these solvents are available for comparison. Data for the two monoacetates fall close to values for glycol ethers and diethers having the same number of ether linkages. The data for the diacetate lies closer to corresponding data for polyglycols (Fig. 1).

The limiting value of Henry's constant for dissolution in phenol at 323.2 K was measured by Lenoir et al. (21) using the gas-liquid chromatographic method. The mole fraction estimated for a partial pressure of 101.3 kPa is 0.00467 but this value is subject to the limitations associated with the method. Horvath et al. (44) measured solubility in 3-methylphenol at 300.5 K. The value of the mole fraction solubility at a partial pressure of 101.3 kPa is 0.00592. This value is compatible with the value for phenol at 323.2 K estimated from Lenoir's...
Fig. 1  Mole ratio solubilities at 293.15 K and a partial pressure of 101.3 kPa in glycol ethers, glycols, glycol esters, diethyl ether and ethanol as a function of the number of \(-\text{C}-\text{O}-\text{C}\)- links in a molecule of the solvent.

\[ \begin{align*}
\Delta & \quad \text{Glycol diethers and diethyl ether} \\
\text{a} & \quad \text{diethyl ether (31)} \\
\text{b} & \quad \text{diethylene glycol dimethyl ether (41)} \\
\text{c} & \quad \text{triethylene glycol dimethyl ether (16)}^1 \\
\text{d} & \quad \text{triethylene glycol dimethyl ether (38)} \\
\text{e} & \quad \text{triethylene glycol diethyl ether (38)} \\
\text{f} & \quad \text{tetraethylene glycol dimethyl ether (41)} \\
\text{g} & \quad \text{polyethylene glycol methyl isopropyl ether, Sepasolv (43)} \\
\text{h} & \quad \text{polyethylene glycol diethyl ether 336 (38)} \\
\text{i} & \quad \text{polyethylene glycol dipropyl ether (38)} \\
\text{j} & \quad \text{polyethylene glycol diethyl ether 456 (38)} \\
\text{k} & \quad \text{polyethylene glycol methyl propyl ether (38)} \\
\text{l} & \quad \text{ethanol (smoothed value; see p.128)} \\
\text{m} & \quad \text{ethylene glycol monomethyl ether (40)} \\
\text{n} & \quad \text{diethylene glycol monomethyl ether (41)} \\
\text{o} & \quad \text{triethylene glycol butyl ether (41)} \\
\text{p} & \quad \text{ethylene glycol^2 (37)} \\
\text{q} & \quad \text{triethylene glycol (35)} \\
\text{r} & \quad \text{polyethylene glycol 280 (38)} \\
\text{s} & \quad \text{polyethylene glycol 400 (38)} \\
\text{t} & \quad \text{methoxy triethylene glycol acetate (20)} \\
\text{u} & \quad \text{butoxy triethylene glycol acetate (20)} \\
\end{align*} \]

\(^1\) 298.15 K  \quad \text{^2} 297.1 K
### COMPONENTS:

1. Carbon dioxide; CO₂; [124-38-9]

2. Solvents, other than Alcohols, Containing Carbon, Oxygen and Hydrogen

<table>
<thead>
<tr>
<th>CRITICAL EVALUATION:</th>
</tr>
</thead>
<tbody>
<tr>
<td>measurements. Just (8) measured solubility in 2-methoxy-4-(2-propenyl)-phenol at 288.2 K to 298.2 K. Extrapolated values of solubility at a partial pressure of 101.3 kPa are much higher than the apparent solubilities in phenol and 3-methylphenol. This is due to the presence of the methoxy group in this compound. Solubility data for phenols must be accepted on a tentative basis until further measurements on these compounds have been carried out.</td>
</tr>
</tbody>
</table>

Kassim et al. (34) measured solubility in dihydro-2-(3H)-furenone at 303.2-333.2 K; 101.3 kPa. Mole fraction solubility is high compared with the reference line based on Raoult's law. These measurements may be accepted on a tentative basis until measurements on this or similar systems are available for comparison.

Selected values of mole fraction solubilities in solvents containing oxygen are shown in Table 1 and in Fig 2.

### REFERENCES


<table>
<thead>
<tr>
<th>COMPONENTS:</th>
<th>EVALUATOR:</th>
</tr>
</thead>
<tbody>
<tr>
<td>2. Solvents, other than Alcohols, Containing Carbon, Oxygen and Hydrogen</td>
<td>July 1991</td>
</tr>
</tbody>
</table>

CRITICAL EVALUATION:

<table>
<thead>
<tr>
<th>COMPONENTS:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Carbon dioxide; CO₂;</td>
</tr>
<tr>
<td>[124-38-9]</td>
</tr>
<tr>
<td>2. Solvents, other than Alcohols, Containing Carbon, Oxygen and Hydrogen</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>EVALUATOR:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peter G.T. Fogg,</td>
</tr>
<tr>
<td>School of Applied Chemistry,</td>
</tr>
<tr>
<td>Polytechnic of North London,</td>
</tr>
<tr>
<td>Holloway Road, London, N7 8DB, U.K.</td>
</tr>
<tr>
<td>July 1991</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CRITICAL EVALUATION:</th>
</tr>
</thead>
<tbody>
<tr>
<td>38. Makarov, K.I.; Malyutin, S.P.; Sushkova, T.V. Soversh. Tekhn. i</td>
</tr>
<tr>
<td>Tekhnol. Promysl. i Zavod. Obrab. Gaza. i Kondensata na Mestorozhd. so</td>
</tr>
<tr>
<td>39. Fogg, P.G.T. Solubility Data Series Vol 32, Hydrogen Sulfide,</td>
</tr>
<tr>
<td>Deuterium Sulfide and Hydrogen Selenide, Pergamon Press, Oxford, 1988,</td>
</tr>
<tr>
<td>page 174.</td>
</tr>
<tr>
<td>40. Bodor, E.; Bor, Gy.; Maleczkine, M.; Nesko, G.; Mohai, B.; Siposs, G.</td>
</tr>
<tr>
<td>43. Wolfer, W.; Schwarz, E.; Vodrazka, W.; Volkamer, K.  Oil Gas J. 1980,</td>
</tr>
<tr>
<td>78(3), 66-70.</td>
</tr>
<tr>
<td>44. Horvath, M.J.; Sebastian, H.M.; Chao, K.-C.  Ind. Eng. Chem. Fundam.</td>
</tr>
</tbody>
</table>
### COMPONENTS:

1. Carbon dioxide; CO₂; [124-38-9]
2. Solvents, other than Alcohols, Containing Carbon, Oxygen and Hydrogen

### CRITICAL EVALUATION:

EVALUATOR:
Peter G.T. Fogg,
School of Applied Chemistry,
Polytechnic of North London,
Holloway Road, London, N7 8DB, U.K.
July 1991

Table 1. Mole fraction solubilities of carbon dioxide at a partial pressure of 101.3 kPa in solvents containing carbon, hydrogen and oxygen

<table>
<thead>
<tr>
<th>Solvent</th>
<th>T/K</th>
<th>x₁CO₂</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-Propanone</td>
<td>298.15</td>
<td>0.0211</td>
<td>9</td>
</tr>
<tr>
<td>Cyclopentanone</td>
<td>298.15</td>
<td>0.01641</td>
<td>12</td>
</tr>
<tr>
<td>Cyclohexanone</td>
<td>298.15</td>
<td>0.0160</td>
<td>13</td>
</tr>
<tr>
<td>2,6-Dimethylcyclohexanone</td>
<td>298.15</td>
<td>0.0168</td>
<td>14</td>
</tr>
<tr>
<td>Benzaldehyde</td>
<td>298.15</td>
<td>0.0115</td>
<td>*</td>
</tr>
<tr>
<td>4-Methyl-1,3-dioxolan-2-one</td>
<td>298.15</td>
<td>0.01210±0.00060</td>
<td>*</td>
</tr>
<tr>
<td>Acetic acid</td>
<td>298.15</td>
<td>0.0123</td>
<td>8</td>
</tr>
<tr>
<td>Propanoic acid</td>
<td>298.15</td>
<td>0.0130</td>
<td>8</td>
</tr>
<tr>
<td>Butanoic acid</td>
<td>298.15</td>
<td>0.0157</td>
<td>8</td>
</tr>
<tr>
<td>9-Octadecenoic acid</td>
<td>298.15</td>
<td>0.0199</td>
<td>8</td>
</tr>
<tr>
<td>Acetic anhydride</td>
<td>298.15</td>
<td>0.0208</td>
<td>8</td>
</tr>
<tr>
<td>Methyl acetate</td>
<td>298.15</td>
<td>0.0226</td>
<td>9</td>
</tr>
<tr>
<td>Ethyl acetate</td>
<td>298.15</td>
<td>0.0230</td>
<td>1</td>
</tr>
<tr>
<td>Propyl acetate</td>
<td>298.15</td>
<td>0.0245</td>
<td>9</td>
</tr>
<tr>
<td>2-Methylpropyl acetate</td>
<td>298.15</td>
<td>0.0250</td>
<td>8</td>
</tr>
<tr>
<td>Pentyl acetate</td>
<td>298.15</td>
<td>0.02584±0.00056</td>
<td>*</td>
</tr>
<tr>
<td>Pentyl formate</td>
<td>298.15</td>
<td>0.0212</td>
<td>8</td>
</tr>
<tr>
<td>Ethyl stearate</td>
<td>307.15</td>
<td>0.0190</td>
<td>28</td>
</tr>
<tr>
<td>Methyl oleate</td>
<td>298.15</td>
<td>0.0269</td>
<td>30</td>
</tr>
<tr>
<td>Ethyl oleate</td>
<td>298.15</td>
<td>0.0277</td>
<td>30</td>
</tr>
<tr>
<td>Butyl oleate</td>
<td>298.15</td>
<td>0.0279</td>
<td>30</td>
</tr>
<tr>
<td>1,2,3-Propanetriol triacetate</td>
<td>298.15</td>
<td>0.0284</td>
<td>17</td>
</tr>
<tr>
<td>1,1'-Oxybisethane</td>
<td>288.15</td>
<td>0.0222</td>
<td>20</td>
</tr>
<tr>
<td>Tetrahydrofuran</td>
<td>298.15</td>
<td>0.027</td>
<td>32</td>
</tr>
<tr>
<td>1,4-Dioxane</td>
<td>298.15</td>
<td>0.02727</td>
<td>33</td>
</tr>
<tr>
<td>Oxybispropanol</td>
<td>298.15</td>
<td>0.00826</td>
<td>21</td>
</tr>
<tr>
<td>Triethylene glycol</td>
<td>298.15</td>
<td>0.00846</td>
<td>35</td>
</tr>
<tr>
<td>2-Methoxyethanol</td>
<td>298.15</td>
<td>0.0100</td>
<td>40</td>
</tr>
<tr>
<td>Phenol</td>
<td>323.15</td>
<td>0.0047</td>
<td>21</td>
</tr>
<tr>
<td>3-Methylphenol</td>
<td>300.15</td>
<td>0.0059</td>
<td>44</td>
</tr>
</tbody>
</table>

* from the equation given by the evaluator on a previous page
† interpolated; ‡ extrapolated
Fig. 2  Mole fraction solubility of carbon dioxide in various solvents containing carbon, oxygen and hydrogen at a partial pressure of gas of 101.3 kPa.

a - ethyl acetate
b - 2-propanone
c - 4-methyl-1,3-dioxolan-2-one (propylene carbonate)
d - pentyl acetate
e - benzaldehyde
f - acetic acid

The curves showing the variation of solubility with temperature correspond to equations derived by the evaluator.

A reference line corresponding to values from the Raoult's law equation is also shown.
COMPONENTS:
(1) Carbon dioxide; \( \text{CO}_2 \); [124-38-9]
(2) 2-Propanone or acetone; \( \text{C}_3\text{H}_6\text{O} \); [67-64-1]

VARIABLES:
\( T/\text{K} = 293.15, 298.15 \)
\( P / \text{kPa} = 101.325 \) (1 atm)

EXPERIMENTAL VALUES:
\[
\begin{array}{cccc}
T/\text{K} & \text{Mol Fraction} & \text{Bunsen Coefficient} & \text{Ostwald Coefficient} \\
\text{293.15} & 2.07 & 6.45 & 6.921 \\
\text{298.15} & 1.87 & 5.77 & 6.295 \\
\end{array}
\]

The author measured the Ostwald coefficient at a pressure of about 746 mmHg. The compiler assumed the Ostwald coefficient to be independent of pressure, and calculated the mole fraction and Bunsen coefficient values at 101.325 kPa (1 atm) partial pressure of the gas.

METHOD/APPARATUS/PROCEDURE:
An Ostwald apparatus as modified by Timofejew (1), and Steiner (2) is used. The apparatus consists of a gas buret, an absorption flask, and a mercury manometer. The system is thermostated with a water jacket.

The gas is introduced into the degassed liquid. The gas volume absorbed is determined by the gas buret. The solvent volume is determined at the end of the experiment by pouring the solvent into a graduated flask.

SOURCE AND PURITY OF MATERIALS:
(1) Carbon dioxide. Generated in a Kipp apparatus using marble and hydrochloric acid.
(2) 2-Propanone. No information.

ESTIMATED ERROR:
\( \delta L/L = 0.03 \) (compiler)

REFERENCES:
1. Timofejew, W.
   Z. Phys. Chem. 1890, 6, 141.
2. Steiner, P.
COMPONENTS:
1. Carbon dioxide; CO₂; [124-38-9]
2. 2-Propanone, (acetone); C₆H₆O; [67-64-1]
   Benzaldehyde; C₇H₆O; [100-52-7]

ORIGINAL MEASUREMENTS:
Kunerth, W.

VARIABLES:
T/K = 291.15-307.15 P/kPa = 101.3

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>Solvent</th>
<th>T/K</th>
<th>Ostwald coefficient</th>
<th>x₃O₂ at P₃O₂ = 101.3 kPa*</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-Propanone</td>
<td>293.15</td>
<td>6.98</td>
<td>0.02103</td>
</tr>
<tr>
<td></td>
<td>295.15</td>
<td>6.76</td>
<td>0.02031</td>
</tr>
<tr>
<td></td>
<td>297.15</td>
<td>6.55</td>
<td>0.01961</td>
</tr>
<tr>
<td></td>
<td>299.15</td>
<td>6.22</td>
<td>0.01857</td>
</tr>
<tr>
<td></td>
<td>301.15</td>
<td>5.88</td>
<td>0.01751</td>
</tr>
<tr>
<td></td>
<td>303.15</td>
<td>5.49</td>
<td>0.01631</td>
</tr>
<tr>
<td></td>
<td>305.15</td>
<td>5.08</td>
<td>0.01506</td>
</tr>
<tr>
<td></td>
<td>307.15</td>
<td>4.66</td>
<td>0.01378</td>
</tr>
<tr>
<td>Benzaldehyde</td>
<td>291.15</td>
<td>3.06</td>
<td>0.01292</td>
</tr>
<tr>
<td></td>
<td>293.15</td>
<td>2.98</td>
<td>0.01252</td>
</tr>
<tr>
<td></td>
<td>295.15</td>
<td>2.90</td>
<td>0.01213</td>
</tr>
<tr>
<td></td>
<td>297.15</td>
<td>2.80</td>
<td>0.01166</td>
</tr>
<tr>
<td></td>
<td>299.15</td>
<td>2.73</td>
<td>0.01131</td>
</tr>
<tr>
<td></td>
<td>301.15</td>
<td>2.66</td>
<td>0.01097</td>
</tr>
<tr>
<td></td>
<td>303.15</td>
<td>2.58</td>
<td>0.01059</td>
</tr>
<tr>
<td></td>
<td>305.15</td>
<td>2.52</td>
<td>0.01030</td>
</tr>
<tr>
<td></td>
<td>307.15</td>
<td>2.46</td>
<td>0.01001</td>
</tr>
<tr>
<td></td>
<td>309.15</td>
<td>2.39</td>
<td>0.00968</td>
</tr>
</tbody>
</table>

* calculated by the compiler

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
The method is based upon that described by McDaniel (1). The apparatus consisted of a gas buret attached to a levelling tube containing mercury and to the absorption cell containing the solvent under test. The volume of gas absorbed by a measured volume of liquid was measured at a total pressure equal to barometric pressure. The mercury in the gas buret was covered with a layer of solvent so that the gas in the buret was saturated with solvent vapor. Buret and absorption cell were surrounded by heating wire and water jackets fitted with thermometers.

SOURCE AND PURITY OF MATERIALS:
1. produced by heating NaHCO₃; dried with CaCl₂; frozen in liquid air and volatile impurities pumped away; passed over P₂O₅.
2. commercial sample; purity attested by boiling point and density.

ESTIMATED ERROR:
δx₃O₂ = ±5% (compiler)

REFERENCES:
COMPONENTS:

(1) Carbon dioxide; CO₂; [124-38-9]
(2) 2-Propanone or acetone; C₃H₆0; [67-64-1]

ORIGIONAL MEASUREMENTS:

Felsing, W. A.; Durban, S. A.

VARIABLES:

\[ T/K = 200.01 - 293.15 \]
\[ P_1/kPa = 101.325 \] (1 atm)

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>Temperature (°C)</th>
<th>Molality (mol kg⁻¹)</th>
<th>Kuenen Coefficient¹ (10⁵ cm³(STP) g⁻¹)</th>
<th>Mol Fraction (x₁)</th>
<th>Ostwald Coefficient (L/cm³ cm⁻³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>-73.14</td>
<td>13.94490</td>
<td>313,597.1</td>
<td>0.4475</td>
<td>-</td>
</tr>
<tr>
<td>-60.12</td>
<td>5.92017</td>
<td>132,710.1</td>
<td>0.2559</td>
<td>-</td>
</tr>
<tr>
<td>-45.14</td>
<td>2.79867</td>
<td>62,736.6</td>
<td>0.13982</td>
<td>-</td>
</tr>
<tr>
<td>-29.24</td>
<td>1.47773</td>
<td>33,125.1</td>
<td>0.07904</td>
<td>25.0</td>
</tr>
<tr>
<td>-13.55</td>
<td>0.90322</td>
<td>20,247.1</td>
<td>0.04984</td>
<td>15.9</td>
</tr>
<tr>
<td>-2.54</td>
<td>0.62115</td>
<td>13,924.0</td>
<td>0.03482</td>
<td>11.3</td>
</tr>
<tr>
<td>+20.00</td>
<td>0.35537</td>
<td>7,966.2</td>
<td>0.02022</td>
<td>6.76</td>
</tr>
</tbody>
</table>

¹ The authors labeled the solubility as cm³ (0 °C/760 mmHg) per 1000 g of acetone. The compiler has labeled it 10³ x Kuenen coefficient.

The mole fraction and Ostwald coefficient values were calculated by the compiler.

The authors fitted the solubility data to the equation

\[ \log m_1 = -18.085436 + 2615.017/(T/K) + 66.55546 \times 10^{-3}(T/K) - 79.07114 \times 10^{-6}(T/K)^2 \]

for the molal solubility of carbon dioxide at a partial pressure of 760 mmHg.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The apparatus consists of an absorption flask, a manometer, and a gas buret.

The absorption flask was in a cryostat with ethyl bromide as the fluid.

The gas buret appears to be water jacketed. It appears that the volume of dry carbon dioxide vapor was measured, but the authors do not make a statement to confirm the procedure.

The measurement was carried out at a total pressure equal to 760 mmHg CO₂ + the 2-propanone vapor pressure.

The authors used an ideal gas molar volume of 22,416.55 cm³ mol⁻¹ to convert the gas volumes to moles.

SOURCE AND PURITY OF MATERIALS:

(1) Carbon dioxide. Source and purity not stated.
(2) 2-Propanone. The best c.p. material available was distilled three times, converted to the NaI addition compound which was distilled and reformed several times. Density, \( \rho^25/g \text{ cm}^{-3} = 0.78612 \).

ESTIMATED ERROR:

\[ \delta T/K = \pm 0.02 \]

REFERENCES:
COMPONENTS:
(1) Carbon dioxide; CO₂; [124-38-9]
(2) 2-Propanone or acetone; C₃H₆O; [67-64-1]

ORIGINAL MEASUREMENTS:
Gjaldbaek, J. C.; Andersen, E. K.

VARIABLES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>P₁/kPa = 101.325 (1 atm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>298.15</td>
<td></td>
</tr>
</tbody>
</table>

PREPARED BY:
J. Chr. Gjaldbaek

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>Mol Fraction</th>
<th>Bunsen Coefficient</th>
<th>Ostwald Coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>10²x₁</td>
<td>a/cm³(STP)cm⁻³atm⁻¹</td>
<td>l/cm³cm⁻³</td>
</tr>
<tr>
<td>298.15</td>
<td>2.12</td>
<td>6.48</td>
<td>7.07</td>
</tr>
<tr>
<td>2.11</td>
<td>6.45</td>
<td>7.04</td>
<td></td>
</tr>
<tr>
<td>2.11</td>
<td>6.43</td>
<td>7.02</td>
<td></td>
</tr>
<tr>
<td>2.08</td>
<td>6.34</td>
<td>6.92</td>
<td></td>
</tr>
<tr>
<td>2.12</td>
<td>6.49</td>
<td>7.08</td>
<td></td>
</tr>
</tbody>
</table>

The mole fraction and Ostwald coefficient values were calculated by the compiler.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
The apparatus consists of a calibrated all-glass manometer and bulb enclosed in an air thermostat. The solvent is added and degassed in the apparatus. The gas is added. The apparatus and contents are shaken until equilibrium is attained. Mercury is used for calibration and as the confining liquid.

The absorbed volume of gas is calculated from the initial and final amounts of gas, both saturated with solvent vapor. The amount of solvent is determined by the weight of displaced mercury. Further details are in the references (1, 2).

The mole fraction values are at one atm pressure assuming Henry's law is obeyed.

SOURCE AND PURITY OF MATERIALS:

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) Carbon dioxide. Prepared from potassium bicarbonate and sulfuric acid. 99.8 - 99.9% CO₂.</td>
<td></td>
</tr>
<tr>
<td>(2) Acetone. Merck and Co. Fractionated by distillation. B.p. (760 mmHg)/°C = 56.12 - 56.14, refractive index nD(20°C) = 1.3588 - 1.3589.</td>
<td></td>
</tr>
</tbody>
</table>

ESTIMATED ERROR:

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>ΔT/K = ± 0.05</td>
<td></td>
</tr>
<tr>
<td>Δx₁/x₁ = ± 0.015</td>
<td></td>
</tr>
</tbody>
</table>

REFERENCES:

2. Gjaldbaek, J. C.
COMPONENTS:
(1) Carbon dioxide; CO₂; [124-38-9]
(2) 2-Propanone (acetone); C₃H₆O; [67-64-1]

ORIGINAL MEASUREMENTS:
Rosenthal, W.
Thèse. fac. sci. Univ. Strasbourg
(France) 1954.

VARIABLES:
\[ T/K = 293.15 \]
\[ p/kPa = 101.325 \]

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>Ostwald Coefficient</th>
<th>Bunsen Coefficient</th>
<th>Mole Fraction</th>
</tr>
</thead>
<tbody>
<tr>
<td>293.15</td>
<td>6.88</td>
<td>6.40</td>
<td>0.0211</td>
</tr>
</tbody>
</table>

a Original data.

b Calculated by compiler using real gas molar volumes.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
The prepared solvent solution was charged into an evacuated cell after degassing, and the mass of solvent was determined by weight. Gas was introduced into the cell from a measuring burette in which the gas was stored over mercury. The cell was agitated while the gas pressure was maintained by adjusting the gas volume. The Ostwald coefficient was determined from the mass of solvent and volume of gas used. Solubilities were measured at pressures above and below atmospheric.

SOURCE AND PURITY OF MATERIALS:
(1) Carbon dioxide. Source and purity not given. An aqueous "soda" solution absorbed 99.8% of the gas.
(2) 2-Propanone (acetone). Research grade. Purity not given. Dried and distilled.

ESTIMATED ERROR:
\[ \delta T/K = \pm 0.2 \]
\[ \delta p/kPa = \pm 0.1 \]
\[ \delta L/L = \pm 0.02 \text{ (compiler)} \]

REFERENCES:
Some data in the thesis have been published. See:

1. Maillard, A.; Rosenthal, W.
Comp rend. 1952, 234, 2546-8.
**COMPONENTS:**

1. Carbon dioxide; CO₂; [124-38-9]
2. 2-Propanone (Acetone); C₃H₆O; [67-64-1]

**VARIABLES:**

\[
T/K = 198-318.2 \\
P/kPa = 7.7-97.2
\]

**ORIGINAL MEASUREMENTS:**

Bodor, E.; Bor, Gy.; Maleczkine, M.; Mesko, G.; Mohai, B.; Siposs, G.


**EXPERIMENTAL VALUES:**

<table>
<thead>
<tr>
<th>T/K</th>
<th>p/mmHg</th>
<th>p/kPa</th>
<th>Absorption (^1/\text{cm}^2\text{g}^{-1})</th>
<th>Mole fraction* of carbon dioxide in liquid, (x_{\text{CO}_2})</th>
</tr>
</thead>
<tbody>
<tr>
<td>318.2</td>
<td>58</td>
<td>7.7</td>
<td>0.83</td>
<td>0.00215</td>
</tr>
<tr>
<td></td>
<td>142</td>
<td>18.9</td>
<td>1.67</td>
<td>0.00431</td>
</tr>
<tr>
<td></td>
<td>148</td>
<td>19.7</td>
<td>1.61</td>
<td>0.00415</td>
</tr>
<tr>
<td></td>
<td>214</td>
<td>28.5</td>
<td>2.34</td>
<td>0.00603</td>
</tr>
<tr>
<td></td>
<td>246</td>
<td>32.8</td>
<td>2.75</td>
<td>0.00708</td>
</tr>
<tr>
<td>295.2</td>
<td>176</td>
<td>23.5</td>
<td>2.54</td>
<td>0.00654</td>
</tr>
<tr>
<td></td>
<td>216</td>
<td>28.8</td>
<td>2.90</td>
<td>0.00746</td>
</tr>
<tr>
<td></td>
<td>254</td>
<td>33.9</td>
<td>3.88</td>
<td>0.00995</td>
</tr>
<tr>
<td></td>
<td>310</td>
<td>41.3</td>
<td>4.32</td>
<td>0.0111</td>
</tr>
<tr>
<td></td>
<td>348</td>
<td>46.4</td>
<td>4.90</td>
<td>0.0125</td>
</tr>
<tr>
<td></td>
<td>405</td>
<td>54.0</td>
<td>5.72</td>
<td>0.0146</td>
</tr>
<tr>
<td></td>
<td>448</td>
<td>59.7</td>
<td>6.40</td>
<td>0.0163</td>
</tr>
<tr>
<td></td>
<td>514</td>
<td>68.5</td>
<td>7.27</td>
<td>0.0185</td>
</tr>
<tr>
<td></td>
<td>522</td>
<td>69.6</td>
<td>7.25</td>
<td>0.0184</td>
</tr>
<tr>
<td></td>
<td>386</td>
<td>51.5</td>
<td>8.12</td>
<td>0.0206</td>
</tr>
<tr>
<td></td>
<td>419</td>
<td>55.9</td>
<td>9.70</td>
<td>0.0245</td>
</tr>
<tr>
<td></td>
<td>469</td>
<td>62.5</td>
<td>9.87</td>
<td>0.0249</td>
</tr>
<tr>
<td></td>
<td>471</td>
<td>62.8</td>
<td>10.70</td>
<td>0.0270</td>
</tr>
<tr>
<td></td>
<td>552</td>
<td>73.6</td>
<td>11.60</td>
<td>0.0292</td>
</tr>
<tr>
<td></td>
<td>563</td>
<td>75.1</td>
<td>12.60</td>
<td>0.0316</td>
</tr>
<tr>
<td></td>
<td>608</td>
<td>81.1</td>
<td>12.70</td>
<td>0.0319</td>
</tr>
</tbody>
</table>

**(cont.)**

**AUXILIARY INFORMATION**

**METHOD/APPARATUS/PROCEDURE:**

Volumetric method. Pressure measured when known amounts of gas were added, in increments, to a known amount of liquid in a vessel of known dimensions. Corrections were made for the partial pressure of solvent. Details in ref. (1).

**SOURCE AND PURITY OF MATERIALS:**

**ESTIMATED ERROR:**

\[
\delta T/K = \pm 0.1; \\
\delta(\text{absorption}) = \pm 4\% \text{ or less}
\]

**REFERENCES:**

1. Bodor, E.; Bor, G. J.; Mohai, B.; Siposs, G.

**COMPONENTS:**

1. Carbon dioxide; CO₂; [124-38-9]
2. 2-Propanone (Acetone);
   C₃H₆O; [67-64-1]

**ORIGINAL MEASUREMENTS:**
Bodor, E.; Bor, Gy.; Maleczkine, N.; Mesko, G.; Mohai, B.; Siposs, G.

**EXPERIMENTAL VALUES:**

<table>
<thead>
<tr>
<th>T/K</th>
<th>p/mmHg</th>
<th>p/kPa</th>
<th>Absorption of gas /cm²g⁻¹ †</th>
<th>Mole fraction * of carbon dioxide in liquid, x CO₂</th>
</tr>
</thead>
<tbody>
<tr>
<td>273.2</td>
<td>639</td>
<td>85.2</td>
<td>14.25</td>
<td>0.0356</td>
</tr>
<tr>
<td>677</td>
<td>90.3</td>
<td>14.20</td>
<td>0.0355</td>
<td></td>
</tr>
<tr>
<td>689</td>
<td>91.9</td>
<td>15.0</td>
<td>0.0374</td>
<td></td>
</tr>
<tr>
<td>(760)</td>
<td>(101.3)</td>
<td>(16.5)</td>
<td>(0.0410)</td>
<td></td>
</tr>
<tr>
<td>248.2</td>
<td>88</td>
<td>11.7</td>
<td>5.8</td>
<td>0.0148</td>
</tr>
<tr>
<td>219</td>
<td>29.2</td>
<td>8.8</td>
<td>0.0223</td>
<td></td>
</tr>
<tr>
<td>351</td>
<td>46.8</td>
<td>12.8</td>
<td>0.0321</td>
<td></td>
</tr>
<tr>
<td>470</td>
<td>62.7</td>
<td>16.6</td>
<td>0.0412</td>
<td></td>
</tr>
<tr>
<td>566</td>
<td>75.5</td>
<td>21.0</td>
<td>0.0516</td>
<td></td>
</tr>
<tr>
<td>712</td>
<td>94.9</td>
<td>27.0</td>
<td>0.0654</td>
<td></td>
</tr>
<tr>
<td>(760)</td>
<td>(101.3)</td>
<td>(30)</td>
<td>(0.072)</td>
<td></td>
</tr>
<tr>
<td>223.2</td>
<td>225</td>
<td>30.0</td>
<td>26.8</td>
<td>0.0649</td>
</tr>
<tr>
<td>258</td>
<td>34.4</td>
<td>29.6</td>
<td>0.0712</td>
<td></td>
</tr>
<tr>
<td>395</td>
<td>52.7</td>
<td>42.1</td>
<td>0.0984</td>
<td></td>
</tr>
<tr>
<td>568</td>
<td>75.7</td>
<td>59.3</td>
<td>0.133</td>
<td></td>
</tr>
<tr>
<td>612</td>
<td>81.6</td>
<td>67.6</td>
<td>0.149</td>
<td></td>
</tr>
<tr>
<td>726</td>
<td>96.8</td>
<td>82.9</td>
<td>0.177</td>
<td></td>
</tr>
<tr>
<td>(760)</td>
<td>(101.3)</td>
<td>(90)</td>
<td>(0.189)</td>
<td></td>
</tr>
<tr>
<td>198 ± 2</td>
<td>151</td>
<td>20.1</td>
<td>74.3</td>
<td>0.161</td>
</tr>
<tr>
<td>246</td>
<td>32.8</td>
<td>118.2</td>
<td>0.234</td>
<td></td>
</tr>
<tr>
<td>540</td>
<td>72.0</td>
<td>310.3</td>
<td>0.446</td>
<td></td>
</tr>
<tr>
<td>632</td>
<td>84.3</td>
<td>421</td>
<td>0.522</td>
<td></td>
</tr>
<tr>
<td>729</td>
<td>97.2</td>
<td>509</td>
<td>0.569</td>
<td></td>
</tr>
<tr>
<td>(760)</td>
<td>(101.3)</td>
<td>(570)</td>
<td>(0.596)</td>
<td></td>
</tr>
</tbody>
</table>

† the volume of gas absorbed by one gram of solvent was corrected to 273.15 K and 101.3 kPa calculated by compiler.

Values in parentheses are extrapolated to 1 atmosphere.
COMPONENTS:
1. Carbon dioxide; CO₂; [124-38-9]
2. Alkanones

ORIGINAL MEASUREMENTS:
Balog-Megyery, K.; Makranczy, J.; Rusz, L.; Mate, E.

VARIABLES:
T/K = 298.15; P/kPa = 101.3

PREPARED BY:
P.G.T. Fogg

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>Solvent</th>
<th>Bunsen coeff. X CO₂</th>
<th>Mole fraction* X CO₂</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-Propanone, (acetone); C₃H₆O; [67-64-1]</td>
<td>5.92</td>
<td>0.0192</td>
</tr>
<tr>
<td>3-Pentanone, (diethyl ketone); C₅H₁₀O; [96-22-0]</td>
<td>4.15</td>
<td>0.0194</td>
</tr>
<tr>
<td>4-Heptanone, (dipropyl ketone); C₇H₁₄O; [123-19-3]</td>
<td>3.25</td>
<td>0.0200</td>
</tr>
<tr>
<td>5-Nonanone, (dibutyl ketone); C₉H₁₈O; [502-56-7]</td>
<td>2.62</td>
<td>0.0200</td>
</tr>
<tr>
<td>2-Butanone, (methyl ethyl ketone); C₄H₈O; [78-93-3]</td>
<td>4.85</td>
<td>0.0191</td>
</tr>
<tr>
<td>2-Pentanone, (methyl propyl ketone); C₅H₁₀O; [107-87-9]</td>
<td>4.20</td>
<td>0.0197</td>
</tr>
<tr>
<td>2-Hexanone, (methyl butyl ketone); C₆H₁₂O; [591-78-6]</td>
<td>3.53</td>
<td>0.0192</td>
</tr>
</tbody>
</table>

* calculated by the compiler for a partial pressure of CO₂ of 101.3 kPa by use of densities of solvents given in ref.(1).

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
Solubility measurements were made by a static method using apparatus described in earlier papers (2-4). A measured quantity of solvent was saturated with carbon dioxide and the volume of gas absorbed was measured when equilibrium was attained.

SOURCE AND PURITY OF MATERIALS:
No information

ESTIMATED ERROR:

REFERENCES:
1. Weast, R.C.; Astle, M.J.


3. Makranczy, J.; Rusz, L.; Balog-Megyery, K.

4. Bodor, E.; Bor, Gy.; Mohai, B.; Sipos, G.
### COMPONENTS:
1. Carbon dioxide; \( \text{CO}_2 \); [124-38-9]
2. Alkanones

### EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>Solvent</th>
<th>Bunsen coeff. ( \alpha )</th>
<th>Mole fraction ( x_{\text{CO}_2} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>3-Hexanone, ((\text{ethyl propyl ketone})); ( \text{C}<em>6\text{H}</em>{12}\text{O} ); [589-38-8]</td>
<td>3.62</td>
<td>0.0197</td>
</tr>
<tr>
<td>3-Heptanone, ((\text{ethyl butyl ketone})); ( \text{C}<em>7\text{H}</em>{14}\text{O} ); [106-35-4]</td>
<td>3.17</td>
<td>0.0195</td>
</tr>
<tr>
<td>3-Octanone, ((\text{ethyl pentyl ketone})); ( \text{C}<em>8\text{H}</em>{16}\text{O} ); [106-68-3]</td>
<td>2.91</td>
<td>0.0200</td>
</tr>
<tr>
<td>3-Nonanone, ((\text{ethyl hexyl ketone})); ( \text{C}<em>9\text{H}</em>{18}\text{O} ); [925-78-0]</td>
<td>2.63</td>
<td>0.0200</td>
</tr>
<tr>
<td>3-Decanone, ((\text{ethyl heptyl ketone})); ( \text{C}<em>{10}\text{H}</em>{22}\text{O} ); [928-80-3]</td>
<td>2.51</td>
<td>0.0209</td>
</tr>
<tr>
<td>2-Octanone, ((\text{methyl hexyl ketone})); ( \text{C}<em>9\text{H}</em>{18}\text{O} ); [111-13-7]</td>
<td>2.86</td>
<td>0.0197</td>
</tr>
<tr>
<td>2-Nonanone, ((\text{methyl heptyl ketone})); ( \text{C}<em>{10}\text{H}</em>{20}\text{O} ); [821-55-6]</td>
<td>2.60</td>
<td>0.0198</td>
</tr>
<tr>
<td>2-Decanone, ((\text{methyl octyl ketone})); ( \text{C}<em>{11}\text{H}</em>{22}\text{O} ); [693-54-9]</td>
<td>2.48</td>
<td>0.0207</td>
</tr>
<tr>
<td>2-Undecanone, ((\text{methyl nonyl ketone})); ( \text{C}<em>{11}\text{H}</em>{22}\text{O} ); [112-12-9]</td>
<td>2.33</td>
<td>0.0212</td>
</tr>
</tbody>
</table>

* calculated by the compiler using densities of liquids given in (1)
COMPONENTS:
1. Carbon dioxide; CO₂; [124-38-9]
2. Compounds containing oxygen

VARIABLES:

\[ T/K = 293.2 \]

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>( T/K )</th>
<th>Henry's Constant ( \frac{t}{(Pa \ m^3/mol^{-1})} )</th>
<th>Mole fraction of CO₂ at 101.3 kPa partial pressure*</th>
</tr>
</thead>
<tbody>
<tr>
<td>293.2</td>
<td>399</td>
<td>0.0248</td>
</tr>
<tr>
<td>293.2</td>
<td>499</td>
<td>0.0267</td>
</tr>
<tr>
<td>293.2</td>
<td>347</td>
<td>0.0215</td>
</tr>
<tr>
<td>293.2</td>
<td>357</td>
<td>0.0242</td>
</tr>
</tbody>
</table>

*referred to as Henry's constant in source but appears to be usual Henry's constant multiplied by molar volume.
*calculated by compiler using density data taken from ref.(1).

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE

Little information given in source. Method consisted of equilibrating known amounts of degassed liquid and gas and measuring the change in pressure. Equilibration was reached in 3 to 6 minutes. Some details given in ref.(2).

SOURCE AND PURITY OF MATERIALS:

Obtained from Merck at the highest available purity. No other details given.

ESTIMATED ERROR:

\[ \delta T/K = \pm 0.1 \] (authors)
\[ \delta x/x = \pm 0.01 \text{ to } 0.15 \] (compiler)

REFERENCES:

**COMPONENTS:**
1. Carbon dioxide; CO$_2$; [124-38-9]
2. 2-Propanone; C$_3$H$_6$O; [67-64-1]
3. Ethyne; C$_2$H$_2$; [74-86-2]

**VARIABLES:**
- $T/K = 217.17$
- \[ P_{CO_2}/kPa = 13.3-101.3 \]
- \[ x_{C_2H_2} = 0.08-0.34 \]

**EXPERIMENTAL VALUES:**

<table>
<thead>
<tr>
<th>Conc. of ethyne* /cm$^3$g$^{-1}$</th>
<th>Mole fraction of ethyne, $x_{C_2H_2}$</th>
<th>Pressure increase due to CO$_2$, $P - P_0$</th>
<th>Mole fraction of CO$<em>2$, $x</em>{CO_2}$</th>
<th>Solubility of CO$_2$ at $P_0$ * $P^*/cm^3g^{-1}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>42.7</td>
<td>0.0978</td>
<td>100</td>
<td>0.0281</td>
<td>12.27</td>
</tr>
<tr>
<td></td>
<td>0.0924</td>
<td>300</td>
<td>0.0842</td>
<td>37.90</td>
</tr>
<tr>
<td></td>
<td>0.0865</td>
<td>500</td>
<td>0.1402</td>
<td>69.32</td>
</tr>
<tr>
<td></td>
<td>0.0792</td>
<td>760</td>
<td>0.2131</td>
<td>115.10</td>
</tr>
<tr>
<td>128</td>
<td>0.2451</td>
<td>100</td>
<td>0.0243</td>
<td>12.71</td>
</tr>
<tr>
<td></td>
<td>0.2329</td>
<td>300</td>
<td>0.0730</td>
<td>40.13</td>
</tr>
<tr>
<td></td>
<td>0.2207</td>
<td>500</td>
<td>0.1216</td>
<td>70.59</td>
</tr>
<tr>
<td></td>
<td>0.2049</td>
<td>760</td>
<td>0.1848</td>
<td>115.62</td>
</tr>
<tr>
<td>207</td>
<td>0.3439</td>
<td>100</td>
<td>0.0222</td>
<td>13.35</td>
</tr>
<tr>
<td></td>
<td>0.3283</td>
<td>300</td>
<td>0.0666</td>
<td>42.09</td>
</tr>
<tr>
<td></td>
<td>0.3128</td>
<td>500</td>
<td>0.1109</td>
<td>73.43</td>
</tr>
<tr>
<td></td>
<td>0.2926</td>
<td>760</td>
<td>0.1685</td>
<td>119.27</td>
</tr>
<tr>
<td>384</td>
<td>0.4919</td>
<td>100</td>
<td>0.0194</td>
<td>15.14</td>
</tr>
<tr>
<td></td>
<td>0.4725</td>
<td>300</td>
<td>0.0582</td>
<td>47.29</td>
</tr>
<tr>
<td></td>
<td>0.4530</td>
<td>500</td>
<td>0.0970</td>
<td>82.40</td>
</tr>
<tr>
<td></td>
<td>0.4279</td>
<td>760</td>
<td>0.1475</td>
<td>132.37</td>
</tr>
</tbody>
</table>

* concentrations are expressed at volume of gas, corrected to 273.15 K and 101.325 kPa, dissolved per gram of acetone

**METHOD/APPARATUS/PROCEDURE:**
The method is described in ref. (1).

**ORIGINAL MEASUREMENTS:**
Shenderei, E.R.

**PREPARED BY:**
P.G.T. Fogg

**ESTIMATED ERROR:**
$\delta x_{CO_2} = \pm 0.5\%$ (author)

**REFERENCES:**
Gaz. Prom. 1958, 12, 36.
COMPONENTS:
1. Carbon dioxide; CO₂; [124-38-9]
2. Cyclopentanone; C₅H₈O; [120-92-3]

VARIABLES:
T/K = 273.15-303.15
P CO₂/kPa = 101.33

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>P CO₂</th>
<th>T/K</th>
<th>x CO₂</th>
</tr>
</thead>
<tbody>
<tr>
<td>101.33</td>
<td>273.15</td>
<td>0.02750</td>
</tr>
<tr>
<td>283.15</td>
<td>0.02205</td>
<td></td>
</tr>
<tr>
<td>293.15</td>
<td>0.01810</td>
<td></td>
</tr>
<tr>
<td>298.15</td>
<td>0.01641</td>
<td></td>
</tr>
<tr>
<td>303.15</td>
<td>0.01495</td>
<td></td>
</tr>
</tbody>
</table>

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
Details of the apparatus and procedure are given in refs. (1) and (2). The total pressure was chosen so that the partial pressure of carbon dioxide was about 101.33 kPa. The number of moles of carbon dioxide introduced into the vessel containing the solution was calculated from the volume and pressure of gas introduced, taking non-ideality into account. The number of moles remaining in the gas phase in the reaction vessel was then calculated and the number of moles dissolved in the known weight of solvent found by difference.

SOURCE AND PURITY OF MATERIALS:
1. Supplied by Sociedad Española del Oxígeno; purity 99.998 mol%.
2. Supplied by Fluka; GLC indicated a purity better than 99.5 mol%; nD = 1.43657

ESTIMATED ERROR:
δT/K = ±0.05 (authors)

REFERENCES:
COMPONENTS:
1. Carbon dioxide; CO₂; [124-38-9]
2. Cyclohexanone; C₆H₁₀O; [108-94-1]

VARIABLES:

T/K = 283.15-303.15
P/kPa = 101.3

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>10⁴ x Mole fraction of carbon dioxide at 1 atm partial pressure</th>
</tr>
</thead>
<tbody>
<tr>
<td>283.15</td>
<td>216</td>
</tr>
<tr>
<td>293.15</td>
<td>176</td>
</tr>
<tr>
<td>298.15</td>
<td>160</td>
</tr>
<tr>
<td>303.15</td>
<td>147</td>
</tr>
</tbody>
</table>

Smoothing equation given in source

\[ \ln x_{CO₂} = -5.6368 \ln (T/K) + 27.986 \]

(Std. dev. = 0.882 x 10⁻⁶)

\[ a \] Data reported previously in ref. (1).

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
Solubility apparatus was similar to that used by Ben-Naim and Baer (2) consisting essentially of a gas buret, mercury manometer and solution vessel. The solvent was degassed in the solution vessel. Measurements were carried out on the saturated gas. It appears that the mole fraction at a partial pressure of 1 atmosphere was estimated from the raw experimental data by assuming that Henry's law is obeyed and that the partial pressure of solvent in the gas phase is given by Raoult's law. Some details in ref. (3).

SOURCE AND PURITY OF MATERIALS:
1. Sociedad Española del Oxigeno sample, purity 99.998 mole per cent.
2. Carla Erba sample, purity at least 99 mole per cent.

ESTIMATED ERROR:

\[ \delta T/K = \pm 0.1; \delta x/x = \pm 0.01. \]

REFERENCES:
COMPONENTS:

1. Carbon dioxide; CO₂; [124-38-9]
2. 2,6-Dimethylcyclohexanone; C₆H₁₄O; [2816-57-1]

ORIGINAL MEASUREMENTS:

Gallardo, M.A.; Lopez, M.C.; Urieta, J.S.; Gutierrez Losa, C.

VARIABLES:

T/K = 273.15-303.15
P_co₂/kPa = 101.33

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>P_co₂/kPa</th>
<th>T/K</th>
<th>x_co₂</th>
</tr>
</thead>
<tbody>
<tr>
<td>101.33</td>
<td>273.15</td>
<td>0.0267</td>
</tr>
<tr>
<td>283.15</td>
<td>0.0218</td>
<td></td>
</tr>
<tr>
<td>293.15</td>
<td>0.0181</td>
<td></td>
</tr>
<tr>
<td>298.15</td>
<td>0.0168</td>
<td></td>
</tr>
<tr>
<td>303.15</td>
<td>0.0154</td>
<td></td>
</tr>
</tbody>
</table>

PREPARED BY:
P.G.T. Fogg

METHOD/APPARATUS/PROCEDURE:

Details of the apparatus and procedure are given in refs. (1) and (2). The total pressure was chosen so that the partial pressure of carbon dioxide was about 101.33 kPa. The number of moles of carbon dioxide introduced into the vessel containing the solution was calculated from the volume and pressure of gas introduced, taking non-ideality into account. The number of moles remaining in the gas phase in the reaction vessel was then calculated and the number of moles dissolved in the known weight of solvent found by difference.

AUXILIARY INFORMATION

SOURCE AND PURITY OF MATERIALS:

1. Supplied by Sociedad Española del Oxígeno; purity 99.998 mol%.
2. Supplied by Fluka; GLC indicates a purity of 98.2%; n_D^20 = 1.44686

ESTIMATED ERROR:

δx_CO₂ = ±0.7% (authors)

REFERENCES:

COMPONENTS:
(1) Carbon dioxide; CO₂; [124-38-9]
(2) 2-Methyl-5-(1-methylethenyl)-2-cyclohexen-1-one or carvon or carvol; C₁₀H₁₄O; [99-49-0]

VARIABLES:

\[
\begin{align*}
T/K &= 288.15 - 298.15 \\
P_/kPa &= 101.325 \text{ (1 atm)}
\end{align*}
\]

ORIGINAL MEASUREMENTS:
Just, G.
Z. Phys. Chem. 1901, 37, 342 - 367.

PREPARED BY:
M. E. Derrick
H. L. Clever

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>10²x₁</th>
<th>Bunsen Coefficient a/cm³(STP)cm⁻³atm⁻¹</th>
<th>Ostwald Coefficient L/cm³cm⁻³</th>
</tr>
</thead>
<tbody>
<tr>
<td>288.15</td>
<td>1.89</td>
<td>2.76</td>
<td>2.914</td>
</tr>
<tr>
<td>293.15</td>
<td>1.72</td>
<td>2.51</td>
<td>2.690</td>
</tr>
<tr>
<td>298.15</td>
<td>1.58</td>
<td>2.29</td>
<td>2.498</td>
</tr>
</tbody>
</table>

The author measured the Ostwald coefficient at a pressure of about 746 mmHg. The compiler assumed the Ostwald coefficient to be independent of pressure, and calculated the mole fraction and Bunsen coefficient values at 101.325 kPa (1 atm) partial pressure of the gas.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
An Ostwald apparatus as modified by Timofejew (1), and Steiner (2) is used. The apparatus consists of a gas buret, an absorption flask, and a mercury manometer. The system is thermostated with a water jacket.

The gas is introduced into the degassed liquid. The gas volume absorbed is determined by the gas buret. The solvent volume is determined at the end of the experiment by pouring the solvent into a graduated flask.

SOURCE AND PURITY OF MATERIALS:
(1) Carbon dioxide. Generated in a Kipp apparatus using marble and hydrochloric acid.
(2) 2-Methyl-5-(1-methylethenyl)-2-cyclohexen-1-one. No information.

ESTIMATED ERROR:
\[ \delta L/L = 0.03 \text{ (compiler)} \]

REFERENCES:
1. Timofejew, W. Z. Phys. Chem. 1890, 6, 141.
COMPONENTS:
1. Carbon dioxide; \( \text{CO}_2; [124-38-9] \)
2. Acetaldehyde; \( \text{C}_2\text{H}_4\text{O}; [75-07-0] \)

ORIGINAL MEASUREMENTS:
Bodor, E.; Mohai, B.; Pfeifer, Gy.

VARIABLES:
\( T/K = 198-248.2 \)
\( P/kPa = 33.2-97.2 \)

PREPARED BY:
C. L. Young

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>( T/K )</th>
<th>( p/mmHg )</th>
<th>( p/kPa )</th>
<th>Absorption( ^{\dagger} )</th>
<th>Mole fraction( ^{*} ) of carbon dioxide in liquid, ( \chi_{\text{CO}_2} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>248.2</td>
<td>267</td>
<td>35.6</td>
<td>4.8</td>
<td>0.0093</td>
</tr>
<tr>
<td></td>
<td>364</td>
<td>48.5</td>
<td>9.4</td>
<td>0.0181</td>
</tr>
<tr>
<td></td>
<td>455</td>
<td>60.7</td>
<td>11.8</td>
<td>0.0227</td>
</tr>
<tr>
<td></td>
<td>531</td>
<td>70.8</td>
<td>14.4</td>
<td>0.0275</td>
</tr>
<tr>
<td></td>
<td>632</td>
<td>84.3</td>
<td>19.9</td>
<td>0.0376</td>
</tr>
<tr>
<td></td>
<td>(760)</td>
<td>(101.3)</td>
<td>(25)</td>
<td>(0.047)</td>
</tr>
<tr>
<td>223.2</td>
<td>266</td>
<td>35.6</td>
<td>21.5</td>
<td>0.0405</td>
</tr>
<tr>
<td></td>
<td>304</td>
<td>40.5</td>
<td>27.3</td>
<td>0.0509</td>
</tr>
<tr>
<td></td>
<td>408</td>
<td>54.4</td>
<td>39.3</td>
<td>0.0717</td>
</tr>
<tr>
<td></td>
<td>525</td>
<td>70.0</td>
<td>53.3</td>
<td>0.0948</td>
</tr>
<tr>
<td></td>
<td>610</td>
<td>81.3</td>
<td>62.6</td>
<td>0.1096</td>
</tr>
<tr>
<td></td>
<td>716</td>
<td>95.5</td>
<td>75.6</td>
<td>0.1294</td>
</tr>
<tr>
<td></td>
<td>(760)</td>
<td>(101.3)</td>
<td>(80)</td>
<td>(0.136)</td>
</tr>
<tr>
<td>198 ± 2</td>
<td>249</td>
<td>33.2</td>
<td>63.7</td>
<td>0.1413</td>
</tr>
<tr>
<td></td>
<td>361</td>
<td>48.1</td>
<td>137.0</td>
<td>0.2121</td>
</tr>
<tr>
<td></td>
<td>460</td>
<td>61.3</td>
<td>194.5</td>
<td>0.2765</td>
</tr>
<tr>
<td></td>
<td>540</td>
<td>72.0</td>
<td>256.8</td>
<td>0.3354</td>
</tr>
<tr>
<td></td>
<td>629</td>
<td>83.9</td>
<td>302</td>
<td>0.3725</td>
</tr>
<tr>
<td></td>
<td>729</td>
<td>97.2</td>
<td>336</td>
<td>0.3977</td>
</tr>
<tr>
<td></td>
<td>(760)</td>
<td>(101.3)</td>
<td>(370)</td>
<td>(0.4210)</td>
</tr>
</tbody>
</table>

\( ^{\dagger} \) volumes of gas corrected to 273.15 K and 101.3 kPa; \( ^{*} \) calc. by compiler
Values in parentheses are extrapolated to 1 atmosphere.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
Volumetric method. Pressure measured when known amounts of gas were added, in increments, to a known amount of liquid in a vessel of known dimensions. Corrections were made for the partial pressure of solvent. Details in ref. (1).

SOURCE AND PURITY OF MATERIALS:

ESTIMATED ERROR:
\( \delta T/K = \pm 0.1; \)
\( \delta(\text{absorption}) = \pm 4\% \) or less

REFERENCES:
1. Bodor, E.; Bor, G. J.; Mohai, B.; Siposs, G.
COMPONENTS: ORIGINAL MEASUREMENTS:
(1) Carbon dioxide; \( \text{CO}_2 \); \([124-38-9]\)  
(2) Benzaldehyde; \( \text{C}_7\text{H}_6\text{O} \); \([100-52-7]\)  

Just, G.  
*Z. Phys. Chem. 1901, 37, 342 - 367.*

VARIABLES:  

\[
\begin{align*}
T/K &= 288.15 - 298.15 \\
p_{\text{p}}/\text{kPa} &= 101.325 \text{ (1 atm)}
\end{align*}
\]

PREPARED BY:  
M. E. Derrick  
H. L. Clever

EXPERIMENTAL VALUES:  

<table>
<thead>
<tr>
<th>(T/K)</th>
<th>Mol Fraction (10^{3}x_{f})</th>
<th>Bunsen Coefficient (a/\text{cm}^{3})(STP)\text{cm}^{-3}\text{atm}^{-1})</th>
<th>Ostwald Coefficient (L/\text{cm}^{3}\text{cm}^{-3})</th>
</tr>
</thead>
<tbody>
<tr>
<td>288.15</td>
<td>13.98</td>
<td>3.13</td>
<td>3.304</td>
</tr>
<tr>
<td>293.15</td>
<td>12.75</td>
<td>2.85</td>
<td>3.057</td>
</tr>
<tr>
<td>298.15</td>
<td>11.67</td>
<td>2.60</td>
<td>2.841</td>
</tr>
</tbody>
</table>

The author measured the Ostwald coefficient at a pressure of about 746 mmHg. The compiler assumed the Ostwald coefficient to be independent of pressure, and calculated the mole fraction and Bunsen coefficient values at 101.325 kPa (1 atm) partial pressure of the gas.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:  
An Ostwald apparatus as modified by Timofejew (1), and Steiner (2) is used. The apparatus consists of a gas buret, an absorption flask, and a mercury manometer. The system is thermostated with a water jacket.

The gas is introduced into the degassed liquid. The gas volume absorbed is determined by the gas buret. The solvent volume is determined at the end of the experiment by pouring the solvent into a graduated flask.

SOURCE AND PURITY OF MATERIALS:  
(1) Carbon dioxide. Generated in a Kipp apparatus using marble and hydrochloric acid.
(2) Benzaldehyde. No information.

ESTIMATED ERROR:  
\[\delta L/L = 0.03\] (compiler)

REFERENCES:  
1. Timofejew, W.  
*Z. Phys. Chem. 1890, 6, 141.*
2. Steiner, P.  
COMPONENTS:
1. Carbon dioxide; CO₂; [124-38-9]
2. 1,3-Dioxolan-2-one, (ethylene carbonate); C₃H₄O₃; [96-49-1]

VARIABLES:
T/K = 313.15
P/kPa = 101.3

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>P/kPa</th>
<th>T/K</th>
<th>x₀₂</th>
<th>x₀₂</th>
</tr>
</thead>
<tbody>
<tr>
<td>101.3</td>
<td>313.15</td>
<td>0.00703</td>
<td></td>
</tr>
</tbody>
</table>

Solubilities in the pressure range 1520 to 3550 kPa are also given in the paper.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
Carbon dioxide was bubbled through 10-50 cm³ of solvent for "a sufficiently long time to attain saturation". The carbon dioxide was then stripped from solution by another gas and collected in a gas buret. The mixed gas in the buret was analysed by gas chromatography.

SOURCE AND PURITY OF MATERIALS:
1. Purity better than 99%

ESTIMATED ERROR:
δx₀₂ = ±5% (authors)

REFERENCES:
COMPONENTS:
1. Carbon dioxide; CO₂; [124-38-9]
2. 4-Methyl-1,3-dioxolan-2-one, (propylene carbonate); C₄H₆O₃; [108-32-7]

VARIABLES:
T/K = 273.2-303.2
P/kPa = 101.3

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>P/kPa</th>
<th>T/K</th>
<th>Solubility* cm³g⁻¹</th>
<th>xCO₂</th>
</tr>
</thead>
<tbody>
<tr>
<td>101.3</td>
<td>273.15</td>
<td>3.50</td>
<td>0.0158</td>
</tr>
<tr>
<td></td>
<td>283.15</td>
<td>4.55</td>
<td>0.0205</td>
</tr>
<tr>
<td></td>
<td>293.15</td>
<td>6.00</td>
<td>0.0268</td>
</tr>
<tr>
<td></td>
<td>303.15</td>
<td>8.30</td>
<td>0.0367</td>
</tr>
</tbody>
</table>

* solubilities are defined as the volume of gas, reduced to 273.15 K and 101.325 kPa, absorbed by one gram of solvent at the temperature and pressure stated.

Solubilities at 506.6, 1013.3, 2533.1 and 5066.3 kPa are also given in the paper.

AUXILIARY INFORMATION:

METHOD/APPARATUS/PROCEDURE:
Apparatus and method described in ref. (1)

SOURCE AND PURITY OF MATERIALS:
No information

ESTIMATED ERROR:
δ(solubility) = ±10%

REFERENCES:
COMPONENTS:
1. Carbon dioxide; CO₂; [124-38-9]
2. 4-Methyl-1,3-dioxolan-2-one, (propylene carbonate); C₄H₆O₃; [108-32-7]

VARIABLES:
P/kPa = 101-1677
T/K = 273-328

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>A/cm³ atm mol⁻¹</th>
<th>Henry's constant, H/mmHg</th>
<th>x₁ CO₂ (101.3 kPa)<em>/kPa</em></th>
</tr>
</thead>
<tbody>
<tr>
<td>273.15</td>
<td>2500</td>
<td>36900</td>
<td>4920</td>
</tr>
<tr>
<td>288.15</td>
<td>5800</td>
<td>53400</td>
<td>7120</td>
</tr>
<tr>
<td>298.15</td>
<td>1000</td>
<td>64500</td>
<td>8600</td>
</tr>
<tr>
<td>313.15</td>
<td>22000</td>
<td>85900</td>
<td>11450</td>
</tr>
<tr>
<td>328.15</td>
<td>108500**</td>
<td>14465</td>
<td>0.0070</td>
</tr>
</tbody>
</table>

Solubility measurements at 223-1677 kPa and 273-313 K were given by the authors. These were used by the authors to calculate the limiting value of Henry's constant, H, from the Krichevsy-Il'inskaya equation in the following form:

\[ P \frac{RT \ln \frac{f_2}{x_2}}{x_2} = RT \ln H + \int \frac{\vec{V}_2 dP}{p} - A(1-x_2^2) \]

where:
- \( f_2 \) = fugacity of carbon dioxide
- \( x_1 \) and \( x_2 \) mole fractions of carbon dioxide and solvent
- \( \vec{V}_2 \) = partial molar volume of carbon dioxide at \( x_2 = 0 \)
- \( A \) = a coefficient

* calculated by the compiler.
** based on measurements at 101.3 kPa only.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
Apparatus described in ref. (1).

SOURCE AND PURITY OF MATERIALS:
2. Supplied by BNIIIneftekhim.

ESTIMATED ERROR:
\( \delta H = \pm 3-5\% \) (authors)

REFERENCES:
COMPONENTS:
1. Carbon dioxide; CO₂;
2. 4-Methyl-1,3-dioxolan-2-one, (Propylene Carbonate); C₄H₆O₃; [108-32-7]

VARIABLES:
T/K = 298.2-343.2

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>Henry's constant HCO₂/atm</th>
<th>Mole fraction at 101.3 kPa xCO₂ (1 atm)*</th>
</tr>
</thead>
<tbody>
<tr>
<td>298.2</td>
<td>67.7</td>
<td>0.0148</td>
</tr>
<tr>
<td>323.2</td>
<td>103</td>
<td>0.00971</td>
</tr>
<tr>
<td>343.2</td>
<td>124</td>
<td>0.00806</td>
</tr>
</tbody>
</table>

* Calculated by compiler assuming a linear function of P CO₂ vs x CO₂, i.e., x CO₂ (1 atm) = 1/H CO₂.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
A conventional gas-liquid chromatographic unit fitted with a thermal conductivity detector was used. The carrier gas was helium. The value of Henry's law constant was calculated from the retention time. The value applies to very low partial pressures of gas and there may be a substantial difference from that measured at 1 atm. pressure. There is also considerable uncertainty in the value of Henry's constant since surface adsorption was not allowed for although its possible existence was noted.

SOURCE AND PURITY OF MATERIALS:
(1) L'Air Liquide sample, minimum purity 99.9 mole per cent.
(2) Touzart and Matignon or Serlabo sample, purity 99 mole per cent.

ESTIMATED ERROR:
δT/K = ±0.1; δH/atm = ±6% (estimated by compiler).

REFERENCES:

ORIGINIAL MEASUREMENTS:
Lenoir, J-Y.; Renault, P.; Renon, H.

PREPARED BY:
C. L. Young
COMPONENTS:
1. Carbon dioxide; CO₂; [124-38-9]
2. 4-Methyl-1,3-dioxolan-2-one; (propylene carbonate); C₄H₆O₃; [108-32-7]

ORIGINAL MEASUREMENTS:
Zubchenko, Yu. P.; Shakhova, S. F.; Ting Wei; Titel'man, L. I.; Kaplan, L. K.

VARIABLES:

P/kPa = 334-12260
T/K = 228-423

EXPERIMENTAL VALUES:

Solubility measurements over a range of pressures to high pressures were reported. Solubility data were used to calculate the limiting value of Henry's law constant, H, at zero partial pressure of carbon dioxide.

\[
H = \lim_{x_{CO_2} \rightarrow 0} \left( \frac{P_{CO_2}}{x_{CO_2}} \right)
\]

* calculated by the compiler

<table>
<thead>
<tr>
<th>T/K</th>
<th>H/mmHg</th>
<th>H/kPa*</th>
</tr>
</thead>
<tbody>
<tr>
<td>228.15</td>
<td>9500</td>
<td>1267</td>
</tr>
<tr>
<td>243.15</td>
<td>16700</td>
<td>2226</td>
</tr>
<tr>
<td>263.15</td>
<td>28700</td>
<td>3826</td>
</tr>
<tr>
<td>343.15</td>
<td>144000</td>
<td>19198</td>
</tr>
<tr>
<td>373.15</td>
<td>196000</td>
<td>26131</td>
</tr>
<tr>
<td>423.15</td>
<td>247000</td>
<td>32931</td>
</tr>
</tbody>
</table>

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
Apparatus described in ref.(1) was used for temperatures from 228 K to 313 K and pressures to 6080 kPa. Measurements at 343 K to 423 K were carried out in a high pressure apparatus described in refs.(2,3).

SOURCE AND PURITY OF MATERIALS:
No information

ESTIMATED ERROR:
δT/K = ±0.1
δP/kPa = ±30.3

REFERENCES:
2. Krichevskii, I.R.; Efremova, G.D.
3. Tsiklis, D.S. High-pressure Physicochemical Investigation Techniques, 1958,
   Goskhimizdat, Moscow.
COMPONENTS:

1. Carbon dioxide; CO₂; [124-38-9]
2. 4-Methyl-1,3-dioxolan-2-one, (propylene carbonate); C₄H₆O₃; [108-32-7]

VARIABLES:

\[ T/\text{K} = 293.2-343.2 \]
\[ P_{\text{CO}_2}/\text{kPa} = 9.3-93 \]

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>( P_{\text{total}}/\text{kPa} )</th>
<th>( P_{\text{CO}_2}/\text{kPa} )</th>
<th>( V_{\text{CO}_2}/\text{cm}^3 )</th>
<th>( x_{\text{CO}_2} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>293.2</td>
<td>93.0</td>
<td>93.0</td>
<td>3.430</td>
<td>0.01306</td>
</tr>
<tr>
<td>293.2</td>
<td>93.0</td>
<td>46.5</td>
<td>0.585</td>
<td>0.00225</td>
</tr>
<tr>
<td>293.2</td>
<td>93.0</td>
<td>27.9</td>
<td>0.357</td>
<td>0.00138</td>
</tr>
<tr>
<td>303.2</td>
<td>91.8</td>
<td>91.8</td>
<td>2.750</td>
<td>0.01050</td>
</tr>
<tr>
<td>313.2</td>
<td>90.6</td>
<td>90.6</td>
<td>2.360</td>
<td>0.00902</td>
</tr>
<tr>
<td>323.2</td>
<td>89.4</td>
<td>89.4</td>
<td>2.000</td>
<td>0.00766</td>
</tr>
<tr>
<td>333.2</td>
<td>89.6</td>
<td>89.6</td>
<td>1.670</td>
<td>0.00640</td>
</tr>
<tr>
<td>349.2</td>
<td>87.2</td>
<td>87.2</td>
<td>1.140</td>
<td>0.00438</td>
</tr>
</tbody>
</table>

\( V_{\text{CO}_2} \) is the volume of carbon dioxide absorbed by one cm³ of solvent.

The compiler has assumed that these volumes have been reduced to 273.2 K and a pressure of 101.3 kPa although this was not stated by the authors.

* calculated by the compiler.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

A static method was used as described in ref. (1).
The authors did not state what gas was used to reduce the partial pressure of carbon dioxide below the total pressure.

SOURCE AND PURITY OF MATERIALS:

No information

ESTIMATED ERROR:

REFERENCES:

1. E.Ya. Tarat; V.V. Zubov; Yu.L. Ponomarev
COMPONENTS:
1. Carbon dioxide; CO₂; [124-38-9]
2. 4-Methyl-1,3-dioxolan-2-one, (propylene carbonate); C₄H₆O₃; [108-32-7]

VARIABLES:
T/K = 313.2, 373.2
P/kPa = 42.2-5768.9

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>P/kPa</th>
<th>mole ratio</th>
<th>x_{CO₂}</th>
<th>H/Mpa†</th>
<th>H/kPa*</th>
</tr>
</thead>
<tbody>
<tr>
<td>313.15</td>
<td>0</td>
<td></td>
<td></td>
<td>11.8</td>
<td>11800</td>
</tr>
<tr>
<td>373.15</td>
<td>0</td>
<td></td>
<td></td>
<td>26.9</td>
<td>26900</td>
</tr>
<tr>
<td>42.2</td>
<td>0.0017</td>
<td></td>
<td>0.0017</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

† Measurements were made at 313.15 K over the pressure range 415.8-5768.9 kPa and at 373.15 K over the pressure range 42.2-5739.8 kPa. The authors obtained the partial molar volume at the two temperatures from volumetric data given by Zubchenko et al. (1) and then fitted the data for low partial pressures to the Krichevsky-Il'inskaya equation (2) to evaluate Henry's law constants given above.

* calculated by the compiler

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
The equilibrium cell consisted of a Jerguson gauge with a 250 cm³ gas reservoir. Temperatures were measured by thermocouples and controlled to ±0.5K by an air-bath. Pressures were measured by a Heise Bourdon tube gauge. The cell was charged with solvent. CO₂ was added to give an appropriate pressure. Nitrogen was added, when necessary, to ensure that total pressure >350 kPa. Gases were circulated by a magnetic pump for at least 8h. The gas phase was analysed by gas chromatography. Samples of the liquid phase were withdrawn, heated at barometric pressure and the quantity of gas evolved found from P-V-T values.

SOURCE AND PURITY OF MATERIALS:
1. no information
2. from Eastman Kodak Co.; minimum purity 98%

ESTIMATED ERROR:
δT/K = ±0.5
δ(mole ratio) = ±0.02 or ±4%
whichever is the larger (authors).

REFERENCES:
   Zhur. Prikl. Khim. 1971, 44(9), 2044
### COMPONENTS:
1. Carbon dioxide; CO₂; [124-38-9]
2. 4 - methyl-1,3-dioxolan-2-one, (propylene carbonate); C₄H₆O₃; [108-32-7].

### ORIGINAL MEASUREMENTS:
Rivas, O.R.; Prausnitz, J.M.

### VARIABLES:
\[ T/K = 278.15, 298.15 \]

### PREPARED BY:
C.L. Young

### EXPERIMENTAL VALUES:

| \( T/K \)   | Henry's constant \(/
<table>
<thead>
<tr>
<th>atm)</th>
<th>Mole fraction of CO₂ at 101.3 kPa (1 atm) partial pressure*</th>
</tr>
</thead>
<tbody>
<tr>
<td>278.15</td>
<td>54.8</td>
</tr>
<tr>
<td>298.15</td>
<td>82.8</td>
</tr>
</tbody>
</table>

* Calculated by compiler assuming mole fraction solubility linear with pressure.

### AUXILIARY INFORMATION

**METHOD APPARATUS PROCEDURE:**
Volumetric apparatus with a fused quartz precision bourdon pressure gauge. Solubility apparatus carefully thermostatted. Solvent degassed in situ. Apparatus described in ref. (1) and modifications given in source.

**SOURCE AND PURITY OF MATERIALS:**
No details given.

**ESTIMATED ERROR:**
\[ \delta T/K = \pm 0.05; \delta p_{CO₂} = \pm 1\% . \]

**REFERENCES:**
1. Cukor, P.M.; Prausnitz, J.M.
COMPONENTS:
1. Carbon dioxide; CO₂; [124-38-9]
2. 4-Methyl-1,3-Dioxolan-2-one, (Propylene carbonate); C₄H₆O₃; [108-32-7]

VARIABLES:
\[ T / \text{K} = 263.15 - 373.15 \]

PREPARED BY: C.L. Young

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>( T / \text{K} )</th>
<th>Henry's constant, ( H ) /MPa</th>
<th>Mole fraction of ( + ) carbon dioxide in liquid, ( x_{\text{CO}_2} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>263.15</td>
<td>3.66</td>
<td>0.0277</td>
</tr>
<tr>
<td>298.15</td>
<td>8.39</td>
<td>0.01208</td>
</tr>
<tr>
<td>323.15</td>
<td>12.47</td>
<td>0.00813</td>
</tr>
<tr>
<td>348.15</td>
<td>17.12</td>
<td>0.00592</td>
</tr>
<tr>
<td>373.15</td>
<td>22.35</td>
<td>0.00453</td>
</tr>
</tbody>
</table>

+ at a partial pressure of 101.3 kPa calculated by compiler assuming Henry's law applies at that pressure.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
Volumetric apparatus with a fused quartz precision bourdon pressure gauge. Solubility apparatus carefully thermostatted. Solvent degassed in situ. Apparatus described in ref. (1) and modifications given in source.

SOURCE AND PURITY OF MATERIALS:
1. and 2. Purity at least 99 mole per cent.

ESTIMATED ERROR:
\[ \delta T / \text{K} = \pm 0.05; \delta x_{\text{CO}_2} = \pm 1\% \]

REFERENCES:
1. Cukor, P.M.; Prausnitz, J.M.
COMPONENTS:
1. Carbon dioxide; CO₂; [124-38-9]
2. 4-Methyl-1,3-dioxolan-2-one, (propylene carbonate); C₄H₆O₃; [108-32-7]

VARIABLES:
T/K = 299.9-377.6
P/kPa = 1966-6900

EXPERIMENTAL VALUES:
Solubility measurements over a range of high pressures were reported. Variation of solubility with pressure could be correlated with the Krachevsky-Kasarnovsky equation i.e.

\[
\log(f_1/x_1) = \log H + \bar{V}(P - P_2)/2.303RT
\]

where \( f_1 \) is the fugacity of carbon dioxide in the vapor;
\( x_1 \) is the mole fraction of carbon dioxide in the liquid;
\( H \) is the limiting value of Henry's law constant at zero partial pressure of carbon dioxide;
\( \bar{V} \) is the partial molar volume of carbon dioxide in the liquid;
\( P \) is the total pressure;
\( P_2 \) is the partial pressure of the solvent.

<table>
<thead>
<tr>
<th>T/K</th>
<th>Partial molar vol. of CO₂ /cm³mol⁻¹</th>
<th>Henry's constant, H /kPa</th>
<th>Mole fraction solubility of CO₂ at P CO₂ = 101.3 kPa*</th>
</tr>
</thead>
<tbody>
<tr>
<td>299.9</td>
<td>-0.06786</td>
<td>81.7</td>
<td>8280</td>
</tr>
<tr>
<td>311.0</td>
<td>-0.04762</td>
<td>101.7</td>
<td>10310</td>
</tr>
<tr>
<td>344.3</td>
<td>-0.01000</td>
<td>159.4</td>
<td>16150</td>
</tr>
<tr>
<td>377.6</td>
<td>0.02273</td>
<td>227.8</td>
<td>23080</td>
</tr>
</tbody>
</table>

* calculated by the compiler from the Krachevsky-Kasarnovsky equation

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
Equilibrium between gas and liquid phases was established in a high pressure cell which could be agitated. A mercury displacement pump was used to provide pressures greater than that in the carbon dioxide cylinder. Temperatures were maintained to ±0.6 K in an air bath. There was provision for withdrawal of samples of the gas from the top of the cell and of liquid from the bottom of the cell.

SOURCE AND PURITY OF MATERIALS:
1. Supplied by Spencer Chemical Co., purity 99.6 mol%
2. Supplied by Jefferson Chemical Co., minimum purity 99 wt%

ESTIMATED ERROR:
\( \delta H/H = ±0.06 \) (estimated by compiler from the stated deviation from the K.-K. eqn.);
\( \delta T/K = ±0.6 \) (authors)

REFERENCES:
COMPONENTS:
1. Carbon dioxide; CO₂; [124-38-9]
2. Polar solvents

ORIGINAL MEASUREMENTS:
Sweeney, C.W.
Chromatographia 1984, 18, 663-7

VARIABLES:
T/K = 298.15; 323.15

PREPARED BY:
P.G.T. Fogg

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>Solvent</th>
<th>Henry's constant/298.15 K</th>
<th>Henry's constant/323.15 K</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phosphoric acid, tributyl ester</td>
<td>29.4</td>
<td>46.6</td>
</tr>
<tr>
<td>(tributyl phosphate); C₃H₇PO₄; [126-73-8]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4-Methyl-1,3-dioxolan-2-one</td>
<td>82.9</td>
<td>127.7</td>
</tr>
<tr>
<td>(propylene carbonate); C₄H₇O₃; [108-32-7]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1-Methyl-2-pyrrolidinone</td>
<td>69.8</td>
<td>110.9</td>
</tr>
<tr>
<td>(N-methylpyrrolidone); C₅H₇NO; [872-50-4]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2,5,8,11,14-Pentaoxapentadecane</td>
<td>31.6</td>
<td>47.4</td>
</tr>
<tr>
<td>(tetaethylene glycol dimethyl ether); C₁₀H₂₀O₈; [143-24-8]</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The Henry's constant, \( H \), was defined as:

\[
H = \left[ \frac{f_2}{x_2} \right]_{x_2=0}
\]

where \( f_2 \) is the fugacity of CO₂ in the gas phase and \( x_2 \) the mole fraction of CO₂ in the liquid phase.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
Henry's constants were calculated from retention volumes measured with a modified 204 Series Pye-Unicam gas chromatograph. Helium was used as carrier gas and the support material was PTFE. Further details are given in refs. 1 - 3.

SOURCE AND PURITY OF MATERIALS:
1. from Cambrian Gases, London; 97.5 - 99.9% pure.
2. from Aldrich Chemicals, Gillingham, U.K.; re-distilled.

ESTIMATED ERROR:
\( \delta T/K = \pm 0.05 \); \( \delta H/H = \pm 0.05 \) (author)

REFERENCES:
COMPONENTS:

1. Carbon dioxide; CO₂; [124-38-9]

2. 4-Methyl-1,3-dioxolan-2-one, (propylene carbonate); C₄H₆O₃; [108-32-7]

ORIGINAL MEASUREMENTS:

Murrieta-Guevara, F.; Romero-Martinez, A.; Trejo, A.

Fluid Phase Equilibria, 1988, 44, 105-115.

VARIABLES:

\[ T/K = 298.15-373.15 \]

\[ P/kPa = 56.3-2228.7 \]

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>( T/K )</th>
<th>( P_{CO₂}/kPa )</th>
<th>( x_{CO₂} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>298.15</td>
<td>56.3</td>
<td>0.0064</td>
</tr>
<tr>
<td>313.15</td>
<td>147.5</td>
<td>0.0178</td>
</tr>
<tr>
<td>373.15</td>
<td>219.4</td>
<td>0.0075</td>
</tr>
</tbody>
</table>

The authors have also given data for higher pressures

<table>
<thead>
<tr>
<th>( T/K )</th>
<th>Henry's law constant ( \frac{H}{MPa} )</th>
<th>( \frac{H}{kPa} )</th>
<th>( x_{CO₂}(101.3 \text{ kPa})^* )</th>
</tr>
</thead>
<tbody>
<tr>
<td>298.15</td>
<td>8.21</td>
<td>8210</td>
<td>0.01234</td>
</tr>
<tr>
<td>313.15</td>
<td>10.23</td>
<td>10230</td>
<td>0.00990</td>
</tr>
<tr>
<td>373.15</td>
<td>28.88</td>
<td>28880</td>
<td>0.00351</td>
</tr>
</tbody>
</table>

* estimated by the compiler as \( P_{CO₂}/H \)

AUXILIARY INFORMATION:

METHOD/APPARATUS/PROCEDURE:

The apparatus and method of calculation have been described in previous publications (refs.1 and 2). The limiting values of Henry's law constant which are given above were found by fitting the experimental data to the Krichevsky-Kasarnovsky equation (3).

SOURCE AND PURITY OF MATERIALS:

1. Supplied by Infra S.A.; reported purity 99.7 mol%.

2. Purity better than 99.5 mol%.

ESTIMATED ERROR

\[ \delta T/K = \pm 0.02 \text{ to } 343 \text{ K}; \pm 0.5 \text{ at } 373 \text{ K. (authors)} \]

\[ \delta P/kPa = \pm 3.5 \]

REFERENCES:


COMPONENTS:
(1) Carbon dioxide; CO\(_2\); [124-38-9]
(2) Acetic acid; C\(_2\)H\(_4\)O\(_2\); [64-19-7]

ORIGINAL MEASUREMENTS:
Just, G.
Z. Phys. Chem. 1901, 37, 342 - 367.

VARIABLES:
\[ T/K = 288.15 - 298.15 \]
\[ p_1/kPa = 101.325 \text{ (1 atm)} \]

PREPARED BY:
M. E. Derrick
H. L. Clever

EXPERIMENTAL VALUES:
<table>
<thead>
<tr>
<th>T/K</th>
<th>Mol Fraction</th>
<th>Bunsen Coefficient</th>
<th>Ostwald Coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>10(^2)x_1</td>
<td>( \alpha/(\text{cm}^3\text{STP})\text{cm}^{-3}\text{atm}^{-1} )</td>
<td>( L/\text{cm}^3\text{cm}^{-3} )</td>
</tr>
<tr>
<td>288.15</td>
<td>1.34</td>
<td>5.32</td>
<td>5.614</td>
</tr>
<tr>
<td>293.15</td>
<td>1.21</td>
<td>4.78</td>
<td>5.129</td>
</tr>
<tr>
<td>298.15</td>
<td>1.09</td>
<td>4.29</td>
<td>4.679</td>
</tr>
</tbody>
</table>

The author measured the Ostwald coefficient at a pressure of about 746 mmHg. The compiler assumed the Ostwald coefficient to be independent of pressure, and calculated the mole fraction and Bunsen coefficient values at 101.325 kPa (1 atm) partial pressure of the gas.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
An Ostwald apparatus as modified by Timofejew (1), and Steiner (2) is used. The apparatus consists of a gas buret, an absorption flask, and a mercury manometer. The system is thermostated with a water jacket.

The gas is introduced into the degassed liquid. The gas volume absorbed is determined by the gas buret. The solvent volume is determined at the end of the experiment by pouring the solvent into a graduated flask.

SOURCE AND PURITY OF MATERIALS:
(1) Carbon dioxide. Generated in a Kipp apparatus using marble and hydrochloric acid.
(2) Acetic acid. No information.

ESTIMATED ERROR:
\[ \delta L/L = 0.03 \text{ (compiler)} \]

REFERENCES:
1. Timofejew, W.
Z. Phys. Chem. 1890, 8, 141.
2. Steiner, P.
COMPONENTS:

1. Carbon dioxide; CO$_2$; [124-38-9]
2. Acetic acid, C$_3$H$_6$O$_2$; [64-19-7]
   Acetic acid, pentyl ester, (amyl acetate); C$_{7}$H$_{14}$O$_2$; [628-63-7]

ORIGINAL MEASUREMENTS:
Kunerth, W.

VARIABLES:

$T/K = 291.15-307.15$  $P/kPa = 101.3$

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>Solvent</th>
<th>T/K</th>
<th>Ostwald coefficient $L$</th>
<th>$x_{CO_2}$ at $P_{CO_2} = 101.3$ kPa*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acetic acid</td>
<td>291.15</td>
<td>5.40</td>
<td>0.01283</td>
</tr>
<tr>
<td></td>
<td>293.15</td>
<td>5.23</td>
<td>0.01237</td>
</tr>
<tr>
<td></td>
<td>295.15</td>
<td>5.07</td>
<td>0.01194</td>
</tr>
<tr>
<td></td>
<td>297.15</td>
<td>4.91</td>
<td>0.01152</td>
</tr>
<tr>
<td></td>
<td>299.15</td>
<td>4.73</td>
<td>0.01105</td>
</tr>
<tr>
<td></td>
<td>301.15</td>
<td>4.57</td>
<td>0.01063</td>
</tr>
<tr>
<td></td>
<td>303.15</td>
<td>4.41</td>
<td>0.01022</td>
</tr>
<tr>
<td></td>
<td>305.15</td>
<td>4.25</td>
<td>0.00981</td>
</tr>
<tr>
<td></td>
<td>307.15</td>
<td>4.12</td>
<td>0.00947</td>
</tr>
<tr>
<td></td>
<td>309.15</td>
<td>4.00</td>
<td>0.00916</td>
</tr>
<tr>
<td>Amyl acetate</td>
<td>291.15</td>
<td>4.79</td>
<td>0.02904</td>
</tr>
<tr>
<td></td>
<td>293.15</td>
<td>4.65</td>
<td>0.02803</td>
</tr>
<tr>
<td></td>
<td>295.15</td>
<td>4.55</td>
<td>0.02726</td>
</tr>
<tr>
<td></td>
<td>297.15</td>
<td>4.44</td>
<td>0.02645</td>
</tr>
<tr>
<td></td>
<td>299.15</td>
<td>4.35</td>
<td>0.02576</td>
</tr>
<tr>
<td></td>
<td>301.15</td>
<td>4.24</td>
<td>0.02496</td>
</tr>
<tr>
<td></td>
<td>303.15</td>
<td>4.14</td>
<td>0.02423</td>
</tr>
<tr>
<td></td>
<td>305.15</td>
<td>4.10</td>
<td>0.02385</td>
</tr>
<tr>
<td></td>
<td>307.15</td>
<td>4.02</td>
<td>0.02324</td>
</tr>
</tbody>
</table>

* calculated by the compiler

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
The method is based upon that described by McDaniel (1). The apparatus consisted of a gas buret attached to a levelling tube containing mercury and to the absorption cell containing the solvent under test. The volume of gas absorbed by a measured volume of liquid was measured at a total pressure equal to barometric pressure. The mercury in the gas buret was covered with a layer of solvent so that the gas in the buret was saturated with solvent vapor. Buret and absorption cell were surrounded by heating wire and water jackets fitted with thermometers.

SOURCE AND PURITY OF MATERIALS:
1. produced by heating NaHCO$_3$; dried with CaCl$_2$; frozen in liquid air and volatile impurities pumped away; passed over P$_2$O$_5$.
2. commercial sample; purity attested by boiling point and density.

ESTIMATED ERROR:
$\delta x_{CO_2} = \pm 5\%$  (compiler)

REFERENCES:
COMPONENTS:
(1) Carbon dioxide; CO₂; [124-38-9]
(2) Butanoic acid or butyric acid; C₄H₈O₂; [107-92-6]

ORIGINAL MEASUREMENTS:
Just, G.
Z. Phys. Chem. 1901, 37, 342 - 367.

VARIABLES:
\[ T/K = 288.15 - 298.15 \]
\[ P_j/kPa = 101.325 \text{ (1 atm)} \]

PREPARED BY:
M. E. Derrick
H. L. Clever

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>Mol Fraction</th>
<th>Bunsen Coefficient</th>
<th>Ostwald Coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>( \times 10^{-3} )</td>
<td>( \text{a/cm}^3 \text{ (STP)cm}^{-3}\text{atm}^{-1} )</td>
<td>( L/\text{cm}^3\text{cm}^{-3} )</td>
</tr>
<tr>
<td>288.15</td>
<td>15.55</td>
<td>3.87</td>
<td>4.084</td>
</tr>
<tr>
<td>293.15</td>
<td>14.20</td>
<td>3.51</td>
<td>3.767</td>
</tr>
<tr>
<td>298.15</td>
<td>12.97</td>
<td>3.19</td>
<td>3.478</td>
</tr>
</tbody>
</table>

The author measured the Ostwald coefficient at a pressure of about 746 mmHg. The compiler assumed the Ostwald coefficient to be independent of pressure, and calculated the mole fraction and Bunsen coefficient values at 101.325 kPa (1 atm) partial pressure of the gas.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
An Ostwald apparatus as modified by Timofejew (1), and Steiner (2) is used. The apparatus consists of a gas buret, an absorption flask, and a mercury manometer. The system is thermostated with a water jacket.

The gas is introduced into the degassed liquid. The gas volume absorbed is determined by the gas buret. The solvent volume is determined at the end of the experiment by pouring the solvent into a graduated flask.

SOURCE AND PURITY OF MATERIALS:
(1) Carbon dioxide. Generated in a Kipp apparatus using marble and hydrochloric acid.
(2) Butanoic acid. No information.

ESTIMATED ERROR:
\[ \delta L/L = 0.03 \text{ (compiler)} \]

REFERENCES:
1. Timofejew, W.
Z. Phys. Chem. 1890, 8, 141.
2. Steiner, P.
COMPONENTS:
(1) Carbon dioxide; CO₂; [124-38-9]
(2) Propanoic acid; C₃H₆O₂; [79-09-4]

ORIGINAL MEASUREMENTS:
Just, G.
Z. Phys. Chem. 1901, 37, 342 - 367.

VARIABLES:

\[ T/K = 288.15 - 298.15 \]

\[ P_j/kPa = 101.325 \text{ (1 atm)} \]

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>Mol Fraction</th>
<th>Bunsen Coefficient (10^3)</th>
<th>Ostwald Coefficient (a/cm^3) (STP) cm⁻¹ atm⁻¹</th>
<th>Coefficient (L/cm^3) cm⁻¹</th>
</tr>
</thead>
<tbody>
<tr>
<td>288.15</td>
<td>14.79</td>
<td>4.54</td>
<td>4.787</td>
<td></td>
</tr>
<tr>
<td>293.15</td>
<td>13.51</td>
<td>4.12</td>
<td>4.417</td>
<td></td>
</tr>
<tr>
<td>298.15</td>
<td>12.34</td>
<td>3.74</td>
<td>4.078</td>
<td></td>
</tr>
</tbody>
</table>

The author measured the Ostwald coefficient at a pressure of about 746 mmHg. The compiler assumed the Ostwald coefficient to be independent of pressure, and calculated the mole fraction and Bunsen coefficient values at 101.325 kPa (1 atm) partial pressure of the gas.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
An Ostwald apparatus as modified by Timofejew (1), and Steiner (2) is used. The apparatus consists of a gas buret, an absorption flask, and a mercury manometer. The system is thermostated with a water jacket.

The gas is introduced into the degassed liquid. The gas volume absorbed is determined by the gas buret. The solvent volume is determined at the end of the experiment by pouring the solvent into a graduated flask.

SOURCE AND PURITY OF MATERIALS:
(1) Carbon dioxide. Generated in a Kipp apparatus using marble and hydrochloric acid.
(2) Propanoic acid. No information.

ESTIMATED ERROR:
\[ \delta L/L = 0.03 \text{ (compiler)} \]

REFERENCES:
1. Timofejew, W.
Z. Phys. Chem. 1890, 6, 141.
2. Steiner, P.
COMPONENTS:
1. Carbon dioxide; CO₂; [124-38-9]
2. 9-Octadecenoic acid (Z), (oleic acid); C₁₈H₃₄O₂; [112-80-1]

VARIABLES:
T/K = 296.2-335.2
P/kPa = 11-59

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>Bunsen coef. α</th>
<th>Pₐ₉₀ = 101.3 kPa</th>
</tr>
</thead>
<tbody>
<tr>
<td>296.15</td>
<td>1.13</td>
<td>0.0160</td>
</tr>
<tr>
<td>316.15</td>
<td>0.90</td>
<td>0.0127</td>
</tr>
<tr>
<td>326.15</td>
<td>0.79</td>
<td>0.0112</td>
</tr>
<tr>
<td>335.15</td>
<td>0.69</td>
<td>0.0098</td>
</tr>
</tbody>
</table>

The authors published a graph showing variations of the volume of carbon dioxide, reduced to 273.15 K and 101.3 kPa, with variations in the partial pressure of carbon dioxide. The partial pressure range was approximately 11-59 kPa. There was linear variation at each of the four temperatures.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
The solvent was placed in a glass bulb held in a thermostat bath and connected by flexible copper tubing to a manometer, gas reservoir and vacuum line. Dissolved air was first pumped out of the liquid. The carbon dioxide was then put in contact with the liquid which was agitated for 10-20 min. The quantity of gas absorbed was calculated from the change in pressure and volume of the system. It was also shown that the process of absorption was completely reversible.

SOURCE AND PURITY OF MATERIALS:
1. prepared by heating magnesium carbonate to 350°C; dried by phosphorus pentoxide.
2. no information.

ESTIMATED ERROR:

REFERENCES:
COMPONENTS:
(1) Carbon dioxide; CO₂ [124-38-9]
(2) Acetic acid anhydride; C₄H₆O₃ [108-24-7]

ORIGINAL MEASUREMENTS:
Just, G.

VARIABLES:
\( T/K = 288.15 - 298.15 \)
\( P/\text{kPa} = 101.325 \) (1 atm)

PREPARED BY:
M. E. Derrick
H. L. Clever

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>Mol Fraction</th>
<th>Bunsen Coefficient</th>
<th>Ostwald Coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>10³ ( x_j )</td>
<td>( a/\text{cm}³(\text{STP})\text{cm}⁻³\text{atm}⁻¹ )</td>
<td>( L/\text{cm}³\text{cm}⁻³ )</td>
</tr>
<tr>
<td>288.15</td>
<td>24.3</td>
<td>5.89</td>
<td>6.218</td>
</tr>
<tr>
<td>293.15</td>
<td>22.1</td>
<td>5.33</td>
<td>5.720</td>
</tr>
<tr>
<td>298.15</td>
<td>19.9</td>
<td>4.77</td>
<td>5.206</td>
</tr>
</tbody>
</table>

The author measured the Ostwald coefficient at a pressure of about 746 mmHg. The compiler assumed the Ostwald coefficient to be independent of pressure, and calculated the mole fraction and Bunsen coefficient values at 101.325 kPa (1 atm) partial pressure of the gas.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
An Ostwald apparatus as modified by Timofejew (1), and Steiner (2) is used. The apparatus consists of a gas buret, an absorption flask, and a mercury manometer. The system is thermostated with a water jacket. The gas is introduced into the degassed liquid. The gas volume absorbed is determined by the gas buret. The solvent volume is determined at the end of the experiment by pouring the solvent into a graduated flask.

SOURCE AND PURITY OF MATERIALS:
(1) Carbon dioxide. Generated in a Kipp apparatus using marble and hydrochloric acid.
(2) Acetic acid anhydride. No information.

ESTIMATED ERROR:
\( \delta \text{L/L} = 0.03 \) (compiler)

REFERENCES:
1. Timofejew, W.
_Z. Phys. Chem._ 1890, 6, 141.
2. Steiner, P.
**COMPONENTS:**

(1) Carbon dioxide; CO₂; [124-38-9]

(2) Formic acid, pentyl ester or amyl formate; C₆H₁₂O₂; [638-49-3]

**ORIGINAL MEASUREMENTS:**

Just, G.


**VARIABLES:**

\[ T/K = 288.15 - 298.15 \]

\[ p_1/kPa = 101.325 \text{ (1 atm)} \]

**PREPARED BY:**

M. E. Derrick  
H. L. Clever

**EXPERIMENTAL VALUES:**

<table>
<thead>
<tr>
<th>T/K</th>
<th>Mol Fraction</th>
<th>Bunsen Coefficient</th>
<th>Ostwald Coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(10^3 \chi_1)</td>
<td>(a/cm^3) (STP)cm⁻³atm⁻¹</td>
<td>(L/cm^3)cm⁻³</td>
</tr>
<tr>
<td>288.15</td>
<td>25.0</td>
<td>4.40</td>
<td>4.646</td>
</tr>
<tr>
<td>293.15</td>
<td>23.1</td>
<td>4.03</td>
<td>4.329</td>
</tr>
<tr>
<td>298.15</td>
<td>21.2</td>
<td>3.69</td>
<td>4.026</td>
</tr>
</tbody>
</table>

The author measured the Ostwald coefficient at a pressure of about 746 mmHg. The compiler assumed the Ostwald coefficient to be independent of pressure, and calculated the mole fraction and Bunsen coefficient values at 101.325 kPa (1 atm) partial pressure of the gas.

**AUXILIARY INFORMATION**

**METHOD/APARATUS/PROCEDURE:**

An Ostwald apparatus as modified by Timofejew (1), and Steiner (2) is used. The apparatus consists of a gas buret, an absorption flask, and a mercury manometer. The system is thermostated with a water jacket.

The gas is introduced into the degassed liquid. The gas volume absorbed is determined by the gas buret. The solvent volume is determined at the end of the experiment by pouring the solvent into a graduated flask.

**SOURCE AND PURITY OF MATERIALS:**

(1) Carbon dioxide. Generated in a Kipp apparatus using marble and hydrochloric acid.

(2) Formic acid, pentyl ester. No information.

**ESTIMATED ERROR:**

\[ \delta L/L = 0.03 \text{ (compiler)} \]

**REFERENCES:**

1. Timofejew, W.  

2. Steiner, P.  
COMPONENTS:
(1) Carbon dioxide; CO₂; [124-38-9]
(2) Acetic acid, methyl ester or methyl acetate; C₃H₆O₂; [79-20-9]

ORIGINAL MEASUREMENTS:
Just, G.
Z. Phys. Chem. 1901, 37, 342 - 367.

VARIABLES:
T/K = 298.15
p₁/kPa = 101.325 (1 atm)

PREPARED BY:
M. E. Derrick
H. L. Clever

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>Mol Fraction</th>
<th>Bunsen Coefficient</th>
<th>Ostwald Coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>298.15</td>
<td>20.76</td>
<td>5.95</td>
<td>6.494</td>
</tr>
</tbody>
</table>

The author measured the Ostwald coefficient at a pressure of about 746 mmHg. The compiler assumed the Ostwald coefficient to be independent of pressure, and calculated the mole fraction and Bunsen coefficient values at 101.325 kPa (1 atm) partial pressure of the gas.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
An Ostwald apparatus as modified by Timofejew (1), and Steiner (2) is used. The apparatus consists of a gas buret, an absorption flask, and a mercury manometer. The system is thermostated with a water jacket.

The gas is introduced into the degassed liquid. The gas volume absorbed is determined by the gas buret. The solvent volume is determined at the end of the experiment by pouring the solvent into a graduated flask.

SOURCE AND PURITY OF MATERIALS:
(1) Carbon dioxide. Generated in a Kipp apparatus using marble and hydrochloric acid.
(2) Acetic acid, methyl ester. No information.

ESTIMATED ERROR:

δ L/L = 0.03 (compiler)

REFERENCES:
1. Timofejew, W.
   Z. Phys. Chem. 1890, 6, 141.
2. Steiner, P.
COMPONENTS:
(1) Carbon dioxide; CO₂; [124-38-9]
(2) Acetic acid, methyl ester or methyl acetate; C₃H₆O₂; [79-20-9]

ORIGINAL MEASUREMENTS:
Gjaldbaek, J. C.; Andersen, E. K.

VARIABLES:
\[ T/K = 298.15 \]
\[ P_1/kPa = 101.325 \text{ (1 atm)} \]

PREPARED BY:
J. Chr. Gjaldbaek

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>( T/K )</th>
<th>( x_i )</th>
<th>( \alpha/(\text{cm}^3\text{STP})\text{cm}^{-3}\text{atm}^{-1} )</th>
<th>( L/\text{cm}^3\text{cm}^{-3} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>298.15</td>
<td>2.28</td>
<td>6.47</td>
<td>7.06</td>
</tr>
<tr>
<td>2.25</td>
<td>6.39</td>
<td>6.97</td>
<td></td>
</tr>
<tr>
<td>2.26</td>
<td>6.42</td>
<td>7.01</td>
<td></td>
</tr>
</tbody>
</table>

The mole fraction and Ostwald coefficient values were calculated by the compiler.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
The apparatus consists of a calibrated all-glass manometer and bulb enclosed in an air thermostat. The solvent is added and degassed in the apparatus. The gas is added. The apparatus and contents are shaken until equilibrium is attained. Mercury is used for calibration and as the confining liquid.
The absorbed volume of gas is calculated from the initial and final amounts of gas, both saturated with solvent vapor. The amount of solvent is determined by the weight of displaced mercury. Further details are in the references (1, 2).
The mole fraction values are at one atm pressure assuming Henry's law is obeyed.

SOURCE AND PURITY OF MATERIALS:
(1) Carbon dioxide. Prepared from potassium bicarbonate and sulfuric acid. 99.8 - 99.9% CO₂.
(2) Acetic acid, methyl ester. Fractionated by distillation. B.p. (760 mmHg)/°C = 56.72 - 56.85; refractive index \( n_D(20°C) = 1.3618 \).

ESTIMATED ERROR:
\[ \delta T/K = \pm 0.05 \]
\[ \delta x_i/x_i = \pm 0.015 \]

REFERENCES:
1. Lannung, A.
   J. Am. Chem. Soc. 1930, 52, 68.
2. Gjaldbaek, J. C.
**COMPONENTS:**

1. Carbon dioxide; CO₂; [124-38-9]
2. Acetic acid, ethyl ester (ethyl acetate); C₄H₇O₂; [141-78-6]

**ORIGINAL MEASUREMENTS:**

Bodor, E.; Bor, G. J.; Maleczkine, M.; Mesko, G.; Mohai, G.; Siposs, G.


**VARIABLES:**

\[ T/K = 198 - 318.2 \]
\[ P/kPa = 9.6 - 102.4 \]

**EXPERIMENTAL VALUES:**

<table>
<thead>
<tr>
<th>( T/K )</th>
<th>( p/\text{mmHg} )</th>
<th>( p/kPa )</th>
<th>Absorption ( \uparrow )</th>
<th>Mole fraction ( \uparrow ) of carbon dioxide in liquid, ( x_{CO_2} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>318.2</td>
<td>72</td>
<td>9.6</td>
<td>0.50</td>
<td>0.00196</td>
</tr>
<tr>
<td></td>
<td>169</td>
<td>22.5</td>
<td>0.82</td>
<td>0.00321</td>
</tr>
<tr>
<td></td>
<td>198</td>
<td>26.4</td>
<td>1.24</td>
<td>0.00485</td>
</tr>
<tr>
<td></td>
<td>309</td>
<td>41.2</td>
<td>1.39</td>
<td>0.00544</td>
</tr>
<tr>
<td></td>
<td>346</td>
<td>46.1</td>
<td>2.06</td>
<td>0.00803</td>
</tr>
<tr>
<td></td>
<td>407</td>
<td>54.3</td>
<td>2.14</td>
<td>0.00834</td>
</tr>
<tr>
<td></td>
<td>515</td>
<td>68.7</td>
<td>2.83</td>
<td>0.01100</td>
</tr>
<tr>
<td>295.2</td>
<td>285</td>
<td>38.0</td>
<td>2.52</td>
<td>0.00981</td>
</tr>
<tr>
<td></td>
<td>379</td>
<td>50.5</td>
<td>3.37</td>
<td>0.01308</td>
</tr>
<tr>
<td></td>
<td>446</td>
<td>59.5</td>
<td>3.23</td>
<td>0.0125</td>
</tr>
<tr>
<td></td>
<td>451</td>
<td>60.1</td>
<td>4.00</td>
<td>0.0155</td>
</tr>
<tr>
<td></td>
<td>526</td>
<td>70.1</td>
<td>4.03</td>
<td>0.0156</td>
</tr>
<tr>
<td></td>
<td>538</td>
<td>71.7</td>
<td>4.77</td>
<td>0.0184</td>
</tr>
<tr>
<td></td>
<td>620</td>
<td>82.7</td>
<td>4.95</td>
<td>0.0191</td>
</tr>
<tr>
<td></td>
<td>768</td>
<td>102.4</td>
<td>6.45</td>
<td>0.0247</td>
</tr>
<tr>
<td>(760) (101.3)</td>
<td>(6.40)</td>
<td>(0.0245)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>273.2</td>
<td>181</td>
<td>24.1</td>
<td>2.46</td>
<td>0.00958</td>
</tr>
<tr>
<td></td>
<td>327</td>
<td>43.6</td>
<td>4.74</td>
<td>0.0183</td>
</tr>
<tr>
<td></td>
<td>406</td>
<td>54.1</td>
<td>5.90</td>
<td>0.0227</td>
</tr>
<tr>
<td></td>
<td>482</td>
<td>64.3</td>
<td>6.95</td>
<td>0.0266</td>
</tr>
<tr>
<td></td>
<td>611</td>
<td>81.5</td>
<td>7.70</td>
<td>0.0294</td>
</tr>
</tbody>
</table>

**METHOD/APPARATUS/PROCEDURE:**

Volumetric method. Pressure measured when known amounts of gas were added, in increments, to a known amount of liquid in a vessel of known dimensions. Corrections were made for the partial pressure of solvent. Details in ref. (1).

**SOURCE AND PURITY OF MATERIALS:**

Bodor, E.; Bor, G. J.; Mohai, G.; Siposs, G.


**ESTIMATED ERROR:**

\[ \delta T/K = \pm 0.1; \]
\[ \delta (\text{absorption}) = \pm 4\% \text{ or less.} \]

**REFERENCES:**

1. Bodor, E.; Bor, G. J.; Mohai, G.; Siposs, G.

COMPONENTS:

1. Carbon dioxide; CO₂; [124-38-9]

2. Acetic acid, ethyl ester (ethyl acetate); C₄H₈O₂; [141-78-6]

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>p/mmHg</th>
<th>p/kPa</th>
<th>Absorption$^+$ of gas /cm³·g⁻¹</th>
<th>Mole fraction$^*$ of carbon dioxide in liquid, xCO₂</th>
</tr>
</thead>
<tbody>
<tr>
<td>273.2</td>
<td>685</td>
<td>91.3</td>
<td>10.2</td>
<td>0.0386</td>
</tr>
<tr>
<td></td>
<td>686</td>
<td>91.5</td>
<td>8.86</td>
<td>0.0337</td>
</tr>
<tr>
<td>799</td>
<td>106.5</td>
<td>10.5</td>
<td>(0.0396)</td>
<td></td>
</tr>
<tr>
<td>(760)</td>
<td>(101.3)</td>
<td>(13)</td>
<td>(0.041)</td>
<td></td>
</tr>
<tr>
<td>534</td>
<td>71.2</td>
<td>17.7</td>
<td>0.0312</td>
<td></td>
</tr>
<tr>
<td>452</td>
<td>60.3</td>
<td>14.3</td>
<td>0.0400</td>
<td></td>
</tr>
<tr>
<td>534</td>
<td>71.2</td>
<td>17.7</td>
<td>0.0378</td>
<td></td>
</tr>
<tr>
<td>730</td>
<td>97.3</td>
<td>23.4</td>
<td>0.0532</td>
<td></td>
</tr>
<tr>
<td>731</td>
<td>97.5</td>
<td>23.8</td>
<td>0.0856</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(760)</td>
<td>(101.3)</td>
<td>(25) (0.089)</td>
<td></td>
</tr>
<tr>
<td>223.2</td>
<td>233</td>
<td>31.1</td>
<td>20.3</td>
<td>0.0739</td>
</tr>
<tr>
<td>277</td>
<td>36.9</td>
<td>24.3</td>
<td>0.0872</td>
<td></td>
</tr>
<tr>
<td>407</td>
<td>54.3</td>
<td>30.8</td>
<td>0.108</td>
<td></td>
</tr>
<tr>
<td>517</td>
<td>68.9</td>
<td>47.1</td>
<td>0.156</td>
<td></td>
</tr>
<tr>
<td>557</td>
<td>74.3</td>
<td>48.8</td>
<td>0.161</td>
<td></td>
</tr>
<tr>
<td>616</td>
<td>82.1</td>
<td>58.0</td>
<td>0.186</td>
<td></td>
</tr>
<tr>
<td>734</td>
<td>97.9</td>
<td>61.8</td>
<td>0.195</td>
<td></td>
</tr>
<tr>
<td>735</td>
<td>98.0</td>
<td>69.6</td>
<td>0.215</td>
<td></td>
</tr>
<tr>
<td>(760)</td>
<td>(101.3)</td>
<td>(70)</td>
<td>(0.216)</td>
<td></td>
</tr>
<tr>
<td>198 ± 2</td>
<td>162</td>
<td>21.6</td>
<td>52.8</td>
<td>0.172</td>
</tr>
<tr>
<td>188</td>
<td>25.1</td>
<td>63.5</td>
<td>0.200</td>
<td></td>
</tr>
<tr>
<td>235</td>
<td>31.3</td>
<td>74.5</td>
<td>0.227</td>
<td></td>
</tr>
<tr>
<td>303</td>
<td>40.4</td>
<td>106.0</td>
<td>0.294</td>
<td></td>
</tr>
<tr>
<td>379</td>
<td>50.5</td>
<td>135.6</td>
<td>0.348</td>
<td></td>
</tr>
<tr>
<td>481</td>
<td>64.1</td>
<td>180.0</td>
<td>0.414</td>
<td></td>
</tr>
<tr>
<td>504</td>
<td>67.2</td>
<td>180.3</td>
<td>0.415</td>
<td></td>
</tr>
<tr>
<td>577</td>
<td>76.9</td>
<td>218.8</td>
<td>0.462</td>
<td></td>
</tr>
<tr>
<td>736</td>
<td>98.1</td>
<td>264.0</td>
<td>0.509</td>
<td></td>
</tr>
<tr>
<td>(760)</td>
<td>(101.3)</td>
<td>(280)</td>
<td>(0.524)</td>
<td></td>
</tr>
</tbody>
</table>

$^+$ the volume of gas absorbed by one gram of solvent was corrected to 273.15 K and 101.3 kPa. Values in parentheses are extrapolated to 1 atmosphere.

$^*$ calculated by compiler.
COMPONENTS:

(1) Carbon dioxide; CO₂; [124-38-9]

(2) Acetic acid, propyl ester or propyl acetate; C₅H₁₀O₂; [109-60-4]

ORIGINAL MEASUREMENTS:

Gjaldbaek, J. C.; Andersen, E. K.

VARIABLES:

\[ T/K = 298.15 \]
\[ P_1/kPa = 101.325 \text{ (1 atm)} \]

PREPARED BY:

J. Chr. Gjaldbaek

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>Mol Fraction</th>
<th>Bunsen Coefficient [ a/cm³(\text{STP})cm⁻³atm⁻¹ ]</th>
<th>Ostwald Coefficient [ L/cm³cm⁻³ ]</th>
</tr>
</thead>
<tbody>
<tr>
<td>298.15</td>
<td>2.46</td>
<td>4.84</td>
<td>5.28</td>
</tr>
<tr>
<td></td>
<td>2.44</td>
<td>4.80</td>
<td>5.24</td>
</tr>
</tbody>
</table>

The mole fraction and Ostwald coefficient values were calculated by the compiler.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The apparatus consists of a calibrated all-glass manometer and bulb enclosed in an air thermostat. The solvent is added and degassed in the apparatus. The gas is added. The apparatus and contents are shaken until equilibrium is attained. Mercury is used for calibration and as the confining liquid. The absorbed volume of gas is calculated from the initial and final amounts of gas, both saturated with solvent vapor. The amount of solvent is determined by the weight of displaced mercury. Further details are in the references (1, 2).

The mole fraction values are at one atm pressure assuming Henry's law is obeyed.

SOURCE AND PURITY OF MATERIALS:

(1) Carbon dioxide. Prepared from potassium bicarbonate and sulfuric acid. 99.8 - 99.9% CO₂.

(2) Acetic acid, propyl ester. Judex Chemicals. Fractionated by distillation. B.p. (760 mmHg)/°C = 101.56 - 101.70, refractive index \( n_D(20°C) = 1.3846 \).

ESTIMATED ERROR:

\[ \Delta T/K = \pm 0.05 \]
\[ \Delta x_2/x_1 = \pm 0.015 \]

REFERENCES:

1. Lannung, A.
   J. Am. Chem. Soc. 1930, 52, 68.

2. Gjaldbaek, J. C.
COMPONENTS:
(1) Carbon dioxide; CO₂; [124-38-9]
(2) Acetic acid, 2-methylpropyl ester or isobutyl acetate; C₆H₁₂O₂; [110-19-0]

VARIABLES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>P₁/kPa (1 atm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>293.15</td>
<td>101.325</td>
</tr>
<tr>
<td>298.15</td>
<td>101.325</td>
</tr>
</tbody>
</table>

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>Mol Fraction 10²x₁</th>
<th>Bunsen Coefficient a/cm³(STP)cm⁻³atm⁻¹</th>
<th>Ostwald Coefficient L/cm³cm⁻³</th>
</tr>
</thead>
<tbody>
<tr>
<td>293.15</td>
<td>2.67</td>
<td>4.63</td>
<td>4.968</td>
</tr>
<tr>
<td>298.15</td>
<td>2.50</td>
<td>4.30</td>
<td>4.691</td>
</tr>
</tbody>
</table>

The author measured the Ostwald coefficient at a pressure of about 746 mmHg. The compiler assumed the Ostwald coefficient to be independent of pressure, and calculated the mole fraction and Bunsen coefficient values at 101.325 kPa (1 atm) partial pressure of the gas.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
An Ostwald apparatus as modified by Timofejew (1), and Steiner (2) is used. The apparatus consists of a gas buret, an absorption flask, and a mercury manometer. The system is thermostated with a water jacket.

The gas is introduced into the degassed liquid. The gas volume absorbed is determined by the gas buret. The solvent volume is determined at the end of the experiment by pouring the solvent into a graduated flask.

SOURCE AND PURITY OF MATERIALS:
(1) Carbon dioxide. Generated in a Kipp apparatus using marble and hydrochloric acid.
(2) Acetic acid, 2-methylpropyl ester. No information.

ESTIMATED ERROR:

δ L/L = 0.03 (compiler)

REFERENCES:
1. Timofejew, W.
   E. Phys. Chem. 1890, 6, 141.
2. Steiner, P.
COMPONENTS:
(1) Carbon dioxide; CO₂; [124-38-9]
(2) Acetic acid, pentyl ester or amylacetate; C₇H₁₄O₂; [628-63-7]

ORIGINAL MEASUREMENTS:
Just, G.
Z. Phys. Chem. 1901, 37, 342 - 367.

VARIABLES:
\[ T/K = 288.15 - 298.15 \]
\[ P_0/kPa = 101.325 (1 \text{ atm}) \]

PREPARED BY:
M. E. Derrick
H. L. Clever

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>Mol Fraction</th>
<th>Bunsen Coefficient ( a/\text{cm}^3(\text{STP})\text{cm}^{-3}\text{atm}^{-1} )</th>
<th>Ostwald Coefficient ( b/\text{cm}^3\text{cm}^{-3} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>288.15</td>
<td>2.95</td>
<td>4.60</td>
<td>4.850</td>
</tr>
<tr>
<td>293.15</td>
<td>2.66</td>
<td>4.11</td>
<td>4.411</td>
</tr>
<tr>
<td>298.15</td>
<td>2.46</td>
<td>3.77</td>
<td>4.119</td>
</tr>
</tbody>
</table>

The author measured the Ostwald coefficient at a pressure of about 746 mmHg. The compiler assumed the Ostwald coefficient to be independent of pressure, and calculated the mole fraction and Bunsen coefficient values at 101.325 kPa (1 atm) partial pressure of the gas.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
An Ostwald apparatus as modified by Timofejew (1), and Steiner (2) is used. The apparatus consists of a gas buret, an absorption flask, and a mercury manometer. The system is thermostated with a water jacket.

The gas is introduced into the degassed liquid. The gas volume absorbed is determined by the gas buret. The solvent volume is determined at the end of the experiment by pouring the solvent into a graduated flask.

SOURCE AND PURITY OF MATERIALS:
(1) Carbon dioxide. Generated in a Kipp apparatus using marble and hydrochloric acid.
(2) Acetic acid, pentyl ester. No information.

ESTIMATED ERROR:
\[ \delta L/L = 0.03 \text{ (compiler)} \]

REFERENCES:
1. Timofejew, W.
Z. Phys. Chem. 1890, 6, 141.
2. Steiner, P.
COMPONENTS:

1. Carbon dioxide; CO₂; [124-38-9]

2. Octadecanoic acid, ethyl ester, (ethyl stearate); C₂₀H₄₀O₂; [111-61-5]

VARIABLES:

\[ T/K = 307.15 - 347.15 \]
\[ P/kPa = 8 - 78 \]

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>Bunsen coeff. ( a )</th>
<th>( x_{CO₂} ) at ( P_{CO₂} = 101.3 ) kPa</th>
</tr>
</thead>
<tbody>
<tr>
<td>307.15</td>
<td>1.15</td>
<td>0.0190</td>
</tr>
<tr>
<td>316.15</td>
<td>1.05</td>
<td>0.0173</td>
</tr>
<tr>
<td>325.15</td>
<td>0.94</td>
<td>0.0155</td>
</tr>
<tr>
<td>335.15</td>
<td>0.85</td>
<td>0.0140</td>
</tr>
<tr>
<td>347.15</td>
<td>0.76</td>
<td>0.0125</td>
</tr>
</tbody>
</table>

The authors published a graph showing variations of the volume of carbon dioxide absorbed, reduced to 273.15 K and 101.3 kPa, with variations in the partial pressure of carbon dioxide. The partial pressure range was approximately 8-78 kPa. There was linear variation at each of the five temperatures.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The solvent was placed in a glass bulb held in a thermostat bath and connected by flexible copper tubing to a manometer, gas reservoir and vacuum line. Dissolved air was first pumped out of the liquid. The carbon dioxide was then put in contact with the liquid which was agitated for 10-20 min. The quantity of gas absorbed was calculated from the change in pressure and volume of the system. It was also shown that the process of absorption was completely reversible.

SOURCE AND PURITY OF MATERIALS:

1. prepared by heating magnesium carbonate to 350°C; dried by phosphorus pentoxide.
2. density at 40°C = 0.848 g cm⁻³; no further information.

REFERENCES:
### COMPONENTS:

1. Carbon dioxide; \(\text{CO}_2\); [124-38-9]

2. Octadecenoic acid, methyl ester, (methyl oleate); \(C_{19}H_{36}O_2\); [27234-05-5]
   - Octadecenoic acid, ethyl ester, (ethyl oleate); \(C_{20}H_{38}O_2\); [28555-06-8]
   - Octadecenoic acid, butyl ester, (butyl oleate); \(C_{22}H_{42}O_2\); [142-77-8]

### ORIGINAL MEASUREMENTS:

Arai, C.; Yoshitama, T.; Nishihara, K.; Sano, Y.


### VARIABLES:

\[
T/K = 273.2-343.2 \\
P/kPa = 30-90
\]

### EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>Solvent</th>
<th>(T/K)</th>
<th>(\ln H)</th>
<th>(H/\text{Mpa})</th>
<th>(H/\text{kPa})</th>
<th>(%\text{CO}<em>2) atm at (P</em>{\text{CO}_2}) 101.3 kPa</th>
</tr>
</thead>
<tbody>
<tr>
<td>Butyl oleate</td>
<td>273.2</td>
<td>2.42</td>
<td>2420</td>
<td>0.0419</td>
<td></td>
</tr>
<tr>
<td></td>
<td>283.2</td>
<td>2.86</td>
<td>2860</td>
<td>0.0354</td>
<td></td>
</tr>
<tr>
<td></td>
<td>293.2</td>
<td>3.37</td>
<td>3370</td>
<td>0.0301</td>
<td></td>
</tr>
<tr>
<td></td>
<td>298.2</td>
<td>3.63</td>
<td>3630</td>
<td>0.0279</td>
<td></td>
</tr>
<tr>
<td></td>
<td>303.2</td>
<td>3.93</td>
<td>3930</td>
<td>0.0258</td>
<td></td>
</tr>
<tr>
<td></td>
<td>323.2</td>
<td>5.14</td>
<td>5140</td>
<td>0.0197</td>
<td></td>
</tr>
<tr>
<td></td>
<td>343.2</td>
<td>6.45</td>
<td>6450</td>
<td>0.0157</td>
<td></td>
</tr>
<tr>
<td>Ethyl oleate</td>
<td>273.2</td>
<td>2.31</td>
<td>2310</td>
<td>0.0439</td>
<td></td>
</tr>
<tr>
<td></td>
<td>298.2</td>
<td>3.66</td>
<td>3660</td>
<td>0.0277</td>
<td></td>
</tr>
<tr>
<td></td>
<td>323.2</td>
<td>5.26</td>
<td>5260</td>
<td>0.0193</td>
<td></td>
</tr>
<tr>
<td>Methyl oleate</td>
<td>273.2</td>
<td>2.37</td>
<td>2370</td>
<td>0.0428</td>
<td></td>
</tr>
<tr>
<td></td>
<td>298.2</td>
<td>3.77</td>
<td>3770</td>
<td>0.0269</td>
<td></td>
</tr>
<tr>
<td></td>
<td>323.2</td>
<td>5.36</td>
<td>5360</td>
<td>0.0189</td>
<td></td>
</tr>
</tbody>
</table>

The authors fitted the following equation to the data for butyl oleate:

\[
\ln H = 6700/(T/K) + 53.729\ln(T/K) - 0.08962(T/K) - 300.58
\]

standard deviation in values of \(H = 0.8\%\)

### AUXILIARY INFORMATION

**METHOD/APPARATUS/PROCEDURE:**

A static method was used. The apparatus consisted of an absorption vessel connected to a gas buret and manometers. The system could be evacuated via a vacuum line. Gas was held in a storage bulb. The contents of the absorption vessel could be stirred magnetically and the temperature measured with a thermometer. The apparatus was held at constant temperature by a thermostat.

**SOURCE AND PURITY OF MATERIALS:**

No information

**ESTIMATED ERROR:**

**REFERENCES:**
### COMPONENTS:

1. Carbon dioxide; CO₂; [124-38-9]

2. 1,2,3-Propanetriol, triacetate (glycerol triacetate); C₉H₁₄O₆; [102-76-1]
   - 2-[2-(2-Methoxyethoxy)ethoxy]ethanol, acetate, (methoxytriethyleneglycol acetate); C₉H₁₄O₆; [3610-27-3]
   - 2-[2-(2-Butoxyethoxy)ethoxy]ethanol, acetate, (butoxytriethyleneglycol acetate); C₁₂H₂₄O₆; [3610-26-2]

### VARIABLES:

- P/kPa = 101.3
- T/K = 273.2-303.2

### EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>Solvent</th>
<th>P/kPa</th>
<th>T/K</th>
<th>Solubility*</th>
<th>xₐCO₂</th>
</tr>
</thead>
<tbody>
<tr>
<td>Glycerol triacetate</td>
<td>101.3</td>
<td>273.15</td>
<td>4.40</td>
<td>0.0414</td>
</tr>
<tr>
<td></td>
<td></td>
<td>283.15</td>
<td>3.45</td>
<td>0.0327</td>
</tr>
<tr>
<td></td>
<td></td>
<td>293.15</td>
<td>2.65</td>
<td>0.0253</td>
</tr>
<tr>
<td></td>
<td></td>
<td>303.15</td>
<td>1.98</td>
<td>0.0190</td>
</tr>
<tr>
<td>Methoxytriethyleneglycol acetate</td>
<td>101.3</td>
<td>273.15</td>
<td>8.10</td>
<td>0.0698</td>
</tr>
<tr>
<td></td>
<td></td>
<td>283.15</td>
<td>6.40</td>
<td>0.0560</td>
</tr>
<tr>
<td></td>
<td></td>
<td>293.15</td>
<td>4.55</td>
<td>0.0405</td>
</tr>
<tr>
<td></td>
<td></td>
<td>303.15</td>
<td>3.50</td>
<td>0.0314</td>
</tr>
<tr>
<td>Butoxytriethyleneglycol acetate</td>
<td>101.3</td>
<td>273.15</td>
<td>4.60</td>
<td>0.0488</td>
</tr>
<tr>
<td></td>
<td></td>
<td>283.15</td>
<td>3.70</td>
<td>0.0397</td>
</tr>
<tr>
<td></td>
<td></td>
<td>293.15</td>
<td>2.95</td>
<td>0.0319</td>
</tr>
<tr>
<td></td>
<td></td>
<td>303.15</td>
<td>2.38</td>
<td>0.0259</td>
</tr>
</tbody>
</table>

* solubilities are defined as the volume of gas, reduced to 273.15 K and 101.325 kPa, absorbed by one gram of solvent at the temperature and pressure stated.

Solubilities at 506.6, 1013.3, 2533.1 and 5066.3 kPa are also given in the paper.

### AUXILIARY INFORMATION

**METHOD/APPARATUS/PROCEDURE:**

Apparatus and method described in ref. (1)

**SOURCE AND PURITY OF MATERIALS:**

No information

**ESTIMATED ERROR:**

δ(solubility) = ±10%

(compiler)

**REFERENCES:**

1. Makranczy, J.; Mohai, B.; Papp, S.; Rusz, L.
   
   
   1964, 8, 225-234.
COMPONENTS:

1. Carbon dioxide; CO₂; [124-38-9]
2. 1,2,3-Propanetriol, triacetate, (triacetin); C₉H₁₄O₆; [102-76-1]

VARIABLES:

P/kPa = 101-1677
T/K = 273-328

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>A/cm³ atm mol⁻¹</th>
<th>Henry's constant, H/ mmHg</th>
<th>x₂ = CO₂ (101.3 kPa)*/kPa</th>
<th>( \frac{RT\ln \frac{f_2}{x_2}}{RT\ln H + \frac{\overline{V}_2 dP}{P_1^0} - A(1-x_2^2)} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>273.15</td>
<td>-4200</td>
<td>15700</td>
<td>2090</td>
<td>0.0466</td>
</tr>
<tr>
<td>288.15</td>
<td>-4500</td>
<td>21800</td>
<td>2910</td>
<td>0.0339</td>
</tr>
<tr>
<td>298.15</td>
<td>-2100</td>
<td>27100</td>
<td>3610</td>
<td>0.0284</td>
</tr>
<tr>
<td>308.15</td>
<td>-1200</td>
<td>32700**</td>
<td>4360</td>
<td>0.0232</td>
</tr>
<tr>
<td>313.15</td>
<td>-1200</td>
<td>34600</td>
<td>4610</td>
<td>0.0221</td>
</tr>
<tr>
<td>323.15</td>
<td>-1200</td>
<td>38900**</td>
<td>5190</td>
<td>0.0195</td>
</tr>
<tr>
<td>328.15</td>
<td>-1200</td>
<td>45800**</td>
<td>6110</td>
<td>0.0166</td>
</tr>
</tbody>
</table>

Solubility measurements at 223-1677 kPa and 273-313 K were given by the authors. These were used by the authors to calculate the limiting value of Henry's constant, H, from the Krichevsky-Il'inskaya equation in the following form:

\[
\frac{RT\ln \frac{f_2}{x_2}}{RT\ln H + \frac{\overline{V}_2 dP}{P_1^0} - A(1-x_2^2)}
\]

where \( f_2 \) = fugacity of carbon dioxide
\( x_1 \) and \( x_2 \) = mole fractions of solvent and carbon dioxide respectively.
\( \overline{V}_2 \) = partial molar volume of carbon dioxide at \( x_2 = 0 \)
\( A \) = a coefficient

* calculated by the compiler
** based on measurements at 101.3 kPa only

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Apparatus described in ref. (1).

SOURCE AND PURITY OF MATERIALS:

2. Pure grade; distilled in vacuum.

ESTIMATED ERROR:

\( \delta H = \pm 3-5\% \) (authors)

REFERENCES:

**COMPONENTS:**

1. Carbon dioxide; $\text{CO}_2$; [124-38-9]
2. 1,1'-oxybisethane or diethyl ether; $\text{C}_4\text{H}_{10}\text{O}$; [60-29-7]

**ORIGINAL MEASUREMENTS:**
Christoff, A.

**VARIABLES:**

\[ T/K = 273.15, 283.15 \]
\[ p_1/kPa = \text{atmospheric} \]

**PREPARED BY:**
H. L. Clever

**EXPERIMENTAL VALUES:**

<table>
<thead>
<tr>
<th>Temperature $t$/$^\circ$C</th>
<th>Mol Fraction $10^2 x_i$</th>
<th>Bunsen Coefficient $a/cm^3($STP$)cm^{-3}atm^{-1}$</th>
<th>Ostwald Coefficient $L/cm^3cm^{-3}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>273.15</td>
<td>3.19</td>
<td>7.330</td>
</tr>
<tr>
<td>10</td>
<td>283.15</td>
<td>2.59</td>
<td>5.831</td>
</tr>
<tr>
<td>15</td>
<td>283.15</td>
<td>2.33</td>
<td>5.181</td>
</tr>
</tbody>
</table>

The mole fraction and Bunsen coefficient values were calculated by the compiler assuming ideal gas behavior.

**AUXILIARY INFORMATION**

**METHOD/APPRATUS/PROCEDURE:**

The apparatus is an Ostwald type as described by Just (ref 1), and modified by Skirrow (ref 2). The apparatus consists of a thermostated gas buret and an absorption flask.

The modification involves the use of vapor free gas in the gas buret. A correction is made for the vapor pressure of the solvent. A steel capillary tube with a stopcock, which prevents the gas and the solvent vapor from mixing in the buret, is used to connect the absorption flask and the buret.

**SOURCE AND PURITY OF MATERIALS:**

1. Carbon dioxide.
   No information.
2. Diethyl ether. Merck. Stated to be pure and anhydrous.

**ESTIMATED ERROR:**

\[ \delta L/L = \pm 0.03 \]

**REFERENCES:**

1. Just, G.
2. Skirrow, F. W.
COMPONENTS:
1. Carbon dioxide; CO₂; [124-38-9]
2. Tetrahydrofuran; C₄H₈O; [109-99-9]

VARIABLES:

\[ \begin{align*}
T/K &= 198-318.2 \\
P/kPa &= 10.5-98.0
\end{align*} \]

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>p/mmHg</th>
<th>p/kPa</th>
<th>Absorption†</th>
<th>Mole fraction* of carbon dioxide in liquid, ( x_{CO₂} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>318.2</td>
<td>79</td>
<td>10.5</td>
<td>0.51</td>
<td>0.00164</td>
</tr>
<tr>
<td>189</td>
<td>25.2</td>
<td>1.57</td>
<td>0.00503</td>
<td></td>
</tr>
<tr>
<td>229</td>
<td>30.3</td>
<td>1.80</td>
<td>0.00576</td>
<td></td>
</tr>
<tr>
<td>283</td>
<td>37.7</td>
<td>2.63</td>
<td>0.00839</td>
<td></td>
</tr>
<tr>
<td>316</td>
<td>42.1</td>
<td>2.50</td>
<td>0.00798</td>
<td></td>
</tr>
<tr>
<td>337</td>
<td>44.9</td>
<td>3.09</td>
<td>0.00984</td>
<td></td>
</tr>
<tr>
<td>295.2</td>
<td>270</td>
<td>3.60</td>
<td>2.72</td>
<td>0.00868</td>
</tr>
<tr>
<td>298</td>
<td>39.7</td>
<td>3.26</td>
<td>0.0104</td>
<td></td>
</tr>
<tr>
<td>394</td>
<td>52.5</td>
<td>4.02</td>
<td>0.0128</td>
<td></td>
</tr>
<tr>
<td>394</td>
<td>52.5</td>
<td>4.45</td>
<td>0.0141</td>
<td></td>
</tr>
<tr>
<td>464</td>
<td>61.9</td>
<td>5.53</td>
<td>0.0175</td>
<td></td>
</tr>
<tr>
<td>490</td>
<td>65.3</td>
<td>5.08</td>
<td>0.0161</td>
<td></td>
</tr>
<tr>
<td>547</td>
<td>72.9</td>
<td>5.64</td>
<td>0.0178</td>
<td></td>
</tr>
<tr>
<td>569</td>
<td>75.9</td>
<td>6.75</td>
<td>0.0213</td>
<td></td>
</tr>
<tr>
<td>585</td>
<td>78.0</td>
<td>6.07</td>
<td>0.0192</td>
<td></td>
</tr>
<tr>
<td>273.2</td>
<td>430</td>
<td>57.3</td>
<td>7.12</td>
<td>0.0224</td>
</tr>
<tr>
<td>441</td>
<td>58.8</td>
<td>7.67</td>
<td>0.0241</td>
<td></td>
</tr>
<tr>
<td>527</td>
<td>70.3</td>
<td>9.30</td>
<td>0.0291</td>
<td></td>
</tr>
<tr>
<td>541</td>
<td>72.1</td>
<td>8.65</td>
<td>0.0271</td>
<td></td>
</tr>
<tr>
<td>609</td>
<td>81.2</td>
<td>10.9</td>
<td>0.0339</td>
<td></td>
</tr>
<tr>
<td>637</td>
<td>84.9</td>
<td>10.3</td>
<td>0.0321</td>
<td></td>
</tr>
</tbody>
</table>

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Volumetric method. Pressure measured when known amounts of gas were added, in increments, to a known amount of liquid in a vessel of known dimensions. Corrections were made for the partial pressure of solvent. Details in ref. (1).

SOURCE AND PURITY OF MATERIALS:

ESTIMATED ERROR:

\[ \begin{align*}
\delta T/K &= ±0.1; \\
\delta(\text{absorption}) &= ±4\% \text{ or less.}
\end{align*} \]

REFERENCES:

### COMPONENTS:

1. Carbon dioxide; CO$_2$; [124-38-9]
2. Tetrahydrofuran; C$_4$H$_8$O; [109-99-9]

### ORIGINAL MEASUREMENTS:

Bodor, E.; Bor, Gy.; Maleczkine, M.; Mesko, G.; Mohai, B.; Siposs, G.


### EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>p/mmHg</th>
<th>p/kPa</th>
<th>Absorption of gas /cm$^3$g$^{-1}$</th>
<th>Mole fraction of carbon dioxide in liquid, x$_{CO_2}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>273.2</td>
<td>728</td>
<td>97.1</td>
<td>11.7</td>
<td>0.0363</td>
</tr>
<tr>
<td>273.2</td>
<td>735</td>
<td>98.0</td>
<td>12.9</td>
<td>0.0399</td>
</tr>
<tr>
<td>(760)</td>
<td>(101.3)</td>
<td>(13)</td>
<td></td>
<td>(0.040)</td>
</tr>
<tr>
<td>248.2</td>
<td>111</td>
<td>14.8</td>
<td>2.6</td>
<td>0.0083</td>
</tr>
<tr>
<td>248.2</td>
<td>222</td>
<td>29.6</td>
<td>5.0</td>
<td>0.0158</td>
</tr>
<tr>
<td>248.2</td>
<td>345</td>
<td>46.0</td>
<td>8.1</td>
<td>0.0254</td>
</tr>
<tr>
<td>248.2</td>
<td>412</td>
<td>54.9</td>
<td>10.4</td>
<td>0.0324</td>
</tr>
<tr>
<td>248.2</td>
<td>420</td>
<td>56.0</td>
<td>11.5</td>
<td>0.0357</td>
</tr>
<tr>
<td>248.2</td>
<td>518</td>
<td>69.1</td>
<td>14.9</td>
<td>0.0458</td>
</tr>
<tr>
<td>248.2</td>
<td>526</td>
<td>70.1</td>
<td>14.1</td>
<td>0.0434</td>
</tr>
<tr>
<td>248.2</td>
<td>622</td>
<td>82.9</td>
<td>16.8</td>
<td>0.0513</td>
</tr>
<tr>
<td>248.2</td>
<td>722</td>
<td>96.3</td>
<td>20.8</td>
<td>0.0627</td>
</tr>
<tr>
<td>248.2</td>
<td>722</td>
<td>96.3</td>
<td>21.4</td>
<td>0.0644</td>
</tr>
<tr>
<td>(760)</td>
<td>(101.3)</td>
<td>(23)</td>
<td></td>
<td>(0.0689)</td>
</tr>
<tr>
<td>223.2</td>
<td>158</td>
<td>21.1</td>
<td>15.1</td>
<td>0.0463</td>
</tr>
<tr>
<td>223.2</td>
<td>319</td>
<td>42.5</td>
<td>30.5</td>
<td>0.0894</td>
</tr>
<tr>
<td>223.2</td>
<td>321</td>
<td>42.8</td>
<td>29.7</td>
<td>0.0872</td>
</tr>
<tr>
<td>223.2</td>
<td>429</td>
<td>57.2</td>
<td>43.8</td>
<td>0.124</td>
</tr>
<tr>
<td>223.2</td>
<td>528</td>
<td>70.4</td>
<td>53.6</td>
<td>0.147</td>
</tr>
<tr>
<td>223.2</td>
<td>541</td>
<td>72.1</td>
<td>51.1</td>
<td>0.141</td>
</tr>
<tr>
<td>223.2</td>
<td>636</td>
<td>84.8</td>
<td>66.9</td>
<td>0.177</td>
</tr>
<tr>
<td>223.2</td>
<td>730</td>
<td>97.3</td>
<td>77.3</td>
<td>0.199</td>
</tr>
<tr>
<td>223.2</td>
<td>731</td>
<td>97.5</td>
<td>72.6</td>
<td>0.189</td>
</tr>
<tr>
<td>(760)</td>
<td>(101.3)</td>
<td>(80)</td>
<td></td>
<td>(0.205)</td>
</tr>
<tr>
<td>198 ± 2</td>
<td>147</td>
<td>19.6</td>
<td>63.4</td>
<td>0.169</td>
</tr>
<tr>
<td>198 ± 2</td>
<td>244</td>
<td>32.5</td>
<td>87.4</td>
<td>0.219</td>
</tr>
<tr>
<td>198 ± 2</td>
<td>261</td>
<td>34.8</td>
<td>97.1</td>
<td>0.238</td>
</tr>
<tr>
<td>198 ± 2</td>
<td>417</td>
<td>55.6</td>
<td>160.4</td>
<td>0.340</td>
</tr>
<tr>
<td>198 ± 2</td>
<td>420</td>
<td>56.0</td>
<td>164.3</td>
<td>0.346</td>
</tr>
<tr>
<td>198 ± 2</td>
<td>493</td>
<td>65.7</td>
<td>202.4</td>
<td>0.394</td>
</tr>
<tr>
<td>198 ± 2</td>
<td>542</td>
<td>72.3</td>
<td>225.8</td>
<td>0.421</td>
</tr>
<tr>
<td>198 ± 2</td>
<td>588</td>
<td>78.4</td>
<td>256.1</td>
<td>0.452</td>
</tr>
<tr>
<td>198 ± 2</td>
<td>653</td>
<td>87.1</td>
<td>301.8</td>
<td>0.493</td>
</tr>
<tr>
<td>198 ± 2</td>
<td>733</td>
<td>97.7</td>
<td>351.0</td>
<td>0.530</td>
</tr>
<tr>
<td>198 ± 2</td>
<td>733</td>
<td>97.7</td>
<td>357.8</td>
<td>0.535</td>
</tr>
<tr>
<td>(760)</td>
<td>(101.3)</td>
<td>(375)</td>
<td></td>
<td>(0.547)</td>
</tr>
</tbody>
</table>

*the volume of gas absorbed by one gram of solvent was corrected to 273.15 K and 101.3 kPa

*calculated by compiler.

Values in parentheses are extrapolated to 1 atmosphere.
COMPONENTS:
(1) Carbon dioxide; CO₂; [124-38-9]
(2) 1,4-Dioxane; C₄H₈O₂; [123-91-1]

ORIGINAL MEASUREMENTS:
Gallardo, M. A.; Urieta, J. S.; Gutierrez Losa, C.

VARIABLES:
\[ \frac{T}{K} = 285.15 - 303.15 \]
\[ P₁/kPa = 101 \]

PREPARED BY:
H. L. Clever

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>Mol Fraction</th>
<th>Bunsen Coefficient</th>
<th>Ostwald Coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>10⁻³x₁</td>
<td>a/ cm³(STP)cm⁻³atm⁻¹</td>
<td>L/cm³cm⁻³</td>
</tr>
<tr>
<td>285.15</td>
<td>300.9</td>
<td>8.229</td>
<td>8.590</td>
</tr>
<tr>
<td>289.15</td>
<td>269.4</td>
<td>7.312</td>
<td>7.740</td>
</tr>
<tr>
<td>293.15</td>
<td>254.6</td>
<td>6.869</td>
<td>7.732</td>
</tr>
<tr>
<td>298.15</td>
<td>227.2</td>
<td>6.080</td>
<td>6.636</td>
</tr>
<tr>
<td>303.15</td>
<td>197.4</td>
<td>5.237</td>
<td>5.812</td>
</tr>
</tbody>
</table>

The compiler calculated the Bunsen and Ostwald coefficients from the author's mole fraction values assuming ideal gas behavior.

The authors fitted their data to the equation:
\[ -\ln x₁ = 6.781 \ln \frac{T}{K} - 34.859 \]
from which they obtained
\[ \Delta H^\circ/\text{kJ mol}⁻¹ = -2.09 \]
and \[ \Delta S^\circ/\text{J K}⁻¹\text{mol}⁻¹ = -62 \]
for the transfer of one mole of carbon dioxide from the gas phase at 101 kPa to the hypothetical unit mole fraction solution.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
The apparatus is similar to that of Ben-Naim and Baer (ref 1). It was described in detail in an earlier paper (ref 2).

The apparatus consists of a gas buret, mercury manometer, and solution vessel. The solvent is degassed in the solution vessel. Measurements were carried out on the solvent vapor saturated gas.

Literature 1,4-dioxane vapor pressure data were fitted to the equation
\[ \ln \left( \frac{P₂}{kPa} \right) = -4591.3/(T/K) + 16.98. \]

SOURCE AND PURITY OF MATERIALS:
(1) Carbon dioxide. Sociedad Española del Oxigeno. Stated to be 99.998 %.
(2) 1,4-Dioxane. Merck and Co. Purity checked by GLC to be ≥ 99 %.

ESTIMATED ERROR:
\[ \delta T/K = ± 0.1 \]
\[ \delta P₁/kPa = ± 1 \]
\[ \delta x₁/x₁ = ± 0.01 \]

REFERENCES:
COMPONENTS:
1. Carbon dioxide; $\text{CO}_2$; [124-38-9]
2. 1,4-Dioxane; $\text{C}_4\text{H}_8\text{O}_2$; [124-91-1]

VARIABLES:
$T/\text{K} = 303.15-333.15$
$P/\text{kPa} = 101.3$

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>$T/\text{K}$</th>
<th>Mole fraction of carbon dioxide in liquid, $x_{\text{CO}_2}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>303.15</td>
<td>0.0192</td>
</tr>
<tr>
<td>313.15</td>
<td>0.0187</td>
</tr>
<tr>
<td>323.15</td>
<td>0.0182</td>
</tr>
<tr>
<td>333.15</td>
<td>0.0175</td>
</tr>
</tbody>
</table>

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
Falling film flow apparatus similar to that of Morrison and Billet (1). Apparatus consisted of (i) degassing section in which solvent could be degassed by freezing and thawing under vacuum and (ii) absorption section. The latter consisted of a gas buret and absorption spiral. Mole fraction solubility corrected to 1 atm partial pressure by assuming Henry's law was valid.

SOURCE AND PURITY OF MATERIALS:
1. Purity 99.99 mole per cent.
2. Fluka AG puriss grade sample, purity better than 99 mole per cent.

ESTIMATED ERROR:
$\delta T/\text{K} = \pm 0.1$; $\delta x/x = \pm 0.02$
(estimated by compiler).

REFERENCES:
1. Morrison, T.J.; Billet, F.J.
### COMPONENTS:

1. Carbon dioxide; CO₂; [124-38-9]
2. Oxybispropanol, (Dipropylene glycol); C₆H₁₄O₂; [25265-71-8]

### ORIGINAL MEASUREMENTS:

Lenior, J-Y.; Renault, P.; Renon, H.  

### VARIABLES:

\[ T/\text{K} = 298.2-343.2 \]

### EXPERIMENTAL VALUES:

**T/K** | **Henry's constant \(H_{\text{CO}_2/\text{atm}}\)** | **Mole fraction at 101.3 kPa \(x_{\text{CO}_2}\) (1 atm)**  
--- | --- | ---  
298.2 | 121 | 0.00826  
323.2 | 154 | 0.00649  
343.2 | 212 | 0.00472

*Calculated by compiler assuming a linear function of \(P_{\text{CO}_2}\) vs \(x_{\text{CO}_2}\), i.e., \(x_{\text{CO}_2}(1\ \text{atm}) = 1/H_{\text{CO}_2}\).*

### AUXILIARY INFORMATION

**METHOD/APPARATUS/PROCEDURE:**

A conventional gas-liquid chromatographic unit fitted with a thermal conductivity detector was used. The carrier gas was helium. The value of Henry's law constant was calculated from the retention time. The value applies to very low partial pressures of gas and there may be a substantial difference from that measured at 1 atm. pressure. There is also considerable uncertainty in the value of Henry's constant since surface adsorption was not allowed for although its possible existence was noted.

**SOURCE AND PURITY OF MATERIALS:**

(1) L’Air Liquide sample, minimum purity 99.9 mole per cent.  
(2) Touzart and Matignon or Serlabo sample, purity 99 mole per cent.

**ESTIMATED ERROR:**

\[ \delta T/\text{K} = \pm 0.1; \ \delta H/\text{atm} = \pm 6\% \]  
(estimated by compiler).

**REFERENCES:**...
COMPONENTS:
1. Carbon dioxide; CO₂; [124-38-9]
2. 2,2'-[1,2-Ethanediylbis(oxy)]bis-ethanol, (triethylene glycol); C₆H₁₄O₄; [112-27-6]

ORIGINAL MEASUREMENTS:
Makranczy, J.; Mohai, B.; Papp, S.; Rusz, L.

VARIABLES:
P/kPa = 101.3
T/K = 273.2-303.2

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>P/kPa</th>
<th>T/K</th>
<th>Solubility* cm³g⁻¹</th>
<th>xCO₂</th>
</tr>
</thead>
<tbody>
<tr>
<td>101.3</td>
<td>273.15</td>
<td>1.700</td>
<td>0.01134</td>
</tr>
<tr>
<td>283.15</td>
<td>1.405</td>
<td>0.00939</td>
<td></td>
</tr>
<tr>
<td>293.15</td>
<td>1.135</td>
<td>0.00760</td>
<td></td>
</tr>
<tr>
<td>303.15</td>
<td>0.900</td>
<td>0.00604</td>
<td></td>
</tr>
</tbody>
</table>

* solubilities are defined as the volume of gas, reduced to 273.15 K and 101.325 kPa, absorbed by one gram of solvent at the temperature and pressure stated.

Solubilities at 506.6, 1013.3, 2533.1 and 5066.3 kPa are also given in the paper.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
Apparatus and method described in ref. (1)

SOURCE AND PURITY OF MATERIALS:

ESTIMATED ERROR:
δ(solubility) = ±10%

REFERENCES:
1. Makranczy, J.; Mohai, B.; Papp, S.; Rusz, L.
**COMPONENTS:**

1. Carbon dioxide; CO₂; [124-38-9]

2. 2,2'[(1,2-Ethanediylbis(oxy))bis-ethanol], (triethylene glycol); C₆H₁₄O₄; [112-27-6]

**VARIABLES:**

\[ T/K = 298-398; P/kPa = 105-20250 \]

**EXPERIMENTAL VALUES:**

Experimental data were used to calculate the parameters \( H, V_2 \) and \( A \) in the Krichevsky-Il'inskaya equations of the form

\[
RT \ln \left( \frac{f_2}{x_2} \right) = RT \ln H + V_2 (P - P_\text{S}) + A (x_1^2 - 1)
\]

where \( f_2 \) = fugacity of solute, \( x_2 \) = mole fraction of solute, \( H \) = Henry's constant of the solute at infinite dilution, \( V_2 \) = partial molar volume of the solute at infinite dilution, \( A \) = Margules parameter, \( x_1 \) = mole fraction of the solvent, \( P \) = total pressure, \( P_\text{S} \) = partial pressure of the solvent.

<table>
<thead>
<tr>
<th>( T/K )</th>
<th>( H/\text{kPa} )</th>
<th>( V_2/\text{cm}^3\text{mol}^{-1} )</th>
<th>( A/RT )</th>
<th>( x_{\text{CO}_2} ) at 101.3 kPa*</th>
</tr>
</thead>
<tbody>
<tr>
<td>298.15</td>
<td>11950</td>
<td>36.50</td>
<td>0.229</td>
<td>0.008443</td>
</tr>
<tr>
<td>323.15</td>
<td>17440</td>
<td>38.14</td>
<td>0.228</td>
<td>0.005792</td>
</tr>
<tr>
<td>348.15</td>
<td>23550</td>
<td>40.03</td>
<td>0.229</td>
<td>0.004292</td>
</tr>
<tr>
<td>373.15</td>
<td>29850</td>
<td>42.23</td>
<td>0.232</td>
<td>0.003388</td>
</tr>
<tr>
<td>398.15</td>
<td>35950</td>
<td>44.82</td>
<td>0.237</td>
<td>0.002814</td>
</tr>
</tbody>
</table>

* calculated by the compiler from the parameters for the Krachevsky-Ilnskaia equation

**METHOD/APPARATUS/PROCEDURE:**

The solubility of carbon dioxide in triethylene glycol was measured at five temperatures over a partial pressure range of 105 kPa to 20250 kPa using apparatus and procedure described earlier (1). Where necessary nitrogen was added to maintain a total pressure above 200 kPa. The gas phase was analysed by gas chromatography. The liquid phase was analysed by absorption of dissolved gas in sodium hydroxide solution or barium hydroxide solution, addition of excess barium chloride solution and estimation of the barium carbonate which was precipitated. Relationships described by Bender et al.(2) were used to obtain parameters of the Krichevsky-Ill'inskaya equation which are given above.

**REFERENCES:**


COMPONENTS:

1. Carbon dioxide; CO\(_2\); [124-38-9]

2. Polyethylene glycol
   Polyethylene glycol ethers
   Polyethylene glycol diacetate

VARIABLES:

- \(P/\text{kPa}\) to about 4050
- \(T/K = 293.2-323.2\)

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>Solvent</th>
<th>Mean relative molecular mass(^\dagger)</th>
<th>(T/K)</th>
<th>Bunsen coeff. (\alpha)</th>
<th>Mole fraction solubility (P_{CO_2} = 101.3\ \text{kPa}^*)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(\alpha)-Hydro-(\omega)-hydroxypoly(oxy-1,2-ethanediyl), (H(OC_2H_4)_n OH; [25322-68-3])</td>
<td>280</td>
<td>293.15</td>
<td>1.3(^{***})</td>
<td>0.014</td>
</tr>
<tr>
<td>(\alpha)-Hydro-(\omega)-hydroxypoly(oxy-1,2-ethanediyl), (H(OC_2H_4)_n OH; [25322-68-3])</td>
<td>400</td>
<td>293.15</td>
<td>1.5</td>
<td>0.023</td>
</tr>
<tr>
<td>3,6,9,12-Tetraoxatetradecane, ((\text{triethylene glycol diethyl ether}); C_6H_{14}O_6; [4499-99-4])</td>
<td>206</td>
<td>293.15</td>
<td>2.7</td>
<td>0.026</td>
</tr>
<tr>
<td>(\alpha)-Ethyl-(\omega)-ethoxypoly(oxy-1,2-ethanediyl), ((\text{polyethylene glycol diethyl ether}); C_3H_7(C_2H_4O)_n C_2H_5; [53609-62-4])</td>
<td>336</td>
<td>293.15</td>
<td>2.9</td>
<td>0.041</td>
</tr>
<tr>
<td>(\alpha)-Ethyl-(\omega)-ethoxypoly(oxy-1,2-ethanediyl), ((\text{polyethylene glycol diethyl ether}); C_3H_7(C_2H_4O)_n C_2H_5; [53609-62-4])</td>
<td>456</td>
<td>293.15</td>
<td>2.6</td>
<td>0.049</td>
</tr>
<tr>
<td>(\alpha)-Ethyl-(\omega)-ethoxypoly(oxy-1,2-ethanediyl), ((\text{polyethylene glycol diethyl ether}); C_3H_7(C_2H_4O)_n C_2H_5; [53609-62-4])</td>
<td>456</td>
<td>308.15</td>
<td>2.2(^{***})</td>
<td>0.042</td>
</tr>
<tr>
<td>(\alpha)-Propyl-(\omega)-propoxypoly(oxy-1,2-ethanediyl), ((\text{polyethylene glycol dipropyl ether}); C_3H_7(C_2H_4O)_n C_2H_5; [60314-50-3])</td>
<td>478</td>
<td>293.15</td>
<td>2.8</td>
<td>0.055</td>
</tr>
<tr>
<td>(\alpha)-Methyl-(\omega)-propoxypoly(oxy-1,2-ethanediyl), ((\text{polyethylene glycol methyl-propyl ether}); CH_3(C_2H_4O)_n C_2H_7;</td>
<td>514</td>
<td>293.15</td>
<td>2.8</td>
<td>0.058</td>
</tr>
<tr>
<td>(\alpha)-Acetyl-(\omega)-(acetyloxy)poly(oxy-1,2-ethanediyl), ((\text{polyethylene glycol diacetate}); CH_3CO(C_2H_4O)_n C_2H_5; [27252-83-1])</td>
<td>476</td>
<td>293.15</td>
<td>1.8</td>
<td>0.031</td>
</tr>
</tbody>
</table>

\(^\dagger\) It is not stated whether this represents a number average or a weight average.

\(^*\) calculated by the compiler.

\(^{**}\) The authors published a graph showing the variation of volume of carbon dioxide absorbed (corrected to 1.014 bar and 273.15 K) per unit volume of solvent with the variation of partial pressure of carbon dioxide.

\(^{***}\) estimated from graphical data
COMPONENTS:

1. Carbon dioxide; CO₂; [124-38-9]
2. Polyethylene glycol
   Polyethylene glycol ethers
   Polyethylene glycol diacetate

ORIGINAl MEASUREMENTS:
Makarov, K.I.; Malyutin, S.P.; Sushkova, T.V.
na Mestorozhd. so Složnym Sostavom Gazu 1980, 106-115

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
Measurements were made over a range of pressures to a maximum of about
4050 kPa. Apparatus for use to about 98 kPa consisted of an absorption
vessel fitted with a magnetic stirrer and connected to a surge tank and
ercury pressure gage. The absorption vessel was held in a
thermostat bath. The vessel was filled with gas under test and
the solvent added with a syringe via a diaphragm. The quantity of gas
absorbed was calculated from the difference between the final pressure,
when the system had reached equilibrium, and the initial pressure. A steel
bomb fitted with sampling devices was used for measurements at higher
pressures. The bomb containing gas and solvent was rotated in a water bath
for 4-5 h before samples of solution were withdrawn. Solubilities were
published as Bunsen coefficients. A graph showing the variation of gas
solubility with pressure in four of the solvents was also published.

SOURCE AND PURITY OF MATERIALS:
Solvents were from various industrial sources.
Densities and refractive indices at 293.15 K were as follows:

<table>
<thead>
<tr>
<th>Solvent</th>
<th>Density /g cm⁻³</th>
<th>Refractive index</th>
</tr>
</thead>
<tbody>
<tr>
<td>polyethylene glycol (RMM 280)</td>
<td>1.12</td>
<td>1.4625</td>
</tr>
<tr>
<td>polyethylene glycol (RMM 400)</td>
<td>1.125</td>
<td>1.4625</td>
</tr>
<tr>
<td>triethylene glycol diethyl ether</td>
<td>0.9567</td>
<td>1.4266</td>
</tr>
<tr>
<td>polyethylene glycol diethyl ether (RMM 336)</td>
<td>1.019</td>
<td></td>
</tr>
<tr>
<td>polyethylene glycol diethyl ether (RMM 456)</td>
<td>1.04</td>
<td></td>
</tr>
<tr>
<td>polyethylene glycol dipropyl ether</td>
<td>1.03</td>
<td>1.4505</td>
</tr>
<tr>
<td>polyethylene glycol methylpropyl ether</td>
<td>1.05</td>
<td>1.4539</td>
</tr>
<tr>
<td>polyethylene glycol diacetate</td>
<td>1.20</td>
<td>1.4560</td>
</tr>
</tbody>
</table>

RMM - relative molecular mass

ESTIMATED ERROR:

δxₐ₃₀₂ = ±5% (compiler)

REFERENCES:
### COMPONENTS:

1. Carbon dioxide; \( \text{CO}_2; [124-38-9] \)
2. 2-Methoxyethanol (ethylene glycol monomethyl ether); \( \text{C}_3\text{H}_6\text{O}_2 \) [109-86-4]

### ORIGINAL MEASUREMENTS:

Bodor, E.; Bor, Gy.; Maleczkine, M.; Masko, G.; Mohai, B.; Siposs, G.


1957, 1, 99-108.

### VARIABLES:

\[
\begin{align*}
T/K &= 198-318.2 \\
p/kPa &= 30.3-102.9
\end{align*}
\]

### EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>( T/K )</th>
<th>( p/\text{mmHg} )</th>
<th>( p/\text{kPa} )</th>
<th>( \text{Absorption}\dagger )</th>
<th>( \text{Mole fraction}^* \text{ of carbon dioxide in liquid, } \alpha_{\text{CO}_2} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>318.2</td>
<td>297</td>
<td>39.6</td>
<td>0.72</td>
<td>0.00244</td>
</tr>
<tr>
<td>318.2</td>
<td>443</td>
<td>59.1</td>
<td>1.06</td>
<td>0.00359</td>
</tr>
<tr>
<td>318.2</td>
<td>532</td>
<td>70.9</td>
<td>1.41</td>
<td>0.00476</td>
</tr>
<tr>
<td>318.2</td>
<td>651 (760)</td>
<td>86.8</td>
<td>1.72</td>
<td>0.00581 (0.0067)</td>
</tr>
<tr>
<td>295.2</td>
<td>563 (101.3)</td>
<td>75.1</td>
<td>2.29</td>
<td>0.00772</td>
</tr>
<tr>
<td>295.2</td>
<td>674 (760)</td>
<td>89.9</td>
<td>2.84</td>
<td>0.00955</td>
</tr>
<tr>
<td>295.2</td>
<td>731 (101.3)</td>
<td>97.5</td>
<td>3.11</td>
<td>0.0104</td>
</tr>
<tr>
<td>273.2</td>
<td>605 (760)</td>
<td>80.7</td>
<td>4.15</td>
<td>0.0139</td>
</tr>
<tr>
<td>273.2</td>
<td>658 (101.3)</td>
<td>87.7</td>
<td>4.55</td>
<td>0.0152</td>
</tr>
<tr>
<td>273.2</td>
<td>703 (760)</td>
<td>93.7</td>
<td>4.95</td>
<td>0.0165</td>
</tr>
<tr>
<td>273.2</td>
<td>772 (101.3)</td>
<td>102.9</td>
<td>5.45</td>
<td>0.0182</td>
</tr>
<tr>
<td>248.2</td>
<td>227 (760)</td>
<td>30.3</td>
<td>3.5</td>
<td>0.0117</td>
</tr>
<tr>
<td>248.2</td>
<td>346 (101.3)</td>
<td>46.1</td>
<td>6.7</td>
<td>0.0222</td>
</tr>
<tr>
<td>248.2</td>
<td>411 (760)</td>
<td>54.8</td>
<td>7.9</td>
<td>0.0261</td>
</tr>
<tr>
<td>248.2</td>
<td>610 (101.3)</td>
<td>81.3</td>
<td>10.7</td>
<td>0.0351</td>
</tr>
<tr>
<td>248.2</td>
<td>744 (760)</td>
<td>99.2</td>
<td>12.8</td>
<td>0.0416</td>
</tr>
</tbody>
</table>
| 223.2      | 266 (101.3)    | 35.5           | 16.3             | 0.0524 (cont.)

### AUXILIARY INFORMATION

**METHOD/APPARATUS/PROCEDURE:**

Volumetric method. Pressure measured when known amounts of gas were added, in increments, to a known amount of liquid in a vessel of known dimensions. Corrections were made for the partial pressure of solvent. Details in ref. (1).

**SOURCE AND PURITY OF MATERIALS:**

**ESTIMATED ERROR:**

\[
\delta T/K = \pm 0.1; \\
\delta (\text{absorption}) = \pm 4\% \text{ or less.}
\]

**REFERENCES:**

1. Bodor, E.; Bor, G. J.; Mohai, B.; Siposs, G.


1957, 1, 55.
COMPONENTS:

1. Carbon dioxide; $\text{CO}_2$; [124-38-9]
2. 2-Methoxyethanol (ethylene glycol monomethyl ether); $\text{C}_3\text{H}_7\text{O}_2$ [109-86-4]

ORIGINAL MEASUREMENTS:
Bodor, E.; Bor, Gy.; Maleczkine, M.; Masko, G.; Mohai, B.; Siposs, G.

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>$T$/K</th>
<th>$p$/mmHg</th>
<th>$p$/kPa</th>
<th>Absorption$^+$ of gas/cm$^3$g$^{-1}$</th>
<th>Mole fraction of carbon dioxide in liquid, x$\text{CO}_2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>223.2</td>
<td>350</td>
<td>46.7</td>
<td>17.4</td>
<td>0.0558</td>
</tr>
<tr>
<td></td>
<td>441</td>
<td>58.8</td>
<td>21.8</td>
<td>0.0689</td>
</tr>
<tr>
<td></td>
<td>544</td>
<td>72.5</td>
<td>28.6</td>
<td>0.0885</td>
</tr>
<tr>
<td></td>
<td>637</td>
<td>84.9</td>
<td>31.6</td>
<td>0.0969</td>
</tr>
<tr>
<td></td>
<td>744</td>
<td>99.2</td>
<td>37.0</td>
<td>0.1116</td>
</tr>
<tr>
<td>198 ± 2</td>
<td>(760)</td>
<td>(101.3)</td>
<td>(38)</td>
<td>(0.114)</td>
</tr>
<tr>
<td>244</td>
<td>32.5</td>
<td>47.6</td>
<td>0.1391</td>
<td></td>
</tr>
<tr>
<td>326</td>
<td>43.5</td>
<td>60.5</td>
<td>0.1704</td>
<td></td>
</tr>
<tr>
<td>410</td>
<td>54.7</td>
<td>74.5</td>
<td>0.2019</td>
<td></td>
</tr>
<tr>
<td>552</td>
<td>73.6</td>
<td>104.0</td>
<td>0.2610</td>
<td></td>
</tr>
<tr>
<td>744</td>
<td>99.2</td>
<td>139.7</td>
<td>0.3217</td>
<td></td>
</tr>
<tr>
<td>(760)</td>
<td>(101.3)</td>
<td>(145)</td>
<td>(0.330)</td>
<td></td>
</tr>
</tbody>
</table>

$^+$ the volume of gas absorbed by one gram of solvent was corrected to 273.15 K and 101.3 kPa.

* calculated by compiler.

Values in parentheses are extrapolated to 1 atmosphere.
COMPONENTS:

1. Carbon dioxide; CO₂; [124-38-9]

2. 2,5,8,11,14-Pentaoxapentadecane; (tetraethylene glycol dimethyl ether); C₁₀H₂₂O₅; [143-24-8]

VARIABLES:

\[ P/\text{kPa} = 101.3 \quad T/\text{K} = 298.15 \]

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>( T/\text{K} )</th>
<th>( P/\text{kPa} )</th>
<th>vol.gas/vol.solvent ( \ast )</th>
<th>( x_{\text{CO}_2} ) ( \dagger )</th>
</tr>
</thead>
<tbody>
<tr>
<td>298.15</td>
<td>101.3</td>
<td>3.40</td>
<td>0.0323</td>
</tr>
</tbody>
</table>

\( \ast \) the compiler has assumed the volume of gas was corrected to 273.15 K and 101.3 kPa.

\( \dagger \) calculated by the compiler. The density of the solvent was taken to be the same as that of tetramethylene glycol, 1.0171 g cm\(^{-3}\) at 293.2 K.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The method was described in a previous publication (1).

SOURCE AND PURITY OF MATERIALS:

No information

ESTIMATED ERROR:

REFERENCES:

COMPONENTS:
1. Carbon dioxide; CO₂; [124-38-9]
2. Polyglycol ethers

ORIGINAL MEASUREMENTS:
Sciamanna, S.F.; Lynn, S.

VARIABLES:
P/kPa = 3-100
T/K = 288.2-373.2

PREPARED BY:
P.G.T. Fogg

EXPERIMENTAL VALUES:
Solvent  T/K  H/kPa†  ΔH soln /kJ mol⁻¹

<table>
<thead>
<tr>
<th>Solvent</th>
<th>T/K</th>
<th>H/kPa†</th>
<th>ΔH soln /kJ mol⁻¹</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,1'-Oxybis(2-methoxyethane), (diethylene glycol dimethyl ether; diglyme); C₆H₁₄O₃; [111-96-6]</td>
<td>298.15</td>
<td>3667.0</td>
<td>-11.46 ± 1.7%</td>
</tr>
<tr>
<td>2,5,8,11-Tetraoxadodecane, (triethylene glycol dimethyl ether; triglyme); C₉H₂₄O₇; [112-49-2]</td>
<td></td>
<td>3400.0</td>
<td>-11.40 ± 0.2%</td>
</tr>
<tr>
<td>2,5,8,11,14-Pentaoxapentadecane, (tetraethylene glycol dimethyl ether; tetraglyme); C₁₀H₂₄O₇; [143-24-8]</td>
<td></td>
<td>3002.0</td>
<td>-11.39 ± 4.0%</td>
</tr>
<tr>
<td>2-(2-Methoxyethoxy)ethanol (diethylene glycol monomethyl ether, methyl carbitol); C₅H₁₂O₃; [111-77-3]</td>
<td></td>
<td>6476.0</td>
<td>-10.40 ± 2.5%</td>
</tr>
<tr>
<td>3,6,9-Trioxatridecan-1-ol, (triethylene glycol butyl ether); C₁₂H₂₂O₅; [143-22-6]</td>
<td></td>
<td>3708.0</td>
<td>-10.33 ± 0.6%</td>
</tr>
</tbody>
</table>

† Limiting values of Henry's constants, H, were found by use of a modified form of the Krichevsky-II'inskaya equation i.e.

\[
\ln(f_2/x_2) = \ln H + (A/RT)(x_2^/-1)
\]

where \( f_2 \) is the fugacity of carbon dioxide
\( x_2 \) is the mole fraction of carbon dioxide in the solution
\( x_1 \) is the mole fraction of the solvent
\( A \) is a constant

A plot of \( \ln(f_2/x_2) \) against \( x_2^/-1 \) has an intercept equal to \( \ln H \).

Values of the heat of solution, ΔH, fitted the equation

\[
H = H^\circ \exp[(\Delta H_{\text{soln}}/R)(1/T - 1/T^\circ)]
\]

where \( T^\circ = 298.15 \) K and \( H^\circ \) is the value of Henry's constant at 298.15 K.

AUXILIARY INFORMATION:

METHOD/APPARATUS/PROCEDURE:
Dried solvent was added to a flask of known weight. The solvent was then heated, degassed, and the flask reweighed. Subsequent steps were automated and data stored in a computer. The solvent vapor pressure was recorded after each increment of temperature of 5 K from 288.2 to 373.2 K. The flask was then cooled, a predetermined mass of gas added and total pressures recorded at intervals of 5 K. The process was repeated with further additions of gas.

SOURCE AND PURITY OF MATERIALS:
Analysis of solvents after being degassed indicated a water content of about 0.1 wt%.
2-(2-Methoxyethoxy)ethanol was referred to by the trade name Dowanol DM;
3,6,9-Trioxatridecan-1-ol, by the trade name Dowanol TBH

ESTIMATED ERROR:
As indicated above

REFERENCES:
1. Prausnitz, J.M.; Lichtenthaler, R.N.; de Azevedo, E.G.
<table>
<thead>
<tr>
<th>COMPONENTS:</th>
<th>ORIGINAL MEASUREMENTS:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Vodrazka, W.; Volkamer, K.</td>
</tr>
<tr>
<td>2. Sepasolv MPE†</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>VARIABLES:</th>
<th>PREPARED BY:</th>
</tr>
</thead>
<tbody>
<tr>
<td>$T/K = 268-393$</td>
<td>P.G.T. Fogg</td>
</tr>
</tbody>
</table>

**EXPERIMENTAL VALUES:**

The authors stated that BASF had developed *Sepasolv MPE*, a special mixture of oligoethylene glycol methyl isopropyl ethers with a mean relative molecular mass of 316. Solubilities of several gases were presented on a small scale graph with solubility, $a$, in units of m$^3$/m$^3$ bar, plotted against temperature. No experimental points were shown. The solubility of CO$_2$ was plotted over the temperature range -5°C to 120°C. The compiler found that the line plotted for this gas fits the equation:

$$ \log_{10}(a \text{ bar}) = -2.207 + \frac{823.5}{T} $$

The compiler considers that $a$/pressure is the volume of gas absorbed, reduced to 273.15 K and 1 bar (or alternatively 1 atm), absorbed by one volume of solvent at the temperature of measurement.

The pressure and temperature at which measurements were made was not stated although the graphical information was intended to show behaviour of the solvent from low pressures to pressures greater than 1 bar. Use of the data implies an assumption that the reduced volume of gas absorbed is proportional to partial pressure of gas. The higher the pressure the greater the errors introduced by this assumption.

†*Sepasolv MPE* is a registered trademark of BASF.

---

**AUXILIARY INFORMATION**

**METHOD/APPARATUS/PROCEDURE:**

No information.

**SOURCE AND PURITY OF MATERIALS:**

No information.

**ESTIMATED ERROR:**

$\delta a/a = \pm 10\%$

(estimated by the compiler)

**REFERENCES:**

No information.
### COMPONENTS:
1. Carbon dioxide; CO$_2$; [124-38-9]
2. Phenol; C$_6$H$_6$O; [108-95-2]

### VARIABLES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>Henry's constant $H_{CO_2}$/atm</th>
<th>Mole fraction at 101.3 kPa $x_{CO_2}$ (1 atm)$^*$</th>
</tr>
</thead>
<tbody>
<tr>
<td>323.2</td>
<td>214</td>
<td>0.00467</td>
</tr>
</tbody>
</table>

* Calculated by compiler assuming a linear function of $P_{CO_2}$ vs $x_{CO_2}$, i.e., $x_{CO_2}(1\text{ atm}) = 1/H_{CO_2}$.

### ORIGINAL MEASUREMENTS:
Lenoir, J-Y.; Renault, P.; Renon, H.

### EXPERIMENTAL VALUES:

**PREPARED BY:** C. L. Young

**METHOD/APPARATUS/PROCEDURE:**
A conventional gas-liquid chromatographic unit fitted with a thermal conductivity detector was used. The carrier gas was helium. The value of Henry's law constant was calculated from the retention time. The value applies to very low partial pressures of gas and there may be a substantial difference from that measured at 1 atm. pressure. There is also considerable uncertainty in the value of Henry's constant since surface adsorption was not allowed for although its possible existence was noted.

### SOURCE AND PURITY OF MATERIALS:
1. L'Air Liquide sample, minimum purity 99.9 mole per cent.
2. Touzart and Matignon or Serlabo sample, purity 99 mole per cent.

### ESTIMATED ERROR:

δT/K = ±0.1; δH/atm = ±6%
(estimated by compiler).
COMPONENTS:
1. Carbon dioxide; CO₂; [124-38-9]
2. 3-Methylphenol (m-cresol); C₇H₈O; [108-39-4]

VARIABLES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>Henry's constant /atm</th>
<th>Mole fraction of carbon dioxide in liquid, x_{CO₂}</th>
</tr>
</thead>
<tbody>
<tr>
<td>300.5</td>
<td>168</td>
<td>0.00592</td>
</tr>
</tbody>
</table>

† at a partial pressure of carbon dioxide of 101.3 kPa (1 atm) calculated by compiler assuming ϕ = 0.995.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
Gas chromatographic analysis of a saturated solution at barometric pressure. Henry's constants determined from formula

\[
H = (p - p_Ө)ϕ(m + 1)/m
\]

where \( p \) is the total pressure, \( p_Ө \) the vapor pressure of the solvent and \( ϕ \) is the fugacity coefficient of the gas. The mole ratio, \( m \), is defined by

\[
m = \frac{\text{Moles of carbon dioxide in gas phase}}{\text{Moles of carbon dioxide in liquid phase}}
\]

SOURCE AND PURITY OF MATERIALS:
1. No details given.
2. Purity 99.45 mole per cent.

ESTIMATED ERROR:
\( δT/K = ±0.25 \); \( δH/\text{atm} = ±3\% \) (estimated by compiler).

REFERENCES:
COMPONENTS:
(1) Carbon dioxide; CO₂; [124-38-9]
(2) 2-Methoxy-4-(2-propenyl)-phenol or eugenol; C₁₀H₁₂O₂; [97-53-0]

VARIABLES:
\(T/K = 288.15 - 298.15\)
\(p_f/kPa = 101.325\) (1 atm)

EXPERIMENTAL VALUES:
<table>
<thead>
<tr>
<th>T/K</th>
<th>Mol Fraction</th>
<th>Bunsen Coefficient (a/cm^3(\text{STP})cm^{-3}\text{atm}^{-1})</th>
<th>Ostwald Coefficient (L/cm^3\text{cm}^{-3})</th>
</tr>
</thead>
<tbody>
<tr>
<td>288.15</td>
<td>11.29</td>
<td>1.67</td>
<td>1.762</td>
</tr>
<tr>
<td>293.15</td>
<td>10.45</td>
<td>1.54</td>
<td>1.653</td>
</tr>
<tr>
<td>298.15</td>
<td>9.60</td>
<td>1.41</td>
<td>1.539</td>
</tr>
</tbody>
</table>

The author measured the Ostwald coefficient at a pressure of about 746 mmHg. The compiler assumed the Ostwald coefficient to be independent of pressure, and calculated the mole fraction and Bunsen coefficient values at 101.325 kPa (1 atm) partial pressure of the gas.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
An Ostwald apparatus as modified by Timofejew (1), and Steiner (2) is used. The apparatus consists of a gas buret, an absorption flask, and a mercury manometer. The system is thermostated with a water jacket.

The gas is introduced into the degassed liquid. The gas volume absorbed is determined by the gas buret. The solvent volume is determined at the end of the experiment by pouring the solvent into a graduated flask.

SOURCE AND PURITY OF MATERIALS:
(1) Carbon dioxide. Generated in a Kipp apparatus using marble and hydrochloric acid.
(2) 2-Methyl-4-(2-propenyl)-phenol. No information.

ESTIMATED ERROR:
\(\delta L/L = 0.03\) (compiler)

REFERENCES:
1. Timofejew, W. Z. Phys. Chem. 1890, 6, 141.
**COMPONENTS:**

1. Carbon dioxide; CO₂; [124-38-9]
2. Dihydro-2(3H)-furenone (γ-butyrolactone); C₄H₆O₂; [96-48-0]

**ORIGINAL MEASUREMENTS:**

Kassim, D.M.; Zainel, H.A.; Al-Asof, S.A.; Talib, E.K.

**VARIABLES:**

\[ T/K = 303.15-333.15 \]
\[ P/kPa = 101.3 \]

**EXPERIMENTAL VALUES:**

<table>
<thead>
<tr>
<th>( T/K )</th>
<th>Mole fraction of carbon dioxide in liquid, ( x_{CO₂} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>303.15</td>
<td>0.0160</td>
</tr>
<tr>
<td>313.15</td>
<td>0.0145</td>
</tr>
<tr>
<td>323.15</td>
<td>0.0130</td>
</tr>
<tr>
<td>333.15</td>
<td>0.0115</td>
</tr>
</tbody>
</table>

**METHOD/APPARATUS/PROCEDURE:**

Falling film flow apparatus similar to that of Morrison and Billet (1). Apparatus consisted of (i) degassing section in which solvent could be degassed by freezing and thawing under vacuum and (ii) absorption section. The latter consisted of a gas buret and absorption spiral. Mole fraction solubility corrected at 1 atm partial pressure by assuming Henry's law was valid.

**SOURCE AND PURITY OF MATERIALS:**

1. Purity 99.99 mole per cent.
2. Fluka AG puriss grade sample, purity better than 99 mole per cent.

**ESTIMATED ERROR:**

\[ \delta T/K = \pm 0.1; \ \delta x/x = \pm 0.02 \]
(estimated by compiler).

**REFERENCES:**

The Solubility of carbon dioxide in solvents containing halogens

The solubility in tetrachloromethane measured by Gjaldbaek (1) at 298.2 K and about 101.3 kPa is close to a value measured by Horiuti (2) and is consistent with a value measured by Luhring and Schumpe (3) at 293.2 K. Just (4) made measurements from 288.2 K to 298.2 K. The values of the solubility are low compared with values from later work. The mole fraction solubility at 101.3 kPa and 298.2 K from Just’s data is 0.00902 compared with 0.01048 (Horiuti) and 0.01070 (Gjaldbaek). A value of 0.00877 obtained by an indirect method by Takahashi et al. (5) can be disregarded. A value of 0.0106, the mean of Gjaldbaek and Horiuti’s values, is provisionally recommended for mole fraction solubility at 298.2 K.

Kunerth (6) measured the solubility in trichloromethane at about 101.3 kPa from 291.2 K to 309.2 K. A plot of mole fraction solubility against temperature from these data is concave towards the solubility axis. This is not in agreement with the behaviour of other systems under similar conditions and may indicate incorrect allowance for the vapor pressure of solvent at the higher temperatures of measurement. Just (4) reported a solubility value at 298.2 K which is close to Kunerth’s value at this temperature. Gjaldbaek (1) reported a solubility at 298.2 K which is high in comparison but is compatible with measurements by Woukoloff (7) at 286 K and of Koudelka (8) at 293.2 K. Values of mole fraction solubility at 298.2 K and 101.3 kPa are 0.0128 (Gjaldbaek); 0.01120 (Just); 0.0113 (Kunerth). Values at 293.2 K are 0.01375 (Koudelka); 0.0121 (Just); 0.01230 (Kunerth). The evaluator considers that the higher and more recent measurements by Gjaldbaek and by Koudelka are more reliable than the earlier measurements by Just and Kunerth. These data can only be accepted on a provisional basis until the system is re-investigated.

Eldridge and co-workers (9,10) measured solubility in dichloromethane over pressure ranges from 310.9 K to 327.6 K. Dantzler et al. (11) measured solubilities in dichlorodifluoromethane and in trichlorofluoromethane over pressure ranges at 273.2 K to 310.9 K. These three sets of data seem to be reliable but measurements by other groups are not available for comparison.

The data which are available for 298.2 K and a partial pressure of carbon dioxide of 0.1 kPa show that the mole fraction solubility of gas increases when the hydrogens in dichloromethane or trichloromethane are replaced by fluorine atoms but decreases when they are replaced by chlorine atoms (see Table 1).

Solubility in 1,2-dibromoethane was measured at about 101.3 kPa by Gjaldbaek and Andersen (12), Begley et al. (13), Just (4) and Kunerth (6). There is very good agreement between the sets of data. The greatest discrepancy between values of mole fraction solubility is less than 4% i.e. 0.00642 at 309.2 K (Kunerth); 0.00618 at 308.8 K (Begley). The following equation based on data from the four papers is recommended.

\[
\ln x_{\text{CO}_2} = 324.89 - 13552.2/(T/\text{K}) - 49.902 \ln(T/\text{K})
\]

temperature range = 288.2-319.5 K
standard deviation in \(x_{\text{CO}_2} = 9.3 \times 10^{-5}\)

Just (4) measured solubility in 1,2-dichloroethane at about 101.3 kPa from 288.2 K to 298.2 K. Luhring and Schumpe (3) measured solubility at 293.2 K and confirmed Just’s value at this temperature. Values of mole
fraction solubility at 101.3 kPa fit the following equation.

\[
\ln x_{\text{CO}_2} = -9.120 + \frac{1384.9}{(T/K)}
\]

temperature range = 288.2-298.2 K
standard deviation in \( x_{\text{CO}_2} = 3.6 \times 10^{-5} \)

Just (4) also measured solubilities in 1-bromopentane, 1-chloropentane, 1-chloro-2-methylpropane and 1,2-dibromopropane under the same conditions of temperature and pressure as in 1,2-dichloroethane. Hiraoka and Hildebrand (14) measured solubility in trichlorotrifluoroethane at 101.3 kPa from 276.1 K to 308.5 K. Dantzler et al. (11) measured solubility in 1,2-dichloro-1,1,2,2-tetrafluoroethane over pressure ranges from 273.2 K to 310.9 K. Begley et al. (13) measured solubility in a mixture of 1-bromo-2-chloropropane and 2-bromo-1-chloropropane. There is no reason to doubt the reliability of any of these measurements but no other data for these systems are available for comparison.

Kobatake and Hildebrand (15) measured the solubility in hexadecafluoroheptane at 101.3 kPa and from 292.2 K to 303.2 K. The measurements are consistent with an earlier measurement of the solubility at 298.25 by Gjaldbaek (1) and may therefore be accepted as reliable. Solubility data for a partial pressure of gas of 101.3 kPa from the two papers fit the following equation

\[
\ln x_{\text{CO}_2} = -7.413 + \frac{1056.2}{(T/K)}
\]

temperature range = 292.2-303.2 K
standard deviation in \( x_{\text{CO}_2} = 8.5 \times 10^{-5} \)

Mole fraction solubilities at a partial pressure of 101.3 kPa for various halogenated alkanes are given in Table 1, and are shown in Fig 1. The available data show that the relative effects of halogen in enhancing the solubility of carbon dioxide are fluorine > chlorine > bromine.

Solubility in L-1822 has been measured by Sargent and Seffl (16) at 101.3 kPa; 298.2 K and 310.2 K and reported as Ostwald coefficients and also as weight fractions. This solvent is reported to be mostly a mixture of 10-carbon linear, branched and cyclic fluorocarbons. The relative molecular mass of a C-10 linear or branched perfluorinated alkane is 538. If this is taken to be the approximate average relative molecular mass of L-1822 then the solubility data correspond to a mole fraction solubility of about 0.0186. The mole fraction solubility in hexadecafluoroheptane at this temperature and pressure is 0.0209. The data reported by Sargent and Seffl are therefore consistent with the nature of the solvent under test.

The solubility in three fluorinated ethers has been studied. FC-80 is mostly a mixture of isomers of heptafluorotetrahydro(nonafluorobutyl) -furan (C\(_7\)F\(_{16}\)). Solubility in this solvent at 101.3 kPa has been measured by Tham et al. (17) from 298.2 K to 323.2 K. These data are supported by the measurements of Navari et al. (18) from 1.3 kPa to 101.3 kPa at 310.2 K. Solubility values at 298.2 K and 310.2 K; 101.3 kPa from Sargent and Seffl (16) are very low in comparison with Tham's values.

| VALUES OF \( x_{\text{CO}_2} \) FOR FC-80 AT 101.3 kPa. |
|-----------------|-----------------|
| Tham et al.    | 0.0223           |
| Navari et al.  | 0.0186           |
| Sargent and Seffl | 0.0181           |

No other data for these systems are available for comparison.
CRITICAL EVALUATION:

Solubility in 1,1,1,2,2,3,3,4,4,5,5,6,6-tridecafluoro-6-
[1,2,2,2-tetrafluoro-1-(trifluoromethyl)ethoxy]-hexane (C₉F₃₈O) was
measured by Tham et al. (17) at 298.2 K to 323.2 K; 101.3 kPa. Values are
higher than those given by Nychka and Eiback (19). Tham's data are
probably the more reliable but confirmation is needed.

<table>
<thead>
<tr>
<th>Temperature</th>
<th>Tham et al.</th>
<th>Nychka and Eiback</th>
</tr>
</thead>
<tbody>
<tr>
<td>298.2 K</td>
<td>0.0250</td>
<td>0.0232</td>
</tr>
<tr>
<td>310.2 K</td>
<td>0.0232</td>
<td>0.0198</td>
</tr>
</tbody>
</table>

Tham et al. (17) also measured solubility in 1,1,2,2,3,3,4,4-octafluoro-
1,4-bis[1,2,2,2-tetrafluoro-1-(trifluoromethyl)ethoxy]-butane (C₈F₂₂O₂) at
298.2 K to 323.2 K; 101.3 kPa. There is no reason to doubt the
reliability of this work but no other data on the system are available for
comparison.

López et al. (20) measured solubilities in chlorocyclohexane and
bromocyclohexane at 263.2 K to 303.2 K; 101.3 kPa. The work is
self-consistent but no other data on these systems are available for
comparison. Mole fraction solubilities increase in the order
chlorocyclohexane > bromocyclohexane > cyclohexane under these conditions.

Just (4) measured the solubility in 1,3-dichloro-2-propanol from 288.2 K
to 298.2 K at 99.5 kPa. The corresponding values of the mole fraction
solubility at 101.3 kPa are greater than values for 2-propanol (see
Table 1). No other work on the system is available for comparison.

López et al. (23) measured solubility in chlorobenzene from 263.2 K to
303.2 K at 101.3 kPa. The measurements are consistent with those of
Gjallbaek and Anderson (12) at 298.2 and about 5% higher than those of
Just (4) in the temperature range of 288.2 K to 298.2 K. The following
equation for the mole fraction solubility at a partial pressure of
101.3 kPa, based upon the first two sets of data, is recommended.

\[ \ln x_{\text{CO}_2} = 4.2360 + 756.71/(T/K) - 2.0001 \ln(T/K) \]

temperature range = 263.2-303.2 K
standard deviation in \( x_{\text{CO}_2} = 3 \times 10^{-5} \)

López et al. (23) also measured solubility in bromobenzene under the same
conditions of temperature and pressure. These measurements are consistent
with those of Just (4) in the range 288.2 K to 298.2 K. The following
equation for mole fraction solubility at a partial pressure of 101.3 kPa,
based upon the two sets of data, is recommended.

\[ \ln x_{\text{CO}_2} = -5.2127 + 1189.1/(T/K) - 0.63508 \ln(T/K) \]

temperature range = 263.2-303.2 K
standard deviation in \( x_{\text{CO}_2} = 4 \times 10^{-5} \)

Just also measured solubility in iodobenzene from 288.2 K to 298.2 K at
101.3 kPa. No other measurements on this system are available for
comparison. Mole fraction solubilities at 298.2 K and a partial pressure
of 101.3 kPa are in the order chlorobenzene > bromobenzene > iodobenzene.
Solubility in chlorobenzene is close to that in benzene.

Evans and Battino (21) published the solubility in hexafluorobenzene at
297.7 K and 298.0 K; 101.3 kPa. Mole fraction solubility in this solvent
is higher than in chlorobenzene. There is no reason to doubt the
reliability of this work which can be accepted on a provisional basis.
### COMPONENTS:

1. Carbon dioxide; $\text{CO}_2$; [124-38-9]
2. Compounds Containing Halogens

### CRITICAL EVALUATION:

Just (4) measured solubilities in (chloromethyl)-benzene and in (trichloromethyl)-benzene. No other data on these systems are available. The data indicate that substitution of chlorine into the methyl group of methylbenzene lowers the mole fraction solubility at 298.2 K; 101.3 kPa (see Table 1).

### REFERENCES

**Components:**

1. Carbon dioxide; CO₂; [124-38-9]
2. Compounds containing halogens

**Evaluator:**

Peter G.T. Fogg,
School of Applied Chemistry,
Polytechnic of North London,
Holloway Road, London, N7 8DB, U.K.
July 1991

**Critical Evaluation:**

Table 1.
Mole fraction solubilities of carbon dioxide at a partial pressure of 101.3 kPa in solvents containing halogens.

<table>
<thead>
<tr>
<th>Solvent</th>
<th>T/K</th>
<th>(x_{\text{CO}_2})</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trichloromethane</td>
<td>298.15</td>
<td>0.0128</td>
<td>1</td>
</tr>
<tr>
<td>Tetrachloromethane</td>
<td>298.15</td>
<td>0.0107</td>
<td>1</td>
</tr>
<tr>
<td>Dichloromethane</td>
<td>298.15</td>
<td>0.0105</td>
<td>4</td>
</tr>
<tr>
<td>Dichlorodifluoromethane</td>
<td>297.04</td>
<td>0.019</td>
<td>11</td>
</tr>
<tr>
<td>Trichlorofluoromethane</td>
<td>297.04</td>
<td>0.016</td>
<td>11</td>
</tr>
<tr>
<td>1,2-Dichloro-1,2,2-tetrafluoroethane</td>
<td>297.04</td>
<td>0.021</td>
<td>11</td>
</tr>
<tr>
<td>1,2-Dibromoethane</td>
<td>298.15</td>
<td>0.007553 ± 0.000093</td>
<td>*</td>
</tr>
<tr>
<td>1,2-Dichloroethane</td>
<td>298.15</td>
<td>0.01139 ± 0.00004</td>
<td>*</td>
</tr>
<tr>
<td>1-Chloro-2-methylpropane</td>
<td>298.15</td>
<td>0.0133</td>
<td>4</td>
</tr>
<tr>
<td>1-Chloropentane</td>
<td>298.15</td>
<td>0.0142</td>
<td>4</td>
</tr>
<tr>
<td>1-Bromopentane</td>
<td>298.15</td>
<td>0.0123</td>
<td>4</td>
</tr>
<tr>
<td>1,2-Dibromopropane</td>
<td>298.15</td>
<td>0.00976</td>
<td>4</td>
</tr>
<tr>
<td>Hexadecafluoroheptane</td>
<td>298.15</td>
<td>0.02085 ± 0.00009</td>
<td>*</td>
</tr>
<tr>
<td>1,1,2-Trichloro-1,2,2-trifluoroethane</td>
<td>298.07</td>
<td>0.01823</td>
<td>14</td>
</tr>
<tr>
<td>Heptafluorotetrahydro(nonafuorobutyl)-furan or FC80</td>
<td>298.15</td>
<td>0.0223</td>
<td>17</td>
</tr>
<tr>
<td></td>
<td>310.15</td>
<td>0.0186</td>
<td>17</td>
</tr>
<tr>
<td></td>
<td>310.15</td>
<td>0.0186</td>
<td>18</td>
</tr>
<tr>
<td>1,1,2,3,3,4,4-Octafluoro-1,4-bis(tetrafluoro-1-(trifluoromethyl)ethoxy)-butane or Caroxin-D</td>
<td>298.15</td>
<td>0.0248</td>
<td>17</td>
</tr>
<tr>
<td></td>
<td>310.15</td>
<td>0.0227</td>
<td>17</td>
</tr>
<tr>
<td>1,1,2,3,3,4,4,5,5,6,6-Tridecafluoro-6-(1,2,2,2-tetrafluoro-1-(trifluoromethyl)ethoxy)-hexane or Caroxin-F</td>
<td>298.15</td>
<td>0.0250</td>
<td>17</td>
</tr>
<tr>
<td></td>
<td>310.15</td>
<td>0.0232</td>
<td>17</td>
</tr>
<tr>
<td>Chlorocyclohexane</td>
<td>298.15</td>
<td>0.0108</td>
<td>20</td>
</tr>
<tr>
<td>Bromocyclohexane</td>
<td>298.15</td>
<td>0.0092</td>
<td>20</td>
</tr>
<tr>
<td>Chlorobenzene</td>
<td>298.15</td>
<td>0.00984 ± 0.00003</td>
<td>*</td>
</tr>
<tr>
<td>Bromobenzene</td>
<td>298.15</td>
<td>0.00788 ± 0.00004</td>
<td>*</td>
</tr>
<tr>
<td>Iodobenzene</td>
<td>298.15</td>
<td>0.00592</td>
<td>4</td>
</tr>
<tr>
<td>Hexafluorobenzene</td>
<td>297.98</td>
<td>0.0232</td>
<td>21</td>
</tr>
<tr>
<td>(Chloromethyl)-benzene</td>
<td>298.15</td>
<td>0.00907</td>
<td>4</td>
</tr>
<tr>
<td>(Trichloromethyl)-benzene</td>
<td>298.15</td>
<td>0.00950</td>
<td>4</td>
</tr>
<tr>
<td>1,3-Dichloro-2-propanol</td>
<td>298.15</td>
<td>0.00705</td>
<td>4</td>
</tr>
<tr>
<td>(2-Propanol)</td>
<td>298.15</td>
<td>0.00654</td>
<td>22</td>
</tr>
</tbody>
</table>

* from the equation given by the evaluator on a previous page

† may be 2,3-dichloro-1-propanol; see page 294

† interpolated
COMPONENTS:

1. Carbon dioxide; CO₂; [124-38-9]
2. Compounds Containing Halogens

CRITICAL EVALUATION:

EVALUATOR:

Peter G.T. Fogg,
School of Applied Chemistry,
Polytechnic of North London,
Holloway Road, London, N7 8DB, U.K.
July 1991

Fig. 1 Mole fraction solubility of carbon dioxide in various solvents containing halogens at a partial pressure of gas of 101.3 kPa.

a - perfluoro-1-isopropoxyhexane, C₅F₁₀O (17)
b - hexafluorobenzene (21)
c - hexadecafluoroheptane (1,15)
d - 1-chloropentane (4)
e - trichloromethane (1,8)
f - 1,2-dichloroethane (3,4)
g - chlorocyclohexane (20)
h - tetrachloromethane (1,2,3)
i - chlorobenzene (12,23)
j - bromobenzene (4,23)
k - 1,2-dibromoethane (4,6,12,13)

A reference line corresponding to values from the Raoult's law equation is also shown.
COMPONENTS:
(1) Carbon dioxide; CO₂; [124-38-9]
(2) Tetrachloromethane or carbon tetrachloride; CCl₄; [56-23-5]

VARIABLES:
\[
\begin{align*}
T/K &= 288.15 - 298.15 \\
P₁/kPa &= 101.325 \text{ (1 atm)}
\end{align*}
\]

PREPARED BY:
M. E. Derrick
H. L. Clever

EXPERIMENTAL VALUES:
\[
\begin{array}{cccc}
T/K & \text{Mol Fraction} & \text{Bunsen Coefficient} & \text{Ostwald Coefficient} \\
   & 10^3x₁ & a/\text{cm}^3\text{(STP)}\text{cm}^{-3}\text{atm}^{-1} & L/\text{cm}^3\text{cm}^{-3} \\
288.15 & 10.45 & 2.47 & 2.603 \\
293.15 & 9.94 & 2.33 & 2.502 \\
298.15 & 9.02 & 2.10 & 2.294 \\
\end{array}
\]

The author measured the Ostwald coefficient at a pressure of about 746 mmHg. The compiler assumed the Ostwald coefficient to be independent of pressure, and calculated the mole fraction and Bunsen coefficient values at 101.325 kPa (1 atm) partial pressure of the gas.

METHOD/APPARATUS/PROCEDURE:
An Ostwald apparatus as modified by Timofejew (1), and Steiner (2) is used. The apparatus consists of a gas buret, an absorption flask, and a mercury manometer. The system is thermostated with a water jacket.

The gas is introduced into the degassed liquid. The gas volume absorbed is determined by the gas buret. The solvent volume is determined at the end of the experiment by pouring the solvent into a graduated flask.

SOURCE AND PURITY OF MATERIALS:
(1) Carbon dioxide. Generated in a Kipp apparatus using marble and hydrochloric acid.
(2) Tetrachloromethane. No information.

ESTIMATED ERROR:
\[ \Delta L/L = 0.03 \text{ (compiler)} \]

REFERENCES:
1. Timofejew, W. Z. Phys. Chem. 1890, 6, 141.
**COMPONENTS:**

(1) Carbon dioxide; CO$_2$; [124-38-9]

(2) Tetrachloromethane or carbon tetrachloride; CC1$_4$; [56-23-5]

**ORIGINAL MEASUREMENTS:**

Horiuti, J.


**VARIABLES:**

| T/K: 298.15 | P$_1$/kPa: 101.325 (1 atm) |

**PREPARED BY:**

M. E. Derrick

H. L. Clever

**EXPERIMENTAL VALUES:**

<table>
<thead>
<tr>
<th>T/K</th>
<th>Mol Fraction</th>
<th>Bunsen Coefficient</th>
<th>Ostwald Coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>298.15</td>
<td>1.048</td>
<td>2.444</td>
<td>2.668</td>
</tr>
</tbody>
</table>

The mole fraction and Bunsen coefficient values were calculated by the compiler with the assumption the gas is ideal and that Henry's law is obeyed.

**METHOD/APPARATUS/PROCEDURE:**

The apparatus consists of a gas buret, a solvent reservoir, and an absorption pipet. The volume of the pipet is determined at various meniscus heights by weighing a quantity of water. The meniscus height is read with a cathetometer.

The dry gas is introduced into the degassed solvent. The gas and solvent are mixed with a magnetic stirrer until saturation. Care is taken to prevent solvent vapor from mixing with the solute gas in the gas buret. The volume of gas is determined from the gas buret readings, the volume of solvent is determined from the meniscus height in the absorption pipet.

**SOURCE AND PURITY OF MATERIALS:**

(1) Carbon dioxide. Prepared by the reaction of Na$_2$CO$_3$ and H$_2$SO$_4$. Contamination by air was less than 0.004 per cent.

(2) Tetrachloromethane. Kahlbaum. Dried over P$_2$O$_5$ and distilled. Boiling point (760 mmHg) 76.74°C.

**ESTIMATED ERROR:**

$\delta T/K = 0.05$

$\delta x_1/x_1 = 0.01$

**REFERENCES:**
COMPONENTS:
(1) Carbon dioxide; CO₂; [124-38-9]
(2) Tetrachloromethane; CCl₄; [56-23-5]

ORIGINAL MEASUREMENTS:
Gjaldbaek, J. C.

VARIABLES:

\[
\begin{align*}
T/K &= 298.15 \\
p_j/kPa &= 101.325 \text{ (1 atm)}
\end{align*}
\]

PREPARED BY:
J. Chr. Gjaldbaek

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>Carbon Dioxide Pressure p_j/mmHg</th>
<th>Mol Fraction (10^2x_j)</th>
<th>Bunsen Coefficient (a/cm^3\text{(STP)}\text{cm}^{-1}\text{atm}^{-1})</th>
<th>Ostwald Coefficient (L/cm^3\text{cm}^{-3})</th>
</tr>
</thead>
<tbody>
<tr>
<td>298.15</td>
<td>613.5</td>
<td>1.07</td>
<td>2.47</td>
<td>2.70</td>
</tr>
<tr>
<td></td>
<td>652.1</td>
<td>1.07</td>
<td>2.46</td>
<td>2.68</td>
</tr>
</tbody>
</table>

\(^1\)Mole fraction solubility values adjusted to a gas partial pressure of 101.325 kPa (1 atm) by the compiler assuming Henry's law is obeyed.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
A calibrated all-glass combined manometer and bulb was enclosed in an air thermostat and shaken until equilibrium. Mercury was used for calibration and as confining liquid. The solvent was degassed in the apparatus.

The absorbed volume of gas is calculated from the initial and final amounts, both saturated with solvent vapor. The amount of solvent is determined by the weight of displaced mercury.

The mole fraction solubility values are at 1 atm assuming Henry's law is obeyed.

Details of the apparatus and procedure are given in ref. 1 and 2.

SOURCE AND PURITY OF MATERIALS:
(1) Carbon dioxide. Prepared from potassium bicarbonate (analytical reagent) and concentrated sulfuric acid. 99.9 per cent CO₂.
(2) Tetrachloromethane. Riedel-E. de Haen. Analytical reagent. B.p. (759 mmHg)/°C = 76.80. \(n_D(25°C) = 1.4573\).

ESTIMATED ERROR:
\[
\begin{align*}
\delta T/K &= \pm 0.05 \\
\delta x_j/x_j &= \pm 0.015
\end{align*}
\]

REFERENCES:
1. Lannung, A.
   J. Am. Chem. Soc. 1930, 52, 68.
2. Gjaldbaek, J. C.
**COMPONENTS:**
1. Carbon dioxide; CO$_2$; [124-38-9]
2. Tetrachloromethane, (carbon tetrachloride); CCl$_4$; [56-23-5]
or 1,2-Dichloroethane; C$_2$H$_4$Cl$_2$; [107-06-2]

**ORIGINAL MEASUREMENTS:**
Luhring, P.; Schumpe, A.

**VARIABLES:**

<table>
<thead>
<tr>
<th>T/K</th>
<th>Henry’s Constant† / (Pa m$^3$/mol$^{-1}$)</th>
<th>Mole fraction of CO$_2$ at 101.3 kPa partial pressure*</th>
</tr>
</thead>
<tbody>
<tr>
<td>293.2</td>
<td>Tetrachloromethane</td>
<td>909</td>
</tr>
<tr>
<td>293.2</td>
<td>1,2-Dichloroethane</td>
<td>650</td>
</tr>
</tbody>
</table>

†referred to as Henry’s constant in source but appears to be usual Henry’s constant multiplied by molar volume.
*calculated by compiler using density data taken from ref. (1).

**AUXILIARY INFORMATION**

**METHOD/APPARATUS/PROCEDURE**
Little information given in source.
Method consisted of equilibrating known amounts of degassed liquid and gas and measuring the change in pressure. Equilibration was reached in 3 to 6 minutes. Some details given in ref. (2).

**SOURCE AND PURITY OF MATERIALS:**
Obtained from Merck at the highest available purity.
No other details given.

**ESTIMATED ERROR:**
$\Delta T/K = \pm 0.1$ (authors)
$\Delta x/\bar{x} = \pm 0.01$ to 0.15 (compiler)

**REFERENCES:**
1. Riddick, J.A.; Bunger, W.B.; 1970
2. Schumpe, A.; Quiker, G.; Decker, W.D.
COMPONENTS:
(1) Carbon dioxide; CO₂; [124-38-9]
(2) Trichloromethane or chloroform; CHCl₃; [67-66-3]

VARIABLES:
\[
T/K = 286 \\
P_1/kPa = 4.88 - 101.59 \\
(36.57 - 762 \text{ mmHg})
\]

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>Temperature</th>
<th>Carbon Dioxide Pressure</th>
<th>Carbon Dioxide Absorption A/cm³ cm⁻³</th>
<th>Bunsen Coefficient a/cm³ (STP) cm⁻³ atm⁻¹</th>
</tr>
</thead>
<tbody>
<tr>
<td>t/°C</td>
<td>T/K</td>
<td>P₁/mmHg</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>286</td>
<td>36.57</td>
<td>0.20376</td>
</tr>
<tr>
<td>73.22</td>
<td>4.0927</td>
<td>4.055</td>
<td></td>
</tr>
<tr>
<td>109.62</td>
<td>0.62016</td>
<td>4.105</td>
<td></td>
</tr>
<tr>
<td>144.93</td>
<td>0.83034</td>
<td>4.156</td>
<td></td>
</tr>
<tr>
<td>182.75</td>
<td>1.0449</td>
<td>4.148</td>
<td></td>
</tr>
<tr>
<td>218.95</td>
<td>1.25608</td>
<td>4.162</td>
<td></td>
</tr>
<tr>
<td>255.48</td>
<td>1.4675</td>
<td>4.168</td>
<td></td>
</tr>
<tr>
<td>293.15</td>
<td>1.6847</td>
<td>4.169</td>
<td></td>
</tr>
<tr>
<td>330.1</td>
<td>1.89917</td>
<td>4.174</td>
<td></td>
</tr>
<tr>
<td>367.64</td>
<td>2.1156</td>
<td>4.174</td>
<td></td>
</tr>
<tr>
<td>404.4</td>
<td>2.33103</td>
<td>4.182</td>
<td></td>
</tr>
<tr>
<td>441.95</td>
<td>2.5486</td>
<td>4.177</td>
<td></td>
</tr>
<tr>
<td>479.29</td>
<td>2.758</td>
<td>4.174</td>
<td></td>
</tr>
<tr>
<td>515.39</td>
<td>2.96986</td>
<td>4.180</td>
<td></td>
</tr>
<tr>
<td>552.13</td>
<td>3.17998</td>
<td>4.178</td>
<td></td>
</tr>
<tr>
<td>589.2</td>
<td>3.39003</td>
<td>4.174</td>
<td></td>
</tr>
<tr>
<td>625.29</td>
<td>3.6006</td>
<td>4.177</td>
<td></td>
</tr>
<tr>
<td>660.9</td>
<td>3.81068</td>
<td>4.183</td>
<td></td>
</tr>
<tr>
<td>694.98</td>
<td>4.01633</td>
<td>4.192</td>
<td></td>
</tr>
<tr>
<td>730.31</td>
<td>4.22446</td>
<td>4.196</td>
<td></td>
</tr>
<tr>
<td>762</td>
<td>4.43757</td>
<td>4.225</td>
<td></td>
</tr>
</tbody>
</table>

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
The solvent was degassed by vacuum. The solvent and the gas were brought into contact and a reading of the amount of gas absorbed was made. The readings were repeated after 24 and 48 hours.

In the author's earlier paper, *Comptes rendu 1889, 109, 674*, he stated the absorbed gas volume was reduced to the standard temperature and pressure of 0 °C and 760 mmHg. In the present paper the absorbed gas volume is measured at 13 °C and 760 mmHg.

REFERENCES:

ESTIMATED ERROR:

1 The absorbed gas volume is at a temperature of 286 K and the partial pressure of the carbon dioxide. The Bunsen coefficient values were calculated by the compiler.
COMPONENTS:
(1) Carbon dioxide; \( \text{CO}_2; [124-38-9] \)
(2) Trichloromethane or chloroform; \( \text{CHCl}_3; [67-66-3] \)

ORIGINAL MEASUREMENTS:
Just, G.

VARIABLES:
\[
T/K = 288.15 \, \text{and} \, 298.15
\]
\[
p_f/kPa = 101.325 \text{ (1 atm)}
\]

PREPARED BY:
M. E. Derrick
H. L. Clever

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>(T/K)</th>
<th>Mol Fraction (10^2 x_1)</th>
<th>Bunsen Coefficient (a/\text{cm}^3\text{(STP)}\text{cm}^{-3}\text{atm}^{-1})</th>
<th>Ostwald Coefficient (L/\text{cm}^3\text{cm}^{-3})</th>
</tr>
</thead>
<tbody>
<tr>
<td>288.15</td>
<td>1.315</td>
<td>3.75</td>
<td>3.956</td>
</tr>
<tr>
<td>293.15</td>
<td>1.21</td>
<td>3.43</td>
<td>3.681</td>
</tr>
<tr>
<td>298.15</td>
<td>1.12</td>
<td>3.14</td>
<td>3.430</td>
</tr>
</tbody>
</table>

The author measured the Ostwald coefficient at a pressure of about 746 mmHg. The compiler assumed the Ostwald coefficient to be independent of pressure, and calculated the mole fraction and Bunsen coefficient values at 101.325 kPa (1 atm) partial pressure of the gas.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
An Ostwald apparatus as modified by Timofejew (1), and Steiner (2) is used. The apparatus consists of a gas buret, an absorption flask, and a mercury manometer. The system is thermostated with a water jacket.

The gas is introduced into the degassed liquid. The gas volume absorbed is determined by the gas buret. The solvent volume is determined at the end of the experiment by pouring the solvent into a graduated flask.

SOURCE AND PURITY OF MATERIALS:
(1) Carbon dioxide. Generated in a Kipp apparatus using marble and hydrochloric acid.
(2) Trichloromethane. No information.

ESTIMATED ERROR:
\[
\delta L/L = 0.01 \text{ (compiler)}
\]

REFERENCES:
1. Timofejew, W.
2. Steiner, P.
**COMPONENTS:**

1. Carbon dioxide; CO₂; [124-38-9]
2. Trichloromethane or chloroform; CHCl₃; [67-66-3]

**VARIABLES:**

\[ T/K = 298.15 \]
\[ p_1/\text{kPa} = 101.325 \text{ (1 atm)} \]

**ORIGINAL MEASUREMENTS:**
Gjaldbaek, J. C.; Andersen, E. K.

**PREPARED BY:**
J. Chr. Gjaldbaek

**EXPERIMENTAL VALUES:**

<table>
<thead>
<tr>
<th>( T/K )</th>
<th>Mol Fraction ( 10^2x_j )</th>
<th>Bunsen Coefficient ( a/\text{cm}^3(\text{STP})\text{cm}^{-3}\text{atm}^{-1} )</th>
<th>Ostwald Coefficient ( L/\text{cm}^3\text{cm}^{-3} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>298.15</td>
<td>1.28</td>
<td>3.59</td>
<td>3.92</td>
</tr>
<tr>
<td>1.28</td>
<td></td>
<td>3.58</td>
<td>3.91</td>
</tr>
</tbody>
</table>

The mole fraction and Ostwald coefficient values were calculated by the compiler.

**AUXILIARY INFORMATION**

**METHOD/APPARATUS/PROCEDURE:**

The apparatus consists of a calibrated all-glass manometer and bulb enclosed in an air thermostat. The solvent is added and degassed in the apparatus. The gas is added. The apparatus and contents are shaken until equilibrium is attained. Mercury is used for calibration and as the confining liquid.

The absorbed volume of gas is calculated from the initial and final amounts of gas, both saturated with solvent vapor. The amount of solvent is determined by the weight of displaced mercury. Further details are in the references (1,2).

The mole fraction values are at one atm pressure assuming Henry's law is obeyed.

**SOURCE AND PURITY OF MATERIALS:**

2. Trichloromethane. Merck. Analytical reagent. Fractionated by distillation. B.p. (760 mmHg)/°C = 61.15 - 61.16, refractive index \( n_0(20°C) = 1.4460 - 1.4461 \).

**ESTIMATED ERROR:**

\[ \delta T/K = \pm 0.05 \]
\[ \delta x_1/x_1 = \pm 0.015 \]

**REFERENCES:**

1. Lannung, A.
2. Gjaldbaek, J. C.
**COMPONENTS:**

1. Carbon dioxide; CO₂; [124-38-9]
2. Trichloromethane, (chloroform); CHCl₃; [67-66-3]
   1,2-Dibromoethane, (ethylene dibromide); C₂H₄Br₂; [106-93-4]

**ORIGINAL MEASUREMENTS:**

Kunerth, W.


**PREPARED BY:**

P.G.T. Fogg

**EXPERIMENTAL VALUES:**

<table>
<thead>
<tr>
<th>Solvent</th>
<th>T/K</th>
<th>0.0400</th>
<th>0.0097</th>
<th>0.0089</th>
<th>0.0085</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trichloromethane</td>
<td>291.15</td>
<td>3.83</td>
<td>0.01275</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>293.15</td>
<td>3.71</td>
<td>0.01230</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>295.15</td>
<td>3.60</td>
<td>0.01189</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>297.15</td>
<td>3.50</td>
<td>0.01152</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>299.15</td>
<td>3.39</td>
<td>0.01111</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>301.15</td>
<td>3.26</td>
<td>0.01065</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>303.15</td>
<td>3.11</td>
<td>0.01012</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>305.15</td>
<td>2.94</td>
<td>0.00954</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>307.15</td>
<td>2.81</td>
<td>0.00909</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>309.15</td>
<td>2.68</td>
<td>0.00864</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**1,2-Dibromoethane**

<table>
<thead>
<tr>
<th>T/K</th>
<th>0.0400</th>
<th>0.0097</th>
<th>0.0089</th>
<th>0.0085</th>
</tr>
</thead>
<tbody>
<tr>
<td>291.15</td>
<td>2.32</td>
<td>0.00834</td>
<td></td>
<td></td>
</tr>
<tr>
<td>293.15</td>
<td>2.27</td>
<td>0.00812</td>
<td></td>
<td></td>
</tr>
<tr>
<td>295.15</td>
<td>2.22</td>
<td>0.00791</td>
<td></td>
<td></td>
</tr>
<tr>
<td>297.15</td>
<td>2.16</td>
<td>0.00766</td>
<td></td>
<td></td>
</tr>
<tr>
<td>299.15</td>
<td>2.12</td>
<td>0.00748</td>
<td></td>
<td></td>
</tr>
<tr>
<td>301.15</td>
<td>2.07</td>
<td>0.00727</td>
<td></td>
<td></td>
</tr>
<tr>
<td>303.15</td>
<td>2.03</td>
<td>0.00710</td>
<td></td>
<td></td>
</tr>
<tr>
<td>305.15</td>
<td>1.97</td>
<td>0.00686</td>
<td></td>
<td></td>
</tr>
<tr>
<td>307.15</td>
<td>1.92</td>
<td>0.00666</td>
<td></td>
<td></td>
</tr>
<tr>
<td>309.15</td>
<td>1.86</td>
<td>0.00642</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* calculated by the compiler

**AUXILIARY INFORMATION**

**METHOD/APPARATUS/PROCEDURE:**

The method is based upon that described by McDaniel (1). The apparatus consisted of a gas buret attached to a levelling tube containing mercury and to the absorption cell containing the solvent under test. The volume of gas absorbed by a measured volume of liquid was measured at a total pressure equal to barometric pressure. The mercury in the gas buret was covered with a layer of solvent so that the gas in the buret was saturated with solvent vapor. Buret and absorption cell were surrounded by heating wire and water jackets fitted with thermometers.

**SOURCE AND PURITY OF MATERIALS:**

1. produced by heating NaHCO₃; dried with CaCl₂; frozen in liquid air and volatile impurities pumped away; passed over P₂O₅.
2. commercial sample; purity attested by boiling point and density.

**ESTIMATED ERROR:**

\[ \delta x_{CO₂} = \pm 5\% \] (compiler)

**REFERENCES:**

1. McDaniel, A.S.;
COMPONENTS:

1. Carbon dioxide; CO₂; [124-38-9]
2. Dichloromethane; CH₂Cl₂; [75-09-2]

VARIABLES:

\[ T/K = 294.3 \]
\[ P/kPa = 103-2068 \]

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>( T/\degree F )</th>
<th>( T/K )</th>
<th>Henry's law constant, ( H ), /lbf in⁻²</th>
<th>Mole fraction solubility, ( x_{CO₂} ) at ( P_{CO₂} = 101.3 ) kPa*</th>
</tr>
</thead>
<tbody>
<tr>
<td>70</td>
<td>294.3</td>
<td>1085 ±5</td>
<td>7481 ±34</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>0.0135</td>
</tr>
</tbody>
</table>

* calculated by the compiler.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Measurements of solubility were made at pressures from 103 to 2068 kPa using a specially designed cell. Dichloromethane was transferred to the cell and carbon dioxide introduced from a storage cylinder. The cell was rocked in a thermostatted bath until constant pressure was attained. A sample of the liquid phase was then isolated under pressure, withdrawn and weighed. The sample was then allowed to expand and the carbon dioxide estimated by absorption in sodium hydroxide solution and subsequent titration with hydrochloric acid. The partial pressure of dichloromethane in the cell was taken to be proportional to the mole fraction in the liquid. The partial pressure of carbon dioxide was the total pressure minus the partial pressure of dichloromethane. It was found that the mole fraction of carbon dioxide in the liquid was proportional to partial pressure of carbon dioxide to a pressure of about 1000 kPa.

SOURCE AND PURITY OF MATERIALS:

1. Obtained from a cylinder.
2. Technical grade, degassed by distillation.

REFERENCES:
COMPONENTS:
1. Carbon dioxide; CO₂; [124-38-9]
2. Dichloromethane; CH₂Cl₂; [75-09-2]

VARIABLES:
P/kPa = 103-2068
T/K = 310.9, 327.6

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/°F</th>
<th>T/K*</th>
<th>Henry's law constant, H, /lbf in⁻²</th>
<th>Mole fraction solubility, xCO₂, /kPa* at P CO₂ = 101.3 kPa*</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>310.9</td>
<td>1505</td>
<td>10377</td>
</tr>
<tr>
<td>130</td>
<td>327.6</td>
<td>2015</td>
<td>13893</td>
</tr>
</tbody>
</table>

\[ H = \frac{P_{CO₂}}{x_{CO₂}} \]

* calculated by the compiler.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
Measurements of solubility were made at pressures from 103 to 2068 kPa using a specially designed cell described previously (1). Dichloromethane was transferred to the cell and carbon dioxide introduced from a storage cylinder. The cell was rocked in a thermostatted bath until constant pressure was attained. A sample of the liquid phase was then isolated under pressure, withdrawn and weighed. The sample was then allowed to expand and the carbon dioxide estimated by absorption in sodium hydroxide solution and subsequent titration with hydrochloric acid. The partial pressure of dichloromethane in the cell was taken to be proportional to the mole fraction in the liquid. The partial pressure of carbon dioxide was the total pressure minus the partial pressure of dichloromethane. It was found that the mole fraction of carbon dioxide in the liquid was proportional to partial pressure of carbon dioxide to a pressure of about 1076 kPa at 373.2 K and to about 1310 kPa at 403.2 K.

SOURCE AND PURITY OF MATERIALS:
1. Obtained from a cylinder.
2. Technical grade, degassed by distillation.

REFERENCES:
1. Buell, D.S.; Eldridge, J.W.
COMPONENTS:
1. Carbon dioxide; CO₂; [124-38-9]
2. Fluorocarbons

ORIGINAL MEASUREMENTS:
Dantzler, E.M.; Holler, F.C.; Smith, P.T.

PREPARED BY:
P.G.T. Fogg

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>Solvent</th>
<th>T/°F</th>
<th>T/K*</th>
<th>P_total /psig</th>
<th>P_total mol% CO₂</th>
<th>xCO₂ *</th>
<th>PCO₂ /kPa</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dichlorodifluoromethane; CCl₂F₂; [75-71-8]</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>32</td>
<td>273.15</td>
<td>40</td>
<td>377</td>
<td>2.07</td>
<td>0.0207</td>
<td>87</td>
</tr>
<tr>
<td>32</td>
<td>273.15</td>
<td>55</td>
<td>481</td>
<td>5.31</td>
<td>0.0531</td>
<td>200</td>
</tr>
<tr>
<td>32</td>
<td>273.15</td>
<td>90</td>
<td>722</td>
<td>12.90</td>
<td>0.1290</td>
<td>464</td>
</tr>
<tr>
<td>70</td>
<td>294.26</td>
<td>90</td>
<td>722</td>
<td>3.05</td>
<td>0.0200</td>
<td>101.3</td>
</tr>
<tr>
<td>75</td>
<td>297.04</td>
<td></td>
<td>1.9</td>
<td>0.019</td>
<td>101.3</td>
<td></td>
</tr>
</tbody>
</table>

* estimated by the compiler.
† extrapolated values estimated by the compiler. In the extrapolation it was assumed that data approximated to the Krichevsky-Il'inskaya equation in the form:

\[ \log\left(\frac{P_{CO₂}}{x_{CO₂}}\right) = \log H - \beta (1 - x_s^2) \]

where \( H \) is Henry's constant, \( \beta \) is a constant and \( x_s \) is the mole fraction of solvent in solution.

AUXILIARY INFORMATION:

METHOD/APPARATUS/PROCEDURE:
The apparatus consisted of a 3 ounce aerosol compatibility tube connected via copper and nylon pressure tubing to a vacuum line, gas cylinder liquid phase sampling valve, gas phase sampling valve and pressure gauge. The aerosol compatibility tube served as the absorption cell and its temperature could be controlled to ±0.1 K by a constant temperature bath. A sample of the fluorocarbon was transferred from the gas cylinder and frozen in the absorption cell by liquid nitrogen. It was purified by repeated melting, refreezing and evacuation. Carbon dioxide was then admitted to the liquid fluorocarbon through a metering valve until the desired pressure was attained. The cell was mechanically shaken until the equilibrium pressure was reached. Samples of the gas phase and of the liquid phase were withdrawn and analysed with a gas chromatograph which had been previously calibrated with synthetic mixture of carbon dioxide and fluorocarbon.

SOURCE AND PURITY OF MATERIALS:
1. Minimum purity 99.15-99.8%
2. Fluorocarbons referred to as P11 (trichlorfluoromethane) P12 (dichlorodifluoromethane) P14 (1,2-dichlorotetrafluoroethane)
Analysis by gas chromatography indicated a purity of at least 99%

ESTIMATED ERROR:
\[ \delta T/K = \pm 0.1 \]
\[ \delta P_{total}/psig = \pm 0.5 \]
\[ \delta x_{CO₂} = \pm 3\% \] (40-90 psig) (authors)
\[ \delta x_{CO₂} = \pm 5\% \] (101.3 kPa) (compiler)

REFERENCES:
COMPONENTS:

1. Carbon dioxide; CO₂; [124-38-9]
2. Fluorocarbons

ORIGINAL MEASUREMENTS:

Dantzler, E.M.; Holler, F.C.; Smith, P.T.

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>Solvent</th>
<th>T/°F</th>
<th>T/K*</th>
<th>$P_{\text{total}}$ /psig</th>
<th>$P_{\text{total}}$ /kPa CO₂</th>
<th>$P_{\text{CO₂}}$ /kPa CO₂*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trichlorofluoromethane; CCl₃F; [75-69-4]</td>
<td>32</td>
<td>273.15</td>
<td>40</td>
<td>377</td>
<td>7.70</td>
</tr>
<tr>
<td></td>
<td>32</td>
<td>273.15</td>
<td>55</td>
<td>481</td>
<td>10.10</td>
</tr>
<tr>
<td></td>
<td>32</td>
<td>273.15</td>
<td>90</td>
<td>722</td>
<td>15.30</td>
</tr>
<tr>
<td></td>
<td>70</td>
<td>294.26</td>
<td>40</td>
<td>377</td>
<td>4.83</td>
</tr>
<tr>
<td></td>
<td>70</td>
<td>294.26</td>
<td>55</td>
<td>481</td>
<td>6.50</td>
</tr>
<tr>
<td></td>
<td>70</td>
<td>294.26</td>
<td>90</td>
<td>722</td>
<td>10.50</td>
</tr>
<tr>
<td></td>
<td>70</td>
<td>294.26</td>
<td>90</td>
<td>722</td>
<td>10.50</td>
</tr>
<tr>
<td></td>
<td>75</td>
<td>297.04</td>
<td>1.6</td>
<td>377</td>
<td>3.18</td>
</tr>
<tr>
<td></td>
<td>100</td>
<td>310.93</td>
<td>40</td>
<td>377</td>
<td>3.18</td>
</tr>
<tr>
<td></td>
<td>100</td>
<td>310.93</td>
<td>55</td>
<td>481</td>
<td>4.56</td>
</tr>
<tr>
<td></td>
<td>100</td>
<td>310.93</td>
<td>90</td>
<td>722</td>
<td>7.92</td>
</tr>
<tr>
<td></td>
<td>100</td>
<td>310.93</td>
<td>90</td>
<td>722</td>
<td>7.92</td>
</tr>
<tr>
<td>1,2-Dichloro-1,1,2,2-tetrafluoroethane; C₂Cl₂F₄; [76-14-2]</td>
<td>32</td>
<td>273.15</td>
<td>40</td>
<td>377</td>
<td>9.54</td>
</tr>
<tr>
<td></td>
<td>32</td>
<td>273.15</td>
<td>55</td>
<td>481</td>
<td>12.90</td>
</tr>
<tr>
<td></td>
<td>32</td>
<td>273.15</td>
<td>90</td>
<td>722</td>
<td>20.70</td>
</tr>
<tr>
<td></td>
<td>70</td>
<td>294.26</td>
<td>40</td>
<td>377</td>
<td>4.27</td>
</tr>
<tr>
<td></td>
<td>70</td>
<td>294.26</td>
<td>55</td>
<td>481</td>
<td>6.63</td>
</tr>
<tr>
<td></td>
<td>70</td>
<td>294.26</td>
<td>90</td>
<td>722</td>
<td>12.10</td>
</tr>
<tr>
<td></td>
<td>70</td>
<td>294.26</td>
<td>90</td>
<td>722</td>
<td>12.10</td>
</tr>
<tr>
<td></td>
<td>75</td>
<td>297.04</td>
<td>2.1</td>
<td>377</td>
<td>1.04</td>
</tr>
<tr>
<td></td>
<td>100</td>
<td>310.93</td>
<td>40</td>
<td>377</td>
<td>1.04</td>
</tr>
<tr>
<td></td>
<td>100</td>
<td>310.93</td>
<td>55</td>
<td>481</td>
<td>3.06</td>
</tr>
<tr>
<td></td>
<td>100</td>
<td>310.93</td>
<td>90</td>
<td>722</td>
<td>7.70</td>
</tr>
<tr>
<td></td>
<td>100</td>
<td>310.93</td>
<td>90</td>
<td>722</td>
<td>7.70</td>
</tr>
</tbody>
</table>

* estimated by the compiler.
† extrapolated values estimated by the compiler. In the extrapolation it was assumed that data approximated to the Kricevsky-Il'inskaya equation in the form:

$$\log\left(P_{\text{CO₂}} / x_{\text{CO₂}}\right) = \log H - \beta(1 - x_s^2)$$

where $H$ is Henry's constant, $\beta$ is a constant and $x_s$ is the mole fraction of solvent in solution.
COMPONENTS:
(1) Carbon dioxide; CO$_2$; [124-38-9]
(2) 1,2-Dibromoethane; C$_2$H$_4$Br$_2$; [106-93-4]

ORIGINAL MEASUREMENTS:
Just. G.

VARIABLES:

\[ \frac{T}{K} = 288.15 - 298.15 \]

\[ p_f^o/kPa = 101.325 \text{ (1 atm)} \]

PREPARED BY:
M. E. Derrick
H. L. Clever

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>( \frac{T}{K} )</th>
<th>Mol Fraction ( x_1 )</th>
<th>Bunsen Coefficient ( a/(cm^3\text{ (STP)cm}^{-3}\text{ atm}^{-1}) )</th>
<th>Ostwald Coefficient ( L/cm^3\text{ cm}^{-3} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>288.15</td>
<td>8.69</td>
<td>2.30</td>
<td>2.424</td>
</tr>
<tr>
<td>293.15</td>
<td>8.16</td>
<td>2.14</td>
<td>2.294</td>
</tr>
<tr>
<td>298.15</td>
<td>7.61</td>
<td>1.98</td>
<td>2.157</td>
</tr>
</tbody>
</table>

The author measured the Ostwald coefficient at a pressure of about 746 mmHg. The compiler assumed the Ostwald coefficient to be independent of pressure, and calculated the mole fraction and Bunsen coefficient values at 101.325 kPa (1 atm) partial pressure of the gas.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
An Ostwald apparatus as modified by Timofejew (1), and Steiner (2) is used. The apparatus consists of a gas buret, an absorption flask, and a mercury manometer. The system is thermostated with a water jacket.

The gas is introduced into the degassed liquid. The gas volume absorbed is determined by the gas buret. The solvent volume is determined at the end of the experiment by pouring the solvent into a graduated flask.

SOURCE AND PURITY OF MATERIALS:
(1) Carbon dioxide. Generated in a Kipp apparatus using mable and hydrochloric acid.
(2) 1,2-Dibromoethane. No information.

ESTIMATED ERROR:
\[ \delta L/L = 0.03 \text{ (compiler)} \]

REFERENCES:
COMPONENTS: ORIGINAL MEASUREMENTS:
(1) Carbon dioxide; CO₂; [124-38-9]
Gjaldbaek, J. C.; Andersen, E. K.
(2) 1,2-Dibromoethane; C₂H₄Br₂; [106-93-4]

VARIABLES:
T/K = 298.15
p₁/kPa = 101.325 (1 atm)

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>10²x₁</th>
<th>a/cm³(STP)cm⁻³atm⁻¹</th>
<th>L/cm³cm⁻³</th>
</tr>
</thead>
<tbody>
<tr>
<td>298.15</td>
<td>7.72</td>
<td>2.00</td>
<td>2.18</td>
</tr>
<tr>
<td></td>
<td>7.72</td>
<td>2.00</td>
<td>2.18</td>
</tr>
</tbody>
</table>

The mole fraction and Ostwald coefficient values were calculated by the compiler.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
The apparatus consists of a calibrated all-glass manometer and bulb enclosed in an air thermostat. The solvent is added and degassed in the apparatus. The gas is added. The apparatus and contents are shaken until equilibrium is attained. Mercury is used for calibration and as the confining liquid.
The absorbed volume of gas is calculated from the initial and final amounts of gas, both saturated with solvent vapor. The amount of solvent is determined by the weight of displaced mercury. Further details are in the references (1, 2).
The mole fraction values are at one atm pressure assuming Henry's law is obeyed.

SOURCE AND PURITY OF MATERIALS:
(1) Carbon dioxide. Prepared from potassium bicarbonate and sulfuric acid. 99.8 - 99.9% CO₂.
(2) 1,2-Dibromoethane. Merck and Co. Purified by fractional freezing. M.p./°C = 9.5 - 9.8, refractive index, nD(20°C) = 1.5390, density ρ(20.6°C)/g dm⁻³ = 2.179.

ESTIMATED ERROR:
δT/K = ± 0.05
δx₁/x₁ = ± 0.015

REFERENCES:
1. Lannung, A.
J. Am. Chem. Soc. 1930, 52, 68.
2. Gjaldbaek, J. C.
COMPONENTS:
1. Carbon dioxide; CO₂; [124-38-9]
2. 1,2-Dibromoethane; C₂H₄Br₂; [106-93-4]

VARIABLES:

\[ P/\text{kPa} = 101.3 \]
\[ T/\text{K} = 293.45-319.45 \]

EXPERIMENTAL VALUES:

\[
\begin{array}{ccc}
T/\text{K} & \text{Ostwald coefficient} & \text{Mole fraction solubility} \\
   & L & x_{\text{CO}_2} \text{ at } P_{\text{CO}_2} = 101.3 \text{ kPa}^* \\
293.45 & 2.224 & 0.00795 \\
299.75 & 2.067 & 0.00728 \\
305.05 & 1.905 & 0.00664 \\
308.75 & 1.789 & 0.00618 \\
311.25 & 1.728 & 0.00594 \\
315.15 & 1.617 & 0.00551 \\
319.45 & 1.495 & 0.00505 \\
\end{array}
\]

*calculated by the compiler using the expression for the density of the solvent given in The International Critical Tables.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The solvent was boiled to remove any gases in solution and was then introduced into the absorption vessel without coming into contact with the air. The volume of carbon dioxide absorbed by the liquid from gas buret was then measured. The composition of the solution after equilibrium was attained was measured by chemical analysis. This enabled a check to be made of solubility as calculated from the volume of gas absorbed. The absorption vessel and the gas buret were kept at constant temperature by circulation of water from a thermostat bath.

SOURCE AND PURITY OF MATERIALS:

2. 1,2-Dibromoethane - supplied by Dow Chemical Company

ESTIMATED ERROR:

\[ \delta T/\text{K} = \pm 0.1 \] Solubility measurements reproducible to about \( \pm 0.5\% \) (authors).

REFERENCES:

Begley, J.W.; Maget, J.R.; Williams, B.
COMPONENTS:
(1) Carbon dioxide; CO₂; [124-38-9]
(2) 1,2-Dichloroethane or ethylene chloride; C₂H₄Cl₂; [107-06-2]

ORIGINAL MEASUREMENTS:
Just, G.
Z. Phys. Chem. 1901, 37, 342 - 367.

VARIABLES:
\[ T/K = 288.15 - 298.15 \]
\[ p_j/kPa = 101.325 \text{ (1 atm)} \]

PREPARED BY:
M. E. Derrick
H. L. Clever

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>Mol Fraction (x_j)</th>
<th>Bunsen Coefficient (a/cm^3 \text{(STP)} \text{cm}^{-3} \text{atm}^{-1})</th>
<th>Ostwald Coefficient (L/cm^3 \text{cm}^{-3})</th>
</tr>
</thead>
<tbody>
<tr>
<td>288.15</td>
<td>13.30</td>
<td>3.85</td>
<td>4.061</td>
</tr>
<tr>
<td>293.15</td>
<td>12.31</td>
<td>3.54</td>
<td>3.795</td>
</tr>
<tr>
<td>298.15</td>
<td>11.32</td>
<td>3.23</td>
<td>3.525</td>
</tr>
</tbody>
</table>

The author measured the Ostwald coefficient at a pressure of about 746 mmHg. The compiler assumed the Ostwald coefficient to be independent of pressure, and calculated the mole fraction and Bunsen coefficient values at 101.325 kPa (1 atm) partial pressure of the gas.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
An Ostwald apparatus as modified by Timofejew (1), and Steiner (2) is used. The apparatus consists of a gas buret, an absorption flask, and a mercury manometer. The system is thermostated with a water jacket.

The gas is introduced into the degassed liquid. The gas volume absorbed is determined by the gas buret. The solvent volume is determined at the end of the experiment by pouring the solvent into a graduated flask.

SOURCE AND PURITY OF MATERIALS:
(1) Carbon dioxide. Generated in a Kipp apparatus using marble and hydrochloric acid.
(2) 1,2-Dichloroethane. No information.

ESTIMATED ERROR:
\[ \delta L/L = 0.03 \text{ (compiler)} \]

REFERENCES:
1. Timofejew, W.
   Z. Phys. Chem. 1890, 6, 141.
2. Steiner, P.
**COMPONENTS:**
(1) Carbon dioxide; CO₂; [124-38-9]
(2) 1-Bromopentane or amyl bromide; C₅H₁₁Br; [110-53-2]

**ORIGINAL MEASUREMENTS:**
Just, G.

**VARIABLES:**
\[ T/K = 288.15 - 298.15 \]
\[ p_1/kPa = 101.325 \text{ (1 atm)} \]

**PREPARED BY:**
M. E. Derrick
H. L. Clever

**EXPERIMENTAL VALUES:**
<table>
<thead>
<tr>
<th>T/K</th>
<th>Mol Fraction (10^3 x_1)</th>
<th>Bunsen Coefficient (a/\text{cm}^3\text{(STP)}\text{cm}^{-2}\text{atm}^{-1})</th>
<th>Ostwald Coefficient (L/\text{cm}^2\text{cm}^{-3})</th>
</tr>
</thead>
<tbody>
<tr>
<td>288.15</td>
<td>14.43</td>
<td>2.66</td>
<td>2.803</td>
</tr>
<tr>
<td>293.15</td>
<td>13.42</td>
<td>2.46</td>
<td>2.638</td>
</tr>
<tr>
<td>298.15</td>
<td>12.34</td>
<td>2.25</td>
<td>2.455</td>
</tr>
</tbody>
</table>

The author measured the Ostwald coefficient at a pressure of about 746 mmHg. The compiler assumed the Ostwald coefficient to be independent of pressure, and calculated the mole fraction and Bunsen coefficient values at 101.325 kPa (1 atm) partial pressure of the gas.

**AUXILIARY INFORMATION**

**METHOD/APPARATUS/PROCEDURE:**
An Ostwald apparatus as modified by Timofejew (1), and Steiner (2) is used. The apparatus consists of a gas buret, an absorption flask, and a mercury manometer. The system is thermostated with a water jacket. The gas is introduced into the degassed liquid. The gas volume absorbed is determined by the gas buret. The solvent volume is determined at the end of the experiment by pouring the solvent into a graduated flask.

**SOURCE AND PURITY OF MATERIALS:**
(1) Carbon dioxide. Generated in a Kipp apparatus using marble and hydrochloric acid.
(2) 1-Bromopentane. No information.

**ESTIMATED ERROR:**
\(\delta L/L = 0.03\) (compiler)

**REFERENCES:**
1. Timofejew, W.
   *Z. Phys. Chem.* 1890, 8, 141.
2. Steiner, P.
COMPONENTS:
(1) Carbon dioxide; \( \text{CO}_2 \); [124-38-9]
(2) 1-Chloropentane; \( \text{C}_5\text{H}_{11}\text{Cl} \); [543-59-9]

VARIABLES:
\[
\begin{align*}
T/K &= 288.15 - 298.15 \\
\rho_f/\text{kPa} &= 101.325 \text{ (1 atm)}
\end{align*}
\]

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>( T/K )</th>
<th>Mol Fraction ( 10^3 x_1 )</th>
<th>Bunsen Coefficient ( a/\text{cm}^3(\text{STP})\text{cm}^{-3}\text{atm}^{-1} )</th>
<th>Ostwald Coefficient ( L/\text{cm}^3\text{cm}^{-3} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>288.15</td>
<td>16.81</td>
<td>3.19</td>
<td>3.363</td>
</tr>
<tr>
<td>293.15</td>
<td>15.47</td>
<td>2.91</td>
<td>3.127</td>
</tr>
<tr>
<td>298.15</td>
<td>14.25</td>
<td>2.67</td>
<td>2.910</td>
</tr>
</tbody>
</table>

The author measured the Ostwald coefficient at a pressure of about 746 mmHg. The compiler assumed the Ostwald coefficient to be independent of pressure, and calculated the mole fraction and Bunsen coefficient values at 101.325 kPa (1 atm) partial pressure of the gas.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
An Ostwald apparatus as modified by Timofejew (1), and Steiner (2) is used. The apparatus consists of a gas buret, an absorption flask, and a mercury manometer. The system is thermostated with a water jacket.

The gas is introduced into the degassed liquid. The gas volume absorbed is determined by the gas buret. The solvent volume is determined at the end of the experiment by pouring the solvent into a graduated flask.

SOURCE AND PURITY OF MATERIALS:
(1) Carbon dioxide. Generated in a Kipp apparatus using marble and hydrochloric acid.
(2) 1-Chloropentane. No information.

ESTIMATED ERROR:
\[
\delta L/L = 0.03 \text{ (compiler)}
\]

REFERENCES:
1. Timofejew, W.
   Z. Phys. Chem. 1890, 8, 141.
2. Steiner, P.
COMPONENTS:
(1) Carbon dioxide; CO$_2$; [124-38-9]
(2) 1-Chloro-2-methylpropane; C$_4$H$_9$Cl; [513-36-0]

ORIGINAL MEASUREMENTS:
Just, G.

VARIABLES:
T/K = 288.15 - 298.15
$P_1$/kPa = 101.325 (1 atm)

PREPARED BY:
M. E. Derrick
H. L. Clever

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>Mol Fraction $10^3x_1$</th>
<th>Bunsen Coefficient $a$/cm$^2$(STP)cm$^{-3}$atm$^{-1}$</th>
<th>Ostwald Coefficient $L$/cm$^3$cm$^{-3}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>288.15</td>
<td>15.97</td>
<td>3.47</td>
<td>3.659</td>
</tr>
<tr>
<td>293.15</td>
<td>14.65</td>
<td>3.16</td>
<td>3.388</td>
</tr>
<tr>
<td>298.15</td>
<td>13.30</td>
<td>2.84</td>
<td>3.105</td>
</tr>
</tbody>
</table>

The author measured the Ostwald coefficient at a pressure of about 746 mmHg. The compiler assumed the Ostwald coefficient to be independent of pressure, and calculated the mole fraction and Bunsen coefficient values at 101.325 kPa (1 atm) partial pressure of the gas.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
An Ostwald apparatus as modified by Timofejew (1), and Steiner (2) is used. The apparatus consists of a gas buret, an absorption flask, and a mercury manometer. The system is thermostated with a water jacket.

The gas is introduced into the degassed liquid. The gas volume absorbed is determined by the gas buret. The solvent volume is determined at the end of the experiment by pouring the solvent into a graduated flask.

SOURCE AND PURITY OF MATERIALS:
(1) Carbon dioxide. Generated in a Kipp apparatus using marble and hydrochloric acid.
(2) 1-Chloro-2-methylpropane. No information.

ESTIMATED ERROR:
$\delta L/L = 0.03$ (compiler)

REFERENCES:
1. Timofejew, W.
2. Steiner, P.
**COMPONENTS:**
(1) Carbon dioxide; \( \text{CO}_2; [124-38-9] \)
(2) 1,2-Dibromopropane or propylene bromide; \( \text{C}_3\text{H}_6\text{Br}_2; [78-75-1] \)

**ORIGINAL MEASUREMENTS:**
Just, G.

**VARIABLES:**
\[
\begin{align*}
T/K &= 288.15 - 298.15 \\
P_1/kPa &= 101.325 (1 \text{ atm})
\end{align*}
\]

**PREPARED BY:**
M. E. Derrick
H. L. Clever

**EXPERIMENTAL VALUES:**

<table>
<thead>
<tr>
<th>( T/K )</th>
<th>Mol Fraction ( 10^3 x_j )</th>
<th>Bunsen Coefficient ( a/\text{cm}^3(\text{STP})\text{cm}^{-3}\text{atm}^{-1} )</th>
<th>Ostwald Coefficient ( L/\text{cm}^3\text{cm}^{-3} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>288.15</td>
<td>11.27</td>
<td>2.45</td>
<td>2.586</td>
</tr>
<tr>
<td>293.15</td>
<td>10.54</td>
<td>2.29</td>
<td>2.453</td>
</tr>
<tr>
<td>298.15</td>
<td>9.76</td>
<td>2.11</td>
<td>2.301</td>
</tr>
</tbody>
</table>

The author measured the Ostwald coefficients at a pressure of about 746 mmHg. The compiler assumed the Ostwald coefficient to be independent of pressure, and calculated the mole fraction and Bunsen coefficient values at 101.325 kPa (1 atm) partial pressure of the gas.

**AUXILIARY INFORMATION**

**METHOD/APPARATUS/PROCEDURE:**
An Ostwald apparatus as modified by Timofejew (1), and Steiner (2) is used. The apparatus consists of a gas buret, an absorption flask, and a mercury manometer. The system is thermostated with a water jacket.

The gas is introduced into the degassed liquid. The gas volume absorbed is determined by the gas buret. The solvent volume is determined at the end of the experiment by pouring the solvent into a graduated flask.

**SOURCE AND PURITY OF MATERIALS:**
(1) Carbon dioxide. Generated in a Kipp apparatus using marble and hydrochloric acid.
(2) 1,2-Dibromopropane. No information.

**ESTIMATED ERROR:**
\[ \delta L/L = 0.03 \text{ (compiler)} \]

**REFERENCES:**
1. Timofejew, W.
2. Steiner, P.
COMPONENTS:
(1) Carbon dioxide; CO₂; [124-38-9]
(2) 1,1,2-Trichloro-1,2,2-trifluoroethane; C₂Cl₃F₃; [76-13-1]

ORIGINAL MEASUREMENTS:
Hiraoka, H.; Hildebrand, J. H.

VARIABLES:
T/K = 276.05 - 308.50
p₁/kPa = 101.325 (1 atm)

PREPARED BY:
M. E. Derrick
H. L. Clever

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/°C</th>
<th>T/K</th>
<th>10^2x₁</th>
<th>Bunsen Coefficient a/cm³(STP)cm⁻³atm⁻¹</th>
<th>Ostwald Coefficient L/cm³cm⁻³</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.90</td>
<td>276.05</td>
<td>2.514</td>
<td>4.98</td>
<td>5.03</td>
</tr>
<tr>
<td>13.03</td>
<td>286.18</td>
<td>2.317</td>
<td>4.51</td>
<td>4.72</td>
</tr>
<tr>
<td>24.92</td>
<td>298.07</td>
<td>1.823</td>
<td>3.47</td>
<td>3.79</td>
</tr>
<tr>
<td>35.35</td>
<td>308.50</td>
<td>1.560</td>
<td>2.92</td>
<td>3.30</td>
</tr>
</tbody>
</table>

The Bunsen and Ostwald coefficients were calculated by the compiler assuming ideal gas behavior.

Smoothed Data: For use between 276.05 and 308.50 K.

\[ \ln x₁ = -8.3717 + 13.0336/(T/100 K) \]

The standard error about the regression line is 1.04 x 10⁻³.

<table>
<thead>
<tr>
<th>T/K</th>
<th>10^2x₁</th>
</tr>
</thead>
<tbody>
<tr>
<td>278.15</td>
<td>2.508</td>
</tr>
<tr>
<td>288.15</td>
<td>2.131</td>
</tr>
<tr>
<td>298.15</td>
<td>1.831</td>
</tr>
<tr>
<td>308.15</td>
<td>1.589</td>
</tr>
</tbody>
</table>

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
The apparatus consists of a gas measuring buret, an absorption pipet, and a reservoir for the solvent. The buret is thermostated at 25°C, the pipet at any temperature from 5 to 30°C. The pipet contains an iron bar in glass for magnetic stirring. The pure solvent is degassed by freezing with liquid nitrogen, evacuating, then boiling with a heat lamp. The degassing process is repeated three times. The solvent is flowed into the pipet where it is again boiled for final degassing. Manipulation of the apparatus is such that the solvent never comes in contact with stopcock grease. The liquid in the pipet is sealed off by mercury. Its volume is the difference between the capacity of the pipet and the volume of mercury that confines it. Gas is admitted into the pipet. Its exact amount is determined by P-V measurements in the buret before and after introduction of the gas into the pipet. Equilibrium is attained within 24 hours.

SOURCE AND PURITY OF MATERIALS:
(1) Carbon dioxide. Western Gas Inc. Gas passed through a cold trap.
(2) 1,1,2-Trichloro-1,2,2-trifluoroethane. Union Carbide Co. Distilled, purity checked by ultraviolet absorbance.

ESTIMATED ERROR:
\[ \delta T/K = 0.02 \]
\[ \delta x₁/x₁ = 0.003 \]

REFERENCES:
1. Kobatake, Y.; Hildebrand, J. H.
COMPONENTS:
1. Carbon dioxide; CO₂; [124-38-9]
2. 1-Bromo-2-chloropropane; C₃H₆BrCl; [3017-96-7]
3. 2-Bromo-1-chloropropane; C₃H₆BrCl; [3017-95-6]

VARIABLES:
\[
P/kPa = 101.3 \\
T/K = 293.35-315.25
\]

EXPERIMENTAL VALUES:

The solvent was a mixture of 1-chloro-2-bromopropane and 2-chloro-1-bromopropane.

<table>
<thead>
<tr>
<th>T/K</th>
<th>Ostwald coefficient</th>
<th>Mole fraction solubility x_{CO₂} at p_{CO₂} = 101.3 kPa*</th>
</tr>
</thead>
<tbody>
<tr>
<td>293.35</td>
<td>2.930</td>
<td>0.01258</td>
</tr>
<tr>
<td>297.15</td>
<td>2.660</td>
<td>0.01134</td>
</tr>
<tr>
<td>298.05</td>
<td>2.525</td>
<td>0.01075</td>
</tr>
<tr>
<td>306.55</td>
<td>2.325</td>
<td>0.00972</td>
</tr>
<tr>
<td>310.35</td>
<td>2.065</td>
<td>0.00857</td>
</tr>
<tr>
<td>310.95</td>
<td>2.025</td>
<td>0.00839</td>
</tr>
<tr>
<td>315.25</td>
<td>1.816</td>
<td>0.00746</td>
</tr>
</tbody>
</table>

*calculated by the compiler using densities given by the authors.

AUXILIARY INFORMATION

METHOD APPARATUS/PROCEDURE:
The solvent was boiled to remove any gases in solution and was then introduced into the absorption vessel without coming into contact with the air. The volume of carbon dioxide absorbed by the liquid from gas buret was then measured. The composition of the solution after equilibrium was attained was measured by chemical analysis. This enabled a check to be made of solubility as calculated from the volume of gas absorbed. The absorption vessel and the gas buret were kept at constant temperature by circulation of water from a thermostat bath. Densities of solvent were also measured by the authors.

SOURCE AND PURITY OF MATERIALS:
2. 1-Bromo-2-chloropropane and 2-Bromo-1-chloropropane
Technical mixture of the two sold as propylene chlorobromide

ESTIMATED ERROR:
\[
\delta T/K = \pm 0.1 \quad \text{Solubility measurements reproducible to about} \pm 0.5\% \text{ (authors).}
\]

REFERENCES:

Begley, J.W.; Maget, J.R.; Williams, B.
COMPONENTS:
1) Carbon dioxide; CO₂; [124-38-9]
2) Hexadecafluoroheptane or perfluoroheptane; C₁₇F₁₆; [335-57-9]

VARIABLES:
\[ T/K = 298.25 \]
\[ p₁/kPa = 101.325 \text{ (1 atm)} \]

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>Carbon Dioxide Pressure ( p₁/\text{mmHg} )</th>
<th>( 10²x₁ )</th>
<th>Bunsen Coefficient ( a/\text{cm}³ \text{(STP)} \text{cm}³\text{atm}^{-1} )</th>
<th>Ostwald Coefficient ( L/\text{cm}³ \text{cm}³\text{atm}^{-1} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>298.25</td>
<td>669.3</td>
<td>2.09</td>
<td>2.09</td>
<td>2.28</td>
</tr>
<tr>
<td></td>
<td>686.4</td>
<td>2.09</td>
<td>2.09</td>
<td>2.28</td>
</tr>
</tbody>
</table>

1 The mole fraction solubility values adjusted to a gas partial pressure of 101.325 kPa (1 atm) by the compiler assuming Henry's law is obeyed.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
A calibrated all-glass combined manometer and bulb was enclosed in an air thermostat and shaken until equilibrium. Mercury was used for calibration and as confining liquid. The solvent was degassed in the apparatus.

The absorbed volume of gas is calculated from the initial and final amounts, both saturated with solvent vapor. The amount of solvent is determined by the weight of displaced mercury.

The mole fraction solubility values are at 1 atm assuming Henry's law is obeyed.

Details of the apparatus and procedure are given in ref. 1 and 2.

SOURCE AND PURITY OF MATERIALS:
(1) Carbon dioxide. Prepared from potassium bicarbonate (analytical reagent) and concentrated sulfuric acid. 99.9 per cent CO₂.
(2) Hexadecafluoroheptane. E. I. duPont Co. B.p. (753.7 mmHg)/°C = 82.3 - 82.4.

ESTIMATED ERROR:
\[ \delta T/K = \pm 0.05 \]
\[ \delta x₁/x₁ = \pm 0.015 \]

REFERENCES:
1. Lannung, A.
   J. Am. Chem. Soc. 1930, 52, 68.
2. Gjaldbaek, J. C.
COMPONENTS:
(1) Carbon dioxide; CO$_2$; [124-38-9]
(2) Hexadecafluoroheptane or perfluoroheptane; C$_7$F$_{16}$; [335-57-9]

ORIGINAL MEASUREMENTS:
Kobatake, Y.; Hildebrand, J. H.

VARIABLES:
T/K: 292.15 - 303.15
P/kPa: 101.325 (1 atm)

PREPARED BY:
M. E. Derrick
H. L. Clever

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>Temperature (°C)</th>
<th>Mol Fraction $10^2x_1$</th>
<th>Bunsen Coefficient $a/(STP)\text{ cm}^{-3}\text{ atm}^{-1}$</th>
<th>Ostwald Coefficient $L/(\text{cm}^3\text{ cm}^{-3})$</th>
</tr>
</thead>
<tbody>
<tr>
<td>19.00</td>
<td>2.231</td>
<td>2.282</td>
<td>2.441</td>
</tr>
<tr>
<td>22.01</td>
<td>2.1685</td>
<td>2.206</td>
<td>2.384</td>
</tr>
<tr>
<td>25.00</td>
<td>2.088</td>
<td>2.113</td>
<td>2.307</td>
</tr>
<tr>
<td>26.02</td>
<td>2.059</td>
<td>2.079</td>
<td>2.277</td>
</tr>
<tr>
<td>30.00</td>
<td>1.959</td>
<td>1.964</td>
<td>2.179</td>
</tr>
</tbody>
</table>

1 Probably a smoothed solubility value of the authors.

The Bunsen and Ostwald coefficients were calculated by the compiler.

Smoothed Data: For use between 292.15 and 303.15 K.

\[\ln x_1 = -7.4216 + 10.5851/(T/100K)\]

The standard error about the regression line is $8.81 \times 10^{-5}$.

<table>
<thead>
<tr>
<th>T/K</th>
<th>Mol Fraction $10^2x_1$</th>
</tr>
</thead>
<tbody>
<tr>
<td>293.15</td>
<td>2.213</td>
</tr>
<tr>
<td>298.15</td>
<td>2.083</td>
</tr>
<tr>
<td>303.15</td>
<td>1.965</td>
</tr>
</tbody>
</table>

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
The apparatus consists of a gas measuring buret, an absorption pipet, and a reservoir for the solvent. The buret is thermostated at 25°C, the pipet at any temperature from 5 to 30°C. The pipet contains an iron bar in glass for magnetic stirring. The pure solvent is degassed by freezing with liquid nitrogen, evacuating, then boiling with a heat lamp. The degassing process is repeated three times. The solvent is flowed into the pipet where it is again boiled for final degassing. Manipulation of the apparatus is such that the solvent never comes in contact with stopcock grease. The liquid in the pipet is sealed off by mercury. Its volume is determined by P-V measurements in the buret before and after introduction of the gas into the pipet. The stirrer is set in motion. Equilibrium is attained within 24 hours.

SOURCE AND PURITY OF MATERIALS:
(1) Carbon dioxide. California Dry Ice Co. Standard grade. Dried by passing through a trap at dry ice-acetone temperature, and tubes containing CaCl$_2$ then P$_2$O$_5$. The dried gas was distilled at liquid N$_2$ temperature several times.

ESTIMATED ERROR:
\[\delta T/K = 0.02\]
\[\delta x_1/x_1 = 0.003\]

REFERENCES:

(1) Carbon dioxide. California Dry Ice Co. Standard grade. Dried by passing through a trap at dry ice-acetone temperature, and tubes containing CaCl$_2$ then P$_2$O$_5$. The dried gas was distilled at liquid N$_2$ temperature several times.
COMPONENTS:
(1) Carbon dioxide; CO₂; [124-38-9]
(2) L-1822, which is a mixture of mostly 10-carbon fluorocarbons, including cyclic, open chain, and branched molecules.

ORIGINAL MEASUREMENTS:
Sargent, J. W.; Seff1, R. J.

VARIABLES:
T/K: 298.15, 310.15
Total P/kPa: 101.325 (1 atm)

PREPARED BY:
A. L. Cramer
H. L. Clever

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>Temperature (°C)</th>
<th>Carbon dioxide Solubility (g CO₂/100 g cm³)</th>
<th>Carbon dioxide Solubility (cm³ CO₂/100 cm³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>25</td>
<td>1.55</td>
<td>164.0</td>
</tr>
<tr>
<td>37</td>
<td>1.31</td>
<td>143.0</td>
</tr>
</tbody>
</table>

The authors solubility, cm³ CO₂/100 cm³, appears to be the Ostwald coefficient times 100.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
The equilibrium apparatus is a 50 cm³ three neck flask equipped with a water condenser, a thermometer, and a gas dispersing tube extending below the fluid surface level. Between 25 and 35 cm³ of solvent are placed in the flask. Gas is bubbled through the solvent for 2 - 3 h. An 80 micro-liter sample is slowly taken into a gas tight syringe. The sample is injected into a gas chromatograph. The results of three sampling and analyses are averaged.

The chromatograph is an F and M Model 720 equipped with a thermal conductivity detector at 320 °C, and a 6' by 1/8" stainless steel column packed with 50/80 mesh Parapak-P at room temperature. The apparatus is calibrated with pure gas samples.

Details of the procedure were furnished by R. D. Danielson of the 3 M Co.

SOURCE AND PURITY OF MATERIALS:
(1) Carbon dioxide. Source not given. Commercial cylinder, or dry ice.
(2) L-1822. Minnesota Mining and Manufacturing Co. All H in an organic compound are replaced by F by Simons electrochemical process (1)

ESTIMATED ERROR:

ΔT/K = 0.1
Δc/c = 0.01 (reproducibility)
= 0.05 (absolute)
(c = concentration of CO₂)

REFERENCES:
1. Simons, J. H., Editor
Fluorine Chemistry
COMPONENTS:
(1) Carbon dioxide; CO$_2$; [124-38-9]
(2) FC-80, which is mostly a mixture of isomers of perfluorobutyl-tetrahydrofuran. For example 2,2,3,3,4,4,5-heptafluorotetrahydro-5(nonafluorobutyl)furan; C$_8$F$_{16}$O; [335-36-4]

VARIABLES:
T/K: 298.15, 310.15
Total P/kPa: 101.325 (1 atm)

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>Temperature</th>
<th>Carbon Dioxide Solubility</th>
</tr>
</thead>
<tbody>
<tr>
<td>t/$^\circ$C</td>
<td>g CO$_2$ 1000 g$^{-1}$</td>
</tr>
<tr>
<td>25 298.15</td>
<td>1.95</td>
</tr>
<tr>
<td>37 310.15</td>
<td>1.61</td>
</tr>
</tbody>
</table>

The authors solubility, cm$^3$ CO$_2$ 100 cm$^{-3}$, appears to be the Ostwald coefficient times 100.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
The equilibrium apparatus is a 50 cm$^3$ three neck flask equipped with a water condenser, a thermometer, and a gas dispersing tube extending below the fluid surface level. Between 25 and 35 cm$^3$ of solvent are placed in the flask. Gas is bubbled through the solvent for 2 - 3 h. An 80 micro-liter sample is slowly taken into a gas tight syringe. The sample is injected into a gas chromatograph. The results of three sampling and analyses are averaged.

The chromatograph is an F and M Model 720 equipped with a thermal conductivity detector at 320 $^\circ$C, and a 4' by $\frac{1}{8}$" stainless steel column packed with 50/80 mesh Parapak-P at room temperature. The apparatus is calibrated with pure gas samples. Details of the procedure were furnished by R. D. Danielson of the 3 M Co.

SOURCE AND PURITY OF MATERIALS:
(1) Carbon dioxide. Source not given. Commercial cylinder, or dry ice.
(2) FC-80. Minnesota Mining and Manufacturing Co. All H in an organic compound are replaced by F by Simons electrochemical process (1)

ESTIMATED ERROR:
$\delta T/K = 0.1$
$\delta c/c = 0.01$ (reproducibility)
$\delta c/c = 0.05$ (absolute)
(c = concentration of CO$_2$)

REFERENCES:
1. Simons, J. H., Editor
Fluorine Chemistry
COMPONENTS:
1. Carbon Dioxide; CO₂; [124-38-9]

2. Heptafluorotetrahydro(nonafluorobutyl)-furan or Perfluorobutyl
perfluorotetrahydrofuran or
FC-80, C₈F₁₆O; [40464-54-8]

ORIGINAL MEASUREMENTS:
Tham, M. K.; Walker, R. D. Jr.;
Modell, J. H.

VARIABLES:  
T/K: 298.15 - 323.15  
Total P/kPa: 101.325 (1 atm)

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>Mol Fraction x₁ x 10³</th>
<th>Bunsen Coefficient α</th>
<th>Ostwald Coefficient L</th>
</tr>
</thead>
<tbody>
<tr>
<td>298.15</td>
<td>22.3</td>
<td>2.17</td>
<td>2.37</td>
</tr>
<tr>
<td>303.15</td>
<td>21.0</td>
<td>2.02</td>
<td>2.24</td>
</tr>
<tr>
<td>310.15</td>
<td>18.6</td>
<td>1.77</td>
<td>2.01</td>
</tr>
<tr>
<td>313.15</td>
<td>17.93</td>
<td>1.68</td>
<td>1.93</td>
</tr>
<tr>
<td>323.15</td>
<td>15.50</td>
<td>1.44</td>
<td>1.70</td>
</tr>
</tbody>
</table>

The Bunsen and Ostwald coefficients were calculated by the compiler assuming ideal gas behavior. If the real carbon dioxide molar volume is used the values are decreased by about 0.5 per cent.

Smoothed Data:  
\[ \Delta G^O/J \text{ mol}^{-1} = -RT \ln x_1 = -11938 + 71.604 T/K \]

Std. dev. \( \Delta G^O = 19.9 \), Coef. corr. = 0.9996

\[ \Delta H^O/J \text{ mol}^{-1} = -11938, \Delta S^O/J \text{ K}^{-1} \text{ mol}^{-1} = -71.604 \]

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
The apparatus and procedure described by Shoor, Walker and Gubbins (1) were used. The solvent was placed in a saturator immersed in a constant temperature bath. The gas was dispersed through the liquid by a fritted glass disk at a rate of about 40 cm³ m⁻¹. After an initial equilibration period of 30 minutes, samples were withdrawn with a Hamilton microliter syringe at 15 minute intervals and analyzed chromatographically (Perkin-Elmer 900 gas chromatograph with thermal conductivity detector). The solubility at one atmosphere partial pressure of the gas was the mean value of three consecutive samples which agreed within the limits of experimental error.

SOURCE AND PURITY OF MATERIALS:
2. FC-80. Minnesota Mining and Manufacturing Co. A mixture of several isomers. The authors also measured the density and viscosity of the solvent at several temperatures. At 298.15 K the density is 1.7657 g cm⁻³ and the viscosity is 1.3957 centipoise.

ESTIMATED ERROR:
\[ \delta T/K = 0.05 \]
\[ \delta x_1/x_1 = 0.005 \text{ (Compiler)} \]

REFERENCES:
COMPONENTS:
(1) Carbon dioxide; CO₂; [124-38-9]
(2) FC-BO or heptafluorotetrahydro (nonafluorobutyl)-furan; C₈F₁₆O; [40464-54-8]

ORIGINAL MEASUREMENTS:
Navari, R. M.; Rosenblum, W. I.; Kontos, H. A.; Patterson, J. L.

VARIABLES:
T/K: 310.15
P/kPa: 1.333 - 101.325
(10 - 760 mmHg)

PREPARED BY:
H. L. Clever

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>Carbon</th>
<th>Carbon Dioxide Solubility¹</th>
<th>Diffusion Coefficient²</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Dioxide</td>
<td>cm³ CO₂/cm³</td>
<td>10⁻⁵ D/cm³·s⁻¹</td>
</tr>
<tr>
<td>310.15</td>
<td>10</td>
<td>0.023 ± 0.002</td>
<td>4.34 ± 0.15</td>
</tr>
<tr>
<td></td>
<td>25</td>
<td>0.059 ± 0.003</td>
<td>4.46 ± 0.17</td>
</tr>
<tr>
<td></td>
<td>50</td>
<td>0.117 ± 0.007</td>
<td>4.35 ± 0.15</td>
</tr>
<tr>
<td></td>
<td>75</td>
<td>0.176 ± 0.010</td>
<td>4.43 ± 0.18</td>
</tr>
<tr>
<td></td>
<td>100</td>
<td>0.235 ± 0.013</td>
<td>4.39 ± 0.16</td>
</tr>
<tr>
<td></td>
<td>150</td>
<td>0.353 ± 0.015</td>
<td>4.49 ± 0.19</td>
</tr>
<tr>
<td></td>
<td>760</td>
<td>1.793 ± 0.031</td>
<td>4.61 ± 0.17</td>
</tr>
</tbody>
</table>

¹ Mean of five determinations ± standard deviation.
² Mean of three determinations ± standard deviation.

The author's solubility coefficient is probably a Bunsen coefficient.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
The solubilities were measured by the gas chromatograph method of Shoor et al. (1). The gas, presaturated with solvent vapor, was passed through the degassed liquid in the saturation cell at a rate of 50 ml m⁻¹. Twenty microliter samples of the gas-saturated liquid were withdrawn and analyzed chromatographically at 15 min intervals. When readings remained constant for one hour the solution was assumed to be saturated. The time for saturation was less than 2 hours. The apparatus was calibrated with pure dry oxygen.

SOURCE AND PURITY OF MATERIALS:
(1) Carbon dioxide. No information.
(2) FC-BO. Minnesota Mining and Manufacturing Co.

ESTIMATED ERROR:

REFERENCES:
COMPONENTS:
1. Carbon Dioxide; CO₂; [124-38-9]
2. 1,1,1,2,2,3,3,4,4,5,5,6,6,Tridecafluoro-6-[1,2,2,2-tetrafluoro-1-(trifluoromethyl)ethoxy]-hexane or Perfluoro-1-isoproxy hexane or Caroxin-F; C₉F₂₀O; [37340-18-4] or [41719-16-8]

ORIGINAL MEASUREMENTS:
Tham, M. K.; Walker, R. D. Jr.; Modell, J. H.

VARIABLES:
T/K: 298.15 - 323.15
Total P/kPa: 101.325 (1 atm)

PREPARED BY:
T. D. Kittredge
H. L. Clever

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>Mol Fraction x₁ x 10³</th>
<th>Bunsen Coefficient α</th>
<th>Ostwald Coefficient L</th>
</tr>
</thead>
<tbody>
<tr>
<td>298.15</td>
<td>25.0</td>
<td>1.99</td>
<td>2.17</td>
</tr>
<tr>
<td>303.15</td>
<td>24.3</td>
<td>1.92</td>
<td>2.13</td>
</tr>
<tr>
<td>310.15</td>
<td>23.2</td>
<td>1.81</td>
<td>2.05</td>
</tr>
<tr>
<td>313.15</td>
<td>22.8</td>
<td>1.77</td>
<td>2.03</td>
</tr>
<tr>
<td>323.15</td>
<td>21.4</td>
<td>1.63</td>
<td>1.93</td>
</tr>
</tbody>
</table>

The Bunsen and Ostwald coefficients were calculated by the compiler assuming ideal gas behavior. If the real carbon dioxide molar volume is used the values are decreased by about 0.5 per cent.

Smoothed Data:

\[ \Delta G^o/J \text{ mol}^{-1} = -RT \ln x_1 = -5018.1 + 47.477 T \]

Std. dev. \( \Delta G^o = 5.7 \), Coef. corr. = 0.9999

\[ \Delta H^o/J \text{ mol}^{-1} = -5018.1, \Delta S^o/J K^{-1} \text{ mol}^{-1} = -47.477 \]

<table>
<thead>
<tr>
<th>T/K</th>
<th>Mol Fraction x₁ x 10³</th>
<th>( \Delta G^o/J \text{ mol}^{-1} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>298.15</td>
<td>25.0</td>
<td>9,137.1</td>
</tr>
<tr>
<td>303.15</td>
<td>24.2</td>
<td>9,374.5</td>
</tr>
<tr>
<td>308.15</td>
<td>23.5</td>
<td>9,611.9</td>
</tr>
<tr>
<td>313.15</td>
<td>22.8</td>
<td>9,849.3</td>
</tr>
<tr>
<td>318.15</td>
<td>22.1</td>
<td>10,087</td>
</tr>
<tr>
<td>323.15</td>
<td>21.4</td>
<td>10,324</td>
</tr>
</tbody>
</table>

METHOD/APPARATUS/PROCEDURE:
The apparatus and procedure described by Shoor, Walker and Gubbins (1) were used. The solvent was placed in a saturator immersed in a constant temperature bath. The gas was dispersed through the liquid by a fritted glass disk at a rate of about 40 cm³ m⁻¹. After an initial equilibration period of 30 minutes, samples were withdrawn with a Hamilton microliter syringe at 15 minute intervals and analyzed chromatographically (Perkin-Elmer 900 gas chromatograph with thermal conductivity detector). The solubility at one atmosphere partial pressure of the gas was the mean value of three consecutive samples which agreed within the limits of experimental error.

AUXILIARY INFORMATION

SOURCE AND PURITY OF MATERIALS:
2. Caroxin-F. Allied Chemical Corp. Purity > 99.9 per cent as supplied. The authors also measured the density and viscosity of the solvent at several temperatures. At 298.15 K the density is 1.7449 g cm⁻³ and the viscosity is 1.5405 centipoise.

ESTIMATED ERROR:
\[ \delta T/K = 0.05 \]
\[ \delta x_1/x_1 = 0.005 \text{ (Compiler)} \]

REFERENCES:
**COMPONENTS:**

1. Carbon dioxide; CO₂; [124-38-9]
2. 1,1,1,2,2,3,3,4,4,5,5,6,6-Tridecafluoro-6-[1,2,2,2-tetrafluoro-1-(trifluoromethyl)-ethoxy]-hexane, (perfluoro-l-isopropoxyhexane); C₉F₂₀O; [41719-16-8]

**ORIGINAL MEASUREMENTS:**

Nychka, H.R.; Eiback, R.E.

Ger. Offen. 2253534 (Cl.CO7c.CO1b, A61m) 10 May 1973

**VARIABLES:**

P/kPa ≈ 101.3
T/K = 298.2; 310.2

**EXPERIMENTAL VALUES:**

<table>
<thead>
<tr>
<th>T/K</th>
<th>Volume of gas/cm³, reduced to 101.3 kPa and 273.15 K absorbed by 100 cm³ of solvent at P CO₂ = 101.3 kPa</th>
<th>Bunsen coefficient*</th>
<th>x CO₂ at P CO₂</th>
</tr>
</thead>
<tbody>
<tr>
<td>298.15</td>
<td>173.4†</td>
<td>1.734</td>
<td>0.02232</td>
</tr>
<tr>
<td>310.15</td>
<td>151.1</td>
<td>1.511</td>
<td>0.01984</td>
</tr>
</tbody>
</table>

† The author also states elsewhere in the patent specification that the volume of gas absorbed at 298.15 K is 137.4 cm³. The compiler considers that this is a typing error. Carbon dioxide is unlikely to show an increase in solubility with increase in temperature under these conditions.

* Calculated by the compiler using absorption and density data given in the patent specification.

**AUXILIARY INFORMATION**

**METHOD/APPARATUS/PROCEDURE:**

The authors used a method described by Reilly and Rae (1). The solvent was saturated with carbon dioxide and the solution subsequently analysed.

**SOURCE AND PURITY OF MATERIALS:**

1. No information
2. Prepared by reaction of antimony pentafluoride with Perfluoroisopropylhexyl ether. Vapor pressure 45.6 mmHg at 37°C

<table>
<thead>
<tr>
<th>t/°C</th>
<th>Density/g cm⁻³</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>1.732</td>
</tr>
<tr>
<td>25</td>
<td>1.721</td>
</tr>
<tr>
<td>30</td>
<td>1.709</td>
</tr>
<tr>
<td>35</td>
<td>1.696</td>
</tr>
<tr>
<td>40</td>
<td>1.683</td>
</tr>
<tr>
<td>45</td>
<td>1.661</td>
</tr>
</tbody>
</table>

**ESTIMATED ERROR:**

δx CO₂ = ±10% (compiler)

**REFERENCES:**

1. Reilly, J.; Rae, W.N.

COMPONENTS:
1. Carbon Dioxide; CO₂; [124-38-9]
2. 1,1,2,2,3,3,4,4-Octafluoro-1,4-bis(1,2,2,2-tetrafluoro-1-(trifluoromethyl)ethoxy) butane or Perfluoro-1,4-diisoproxy butane or Caroxin-D; C₁₀F₂₂O₂; [23228-90-2]

ORIGINAL MEASUREMENTS:
Tham, M. K.; Walker, R. D. Jr.; Modell, J. H.

VARIABLES:
T/K: 298.15 - 323.15
Total p/kPa: 101.325 (1 atm)

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>Mol Fraction x₁ × 10³</th>
<th>Bunsen Coefficient α</th>
<th>Ostwald Coefficient L</th>
</tr>
</thead>
<tbody>
<tr>
<td>298.15</td>
<td>24.8</td>
<td>1.75</td>
<td>1.91</td>
</tr>
<tr>
<td>303.15</td>
<td>23.8</td>
<td>1.66</td>
<td>1.84</td>
</tr>
<tr>
<td>310.15</td>
<td>22.7</td>
<td>1.57</td>
<td>1.78</td>
</tr>
<tr>
<td>313.15</td>
<td>22.4</td>
<td>1.54</td>
<td>1.77</td>
</tr>
<tr>
<td>323.15</td>
<td>20.6</td>
<td>1.39</td>
<td>1.64</td>
</tr>
</tbody>
</table>

The Bunsen and Ostwald coefficients were calculated by the compiler assuming ideal gas behavior. The real carbon dioxide molar volume results in values smaller by 0.5 per cent.

Smoothened Data: \[ \Delta G^O/J \text{ mol}^{-1} = -RT \ln x_1 = -5828.2 + 50.273 T \]

Std. dev. \( \Delta G^O = 15.0 \), Coef. corr. = 0.9997
\[ \Delta H^O/J \text{ mol}^{-1} = -5828.2, \Delta S^O/J \text{ K}^{-1} \text{ mol}^{-1} = -50.273 \]

<table>
<thead>
<tr>
<th>T/K</th>
<th>Mol Fraction x₁ × 10³</th>
<th>ΔG°/J mol⁻¹</th>
</tr>
</thead>
<tbody>
<tr>
<td>298.15</td>
<td>24.8</td>
<td>9,160.7</td>
</tr>
<tr>
<td>303.15</td>
<td>23.9</td>
<td>9,412.0</td>
</tr>
<tr>
<td>308.15</td>
<td>23.0</td>
<td>9,663.4</td>
</tr>
<tr>
<td>313.15</td>
<td>22.2</td>
<td>9,914.8</td>
</tr>
<tr>
<td>318.15</td>
<td>21.4</td>
<td>10,166</td>
</tr>
<tr>
<td>323.15</td>
<td>20.7</td>
<td>10,417</td>
</tr>
</tbody>
</table>

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
The apparatus and procedure described by Shoor, Walker and Gubbins (1) were used. The solvent was placed in a saturator immersed in a constant temperature bath. The gas was dispersed through the liquid by a fritted glass disk at a rate of about 40 cm³ m⁻¹. After an initial equilibration period of 30 minutes, samples were withdrawn with a Hamilton microliter syringe at 15 minute intervals and analyzed chromatographically (Perkin-Elmer 900 gas chromatograph with thermal conductivity detector). The solubility at one atmosphere partial pressure of the gas was the mean value of three consecutive samples which agreed within the limits of experimental error.

SOURCE AND PURITY OF MATERIALS:
2. Caroxin-D. Allied Chemical Corp. Purity > 99.9 per cent as supplied. The authors also measured the density and viscosity of the solvent. At 298.15 K the density is 1.7465 g cm⁻³ and the viscosity is 2.0579 centipoise.

ESTIMATED ERROR:
\[ \delta T/K = 0.05 \]
\[ \delta x_1/x_1 = 0.005 \] (Compiler)

REFERENCES:
COMPONENTS:
1. Carbon dioxide; CO₂; [124-38-9]
2. Chlorocyclohexane; C₆H₁₁Cl; [542-18-7]

VARIABLES:
T/K = 263.15 - 303.15
P/kPa = 101.3

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>10⁻¹ Mole fraction of carbon dioxide</th>
</tr>
</thead>
<tbody>
<tr>
<td>263.15</td>
<td>197</td>
</tr>
<tr>
<td>273.15</td>
<td>163</td>
</tr>
<tr>
<td>283.15</td>
<td>137</td>
</tr>
<tr>
<td>293.15</td>
<td>117</td>
</tr>
<tr>
<td>303.15</td>
<td>101</td>
</tr>
</tbody>
</table>

Mole fraction solubility given by

\[ \ln x_1 = -15.3774 + (1608.8/(T/K)) + 0.9575\ln(T/K) \]

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
Solubility apparatus was similar to that used by Ben-Naim and Baer (1) consisting essentially of a gas buret, mercury manometer and solution vessel. The solvent was degassed in the solution vessel. Measurements were carried out on the saturated gas. It was assumed that the mole fraction of the solvent in the gas phase was that corresponding to the vapor pressure of pure solvent. It appears that the mole fraction at a partial pressure of 1 atmosphere was estimated from raw experimental data assuming Henry's law is obeyed.

SOURCE AND PURITY OF MATERIALS:
2. Merck sample purity 98.5 mole per cent main impurity (0.4 mole per cent) cyclohexane.

ESTIMATED ERROR:
\[ \Delta T/K = \pm 0.1 \Delta x/z = \pm 0.015 \]

REFERENCES:
1. Ben-Naim, A.; Baer, S.
COMPONENTS:
1. Carbon dioxide; CO₂; [124-38-9]
2. Bromocyclohexane; C₆H₁₁Br; [108-85-0]

VARIABLES:
T/K = 263.15-303.15; p/kPa = 101.3

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>10⁻⁴ Mole fraction of carbon dioxide in liquid at partial pressure of 101.3 kPa</th>
</tr>
</thead>
<tbody>
<tr>
<td>263.15</td>
<td>162</td>
</tr>
<tr>
<td>273.15</td>
<td>135.5</td>
</tr>
<tr>
<td>283.15</td>
<td>114.7</td>
</tr>
<tr>
<td>293.15</td>
<td>98.4</td>
</tr>
<tr>
<td>303.15</td>
<td>85.7</td>
</tr>
</tbody>
</table>

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
Solubility apparatus was similar to that used by Ben-Naim and Baer (1) consisting essentially of a gas buret, mercury manometer and solution vessel. The solvent was degassed in the solution vessel. Measurements were carried out on the saturated gas. It was assumed that the mole fraction of the solvent in the gas phase was that corresponding to the vapor pressure of pure solvent. It appears that the mole fraction at a partial pressure of 1 atmosphere was estimated from raw experimental data assuming Henry's law is obeyed.

SOURCE AND PURITY OF MATERIALS:
1. Obtained from Sociedad Espanola del Oxigeno, S.A.; purity 99.998 mole per cent.
2. Fluka sample purity 99+ mole per cent as determined by gas chromatography.

ESTIMATED ERROR:
δT/K = ±0.1; δx_l/x_l = ±0.015

REFERENCES:

ORIGIANAL MEASUREMENTS:

PREPARED BY:
C.L. Young
COMPONENTS:
(1) Carbon dioxide; CO\textsubscript{2}; [124-38-9]

(2) 1,3-Dichloro-2-propanol or α-dichlorohydrin; C\textsubscript{3}H\textsubscript{6}Cl\textsubscript{2}O; [96-23-1]

ORIGINAL MEASUREMENTS:
Just, G. 
Z. Phys. Chem. 1901, 37, 342 - 367.

VARIABLES:
\( T/K = 288.15 - 298.15 \)
\( P_1/kPa = 101.325 \) (1 atm)

PREPARED BY: M. E. Derrick
H. L. Clever

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>( T/K )</th>
<th>Mol Fraction ( 10^3 x_1 )</th>
<th>Bunsen Coefficient ( a/cm^3(STP)cm^{-3}atm^{-1} )</th>
<th>Ostwald Coefficient ( L/cm^3cm^{-3} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>288.15</td>
<td>8.05</td>
<td>1.915</td>
<td>2.020</td>
</tr>
<tr>
<td>293.15</td>
<td>7.55</td>
<td>1.79</td>
<td>1.917</td>
</tr>
<tr>
<td>298.15</td>
<td>7.05</td>
<td>1.66</td>
<td>1.810</td>
</tr>
</tbody>
</table>

The author measured the Ostwald coefficient at a pressure of about 746 mmHg. The compiler assumed the Ostwald coefficient to be independent of pressure, and calculated the mole fraction and Bunsen coefficient values at 101.325 kPa (1 atm) partial pressure of the gas. There is a possibility the solvent may be 2,3-dichloro-1-propanol or 8-dichlorohydrin; [616-23-9].

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
An Ostwald apparatus as modified by Timofejew (1), and Steiner (2) is used. The apparatus consists of a gas buret, an absorption flask, and a mercury manometer. The system is thermostated with a water jacket.

The gas is introduced into the degassed liquid. The gas volume absorbed is determined by the gas buret. The solvent volume is determined at the end of the experiment by pouring the solvent into a graduated flask.

SOURCE AND PURITY OF MATERIALS:
(1) Carbon dioxide. Generated in a Kipp apparatus using marble and hydrochloric acid.

(2) 1,3-Dichloro-2-propanol. No information.

ESTIMATED ERROR:
\( \delta L/L = 0.03 \) (compiler)

REFERENCES:
1. Timofejew, W. 
Z. Phys. Chem. 1890, 6, 141.

2. Steiner, P. 
COMPONENTS:
(1) Carbon dioxide; \( \text{CO}_2; [124-38-9] \)
(2) Chlorobenzene; \( \text{C}_6\text{H}_5\text{Cl}; [108-90-7] \)
Bromobenzene; \( \text{C}_6\text{H}_5\text{Br}; [108-86-1] \)

ORIGINAL MEASUREMENTS:
Just, G.

VARIABLES:
\[ T/K = 288.15 - 298.15 \]
\[ P_f/\text{kPa} = 101.325 \text{ (1 atm)} \]

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>Solvent</th>
<th>( T/K )</th>
<th>( 10^3x_1 )</th>
<th>Bunsen Coefficient</th>
<th>Ostwald Coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>( \alpha/\text{cm}^3(\text{STP})\text{cm}^{-3}\text{atm}^{-1} )</td>
<td>( L/\text{cm}^3\text{cm}^{-3} )</td>
</tr>
<tr>
<td>Chlorobenzene</td>
<td>288.15</td>
<td>10.93</td>
<td>2.45</td>
<td>2.58</td>
</tr>
<tr>
<td></td>
<td>293.15</td>
<td>10.13</td>
<td>2.25</td>
<td>2.42</td>
</tr>
<tr>
<td></td>
<td>298.15</td>
<td>9.38</td>
<td>2.08</td>
<td>2.26</td>
</tr>
<tr>
<td>Bromobenzene</td>
<td>288.15</td>
<td>9.17</td>
<td>1.98</td>
<td>2.09</td>
</tr>
<tr>
<td></td>
<td>293.15</td>
<td>8.50</td>
<td>1.83</td>
<td>1.96</td>
</tr>
<tr>
<td></td>
<td>298.15</td>
<td>7.88</td>
<td>1.69</td>
<td>1.84</td>
</tr>
</tbody>
</table>

The author measured the Ostwald coefficient at a pressure of about 746 mmHg. The compiler assumed the Ostwald coefficient to be independent of pressure and calculated the mole fraction and Bunsen coefficient values at 101.325 kPa (1 atm) partial pressure of the gas.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
An Ostwald apparatus as modified by Timofejew (1), and Steiner (2) is used. The apparatus consists of a gas buret, an absorption flask, and a mercury manometer. The system is thermostated with a water jacket.

The gas is introduced into the degassed liquid. The gas volume absorbed is determined by the gas buret. The solvent volume is determined at the end of the experiment by pouring the solvent into a graduated flask.

SOURCE AND PURITY OF MATERIALS:
(1) Carbon dioxide. Generated in a Kipp apparatus using marble and hydrochloric acid.
(2) Chlorobenzene. No information.

ESTIMATED ERROR:
\[ \delta L/L = 0.03 \text{ (compiler)} \]

REFERENCES:
1. Timofejew, W.
   *Z. Phys. Chem.* 1890, 6, 141.
2. Steiner, P.
COMPONENTS:
(1) Carbon dioxide; CO₂; [124-38-9]
(2) Chlorobenzene; C₆H₅Cl; [108-90-7]

VARIABLES:
\[ T/K = 298.15 \]
\[ P_1/kPa = 101.325 \text{ (1 atm)} \]

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>( T/K )</th>
<th>( 10^3 x_1 )</th>
<th>( \text{Bunsen Coefficient} )</th>
<th>( \text{Ostwald Coefficient} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>298.15</td>
<td>9.81</td>
<td>2.16</td>
<td>2.36</td>
</tr>
<tr>
<td></td>
<td>9.86</td>
<td>2.17</td>
<td>2.37</td>
</tr>
<tr>
<td></td>
<td>9.91</td>
<td>2.18</td>
<td>2.38</td>
</tr>
<tr>
<td></td>
<td>9.71₁</td>
<td>2.14</td>
<td>2.34</td>
</tr>
<tr>
<td></td>
<td>9.81₁</td>
<td>2.16</td>
<td>2.36</td>
</tr>
</tbody>
</table>

₁ Results obtained by titration, see the paper.

The mole fraction and Ostwald coefficient values were calculated by the compiler.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
The apparatus consists of a calibrated all-glass manometer and bulb enclosed in an air thermostat. The solvent is added and degassed in the apparatus. The gas is added. The apparatus and contents are shaken until equilibrium is attained. Mercury is used for calibration and as the confining liquid.

The absorbed volume of gas is calculated from the initial and final amounts of gas, both saturated with solvent vapor. The amount of solvent is determined by the weight of displaced mercury. Further details are in the references (1, 2).

The mole fraction values are at one atm pressure assuming Henry's law is obeyed.

SOURCE AND PURITY OF MATERIALS:
(1) Carbon dioxide. Prepared from potassium bicarbonate and sulfuric acid. 99.8 - 99.9% CO₂.
(2) Chlorobenzene. Fractionated by distillation. B.p. (760 mmHg)/°C = 131.95 - 131.98, refractive index \( n_D(20°C) = 1.3840 - 1.3841 \).

ESTIMATED ERROR:
\[ \delta T/K = \pm 0.05 \]
\[ \delta x_1/x_1 = \pm 0.015 \]

REFERENCES:
COMPONENTS:
1. Carbon dioxide; CO₂; [124-38-9]
2. Chlorobenzene; C₆H₅Cl; [108-90-7]
Bromobenzene; C₆H₅Br; [108-86-1]

ORIGINAL MEASUREMENTS:
Lopez, M.C.; Gallardo, M.A.;
Urieta, J.S.; Gutierrez Losa Y.C.
Rev. Acad. Ciencias Zaragoza 1968,
43, 183-189.

VARIABLES:
\[ T/K = 263.15-303.15 \]
\[ P_{CO₂}/kPa = 101.3 \text{ kPa} \]

EXPERIMENTAL VALUES:
<table>
<thead>
<tr>
<th>Solvent</th>
<th>( T/K )</th>
<th>( P_{CO₂}/kPa )</th>
<th>( x_{CO₂} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chlorobenzene</td>
<td>263.15</td>
<td>101.3</td>
<td>0.0177</td>
</tr>
<tr>
<td></td>
<td>273.15</td>
<td></td>
<td>0.0148</td>
</tr>
<tr>
<td></td>
<td>283.15</td>
<td></td>
<td>0.01247</td>
</tr>
<tr>
<td></td>
<td>293.15</td>
<td></td>
<td>0.01060</td>
</tr>
<tr>
<td></td>
<td>303.15</td>
<td></td>
<td>0.00910</td>
</tr>
<tr>
<td>Bromobenzene</td>
<td>263.15</td>
<td>101.3</td>
<td>0.0145</td>
</tr>
<tr>
<td></td>
<td>273.15</td>
<td></td>
<td>0.01203</td>
</tr>
<tr>
<td></td>
<td>283.15</td>
<td></td>
<td>0.01012</td>
</tr>
<tr>
<td></td>
<td>293.15</td>
<td></td>
<td>0.00856</td>
</tr>
<tr>
<td></td>
<td>303.15</td>
<td></td>
<td>0.00733</td>
</tr>
</tbody>
</table>

The authors gave the following smoothing equations for the mole fraction solubility of carbon dioxide:

\[
\ln x_{CO₂} = -0.2467 + 950.7321/(T/K) - 1.3279 \ln(T/K) \\
\ln x_{CO₂} = -3.1678 + 1093.8344/(T/K) - 0.9371 \ln(T/K)
\]

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
The apparatus was similar to that used by Ben Nairn and Baer (1) which consisted essentially of a gas buret, mercury manometer and absorption vessel. The apparatus used for these measurements was described in an earlier publication (2).

SOURCE AND PURITY OF MATERIALS:
1. Carbon dioxide supplied by Sociedad Española del Oxígeno, S.A.; purity 99.998%
2. Chlorobenzene - supplied by Merck.
Bromobenzene - supplied by Fluka.
Purity of each liquid at least 99.5% as indicated by refractive indices and analysis by gas-liquid chromatography.

ESTIMATED ERROR:
\[ \delta x_{CO₂}/x_{CO₂} < 0.01 \] (authors)

REFERENCES:
1. Ben-Naim, A.; Baer, S.
2. Carnicer, J.; Gibanel, F.; Urieta, J.S.; Gutierrez Losa, C.
**COMPONENTS:**
(1) Carbon dioxide; CO₂; [124-38-9]
(2) Iodobenzene; C₆H₅I; [591-50-4]

**ORIGINAL MEASUREMENTS:**
Just, G.

**VARIABLES:**

\[
\begin{align*}
T/K & = 288.15 - 298.15 \\
P_j/kPa & = 101.325 \text{ (1 atm)}
\end{align*}
\]

**PREPARED BY:**
M. E. Derrick
H. L. Clever

**EXPERIMENTAL VALUES:**

<table>
<thead>
<tr>
<th>T/K</th>
<th>Mol Fraction</th>
<th>Bunsen Coefficient (a/cm^3(\text{STP})cm^{-3}atm^{-1})</th>
<th>Ostwald Coefficient (L/cm^3cm^{-3})</th>
</tr>
</thead>
<tbody>
<tr>
<td>288.15</td>
<td>6.71</td>
<td>1.365</td>
<td>1.440</td>
</tr>
<tr>
<td>293.15</td>
<td>6.31</td>
<td>1.28</td>
<td>1.371</td>
</tr>
<tr>
<td>298.15</td>
<td>5.92</td>
<td>1.19</td>
<td>1.301</td>
</tr>
</tbody>
</table>

The author measured the Ostwald coefficient at a pressure of about 746 mmHg. The compiler assumed the Ostwald coefficient to be independent of pressure, and calculated the mole fraction and Bunsen coefficient values at 101.325 kPa (1 atm) partial pressure of the gas.

**METHOD/APPARATUS/PROCEDURE:**
An Ostwald apparatus as modified by Timofejew (1), and Steiner (2) is used. The apparatus consists of a gas buret, an absorption flask, and a mercury manometer. The system is thermostated with a water jacket.

The gas is introduced into the degassed liquid. The gas volume absorbed is determined by the gas buret. The solvent volume is determined at the end of the experiment by pouring the solvent into a graduated flask.

**SOURCE AND PURITY OF MATERIALS:**
(1) Carbon dioxide. Generated in a Kipp apparatus using marble and hydrochloric acid.
(2) Iodobenzene. No information.

**ESTIMATED ERROR:**
\[\delta L/L = 0.03\] (compiler)

**REFERENCES:**
1. Timofejew, W.
2. Steiner, P.
COMPONENTS:
(1) Carbon dioxide; CO₂; [124-38-9]
(2) Hexafluorobenzene; C₆F₆; [392-56-3]

ORIGINAL MEASUREMENTS:
Evans, F. D.; Battino, R.

VARIABLES:
\( T/K: 297.66, 297.98 \)
\( p_1/kPa: 101.325 \) (1 atm)

PREPARED BY:
H. L. Clever

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>( t/°C )</th>
<th>( T/K )</th>
<th>( 10^2 x_1 )</th>
<th>Bunsen Coefficient ( a/cm^3(\text{STP})cm^{-3} \text{atm}^{-1} )</th>
<th>Ostwald Coefficient ( L/cm^3 \text{cm}^{-3} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>24.51</td>
<td>297.66</td>
<td>2.326</td>
<td>4.57</td>
<td>4.98</td>
</tr>
<tr>
<td>24.83</td>
<td>297.98</td>
<td>2.322</td>
<td>4.44</td>
<td>4.84</td>
</tr>
</tbody>
</table>

The Bunsen coefficients were calculated by the compiler.

The solubility values were adjusted to an oxygen partial pressure of 101.325 kPa (1 atm) by Henry's law.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
The solubility apparatus is based on the design of Morrison and Billett (1) and the version used is described by Battino, Evans, and Danforth (2). The degassing apparatus is that described by Battino, Banzhof, Bogan, and Wilhelm (3).

Degassing. Up to 500 cm³ of solvent is placed in a flask of such size that the liquid is about 4 cm deep. The liquid is rapidly stirred, and vacuum is intermittently applied through a liquid N₂ trap until the permanent gas residual pressure drops to 5 microns.

Solubility Determination. The degassed solvent is passed in a thin film down a glass helical tube containing solute gas plus the solvent vapor at a total pressure of one atm. The volume of gas absorbed is found by difference between the initial and final volumes in the buret system. The solvent is collected in a tared flask and weighed.

SOURCE AND PURITY OF MATERIALS:
(1) Carbon dioxide. Either Air Products and Chemicals Inc. or the Matheson Co., Inc. Purest grade available. Minimum purity 99.0 mole per cent (usually > 99.9 mole per cent).
(2) Hexafluorobenzene. Imperial Smelting Co., Avmouth, U.K. GC purity 99.7%, density, \( \rho_{298.15} = 1.60596 \text{ g cm}^{-3} \). Purification described Anal. Chem. 1968, 40, 224.

ESTIMATED ERROR:
\( \delta T/K = 0.03 \)
\( \delta p/mmHg = 0.5 \)
\( \delta x_1/x_1 = 0.005 \)

REFERENCES:
COMPONENTS:
(1) Carbon dioxide; CO₂; [124-38-9]
(2) (Chloromethyl)-benzene or benzyl chloride; C₇H₇Cl; [100-44-7]

ORIGINAL MEASUREMENTS:
Just, G.
Z. Phys. Chem. 1901, 37, 342 - 367.

VARIABLES:

\[ T/K = 288.15 - 298.15 \]
\[ p_1/kPa = 101.325 \text{ (1 atm)} \]

PREPARED BY:
M. E. Derrick
H. L. Clever

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>Mol Fraction (10^3 x_j)</th>
<th>Bunsen Coefficient (a/cm^3 (\text{STP})cm^{-3} \text{atm}^{-1})</th>
<th>Ostwald Coefficient (L/cm^3cm^{-3})</th>
</tr>
</thead>
<tbody>
<tr>
<td>288.15</td>
<td>10.46</td>
<td>2.07</td>
<td>2.180</td>
</tr>
<tr>
<td>293.15</td>
<td>9.82</td>
<td>1.93</td>
<td>2.072</td>
</tr>
<tr>
<td>298.15</td>
<td>9.07</td>
<td>1.775</td>
<td>1.938</td>
</tr>
</tbody>
</table>

The author measured the Ostwald coefficient at a pressure of about 746 mmHg. The compiler assumed the Ostwald coefficient to be independent of pressure, and calculated the mole fraction and Bunsen coefficient values at 101.325 kPa (1 atm) partial pressure of the gas.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
An Ostwald apparatus as modified by Timofejew (1), and Steiner (2) is used. The apparatus consists of a gas buret, an absorption flask, and a mercury manometer. The system is thermostated with a water jacket.

The gas is introduced into the degassed liquid. The gas volume absorbed is determined by the gas buret. The solvent volume is determined at the end of the experiment by pouring the solvent into a graduated flask.

SOURCE AND PURITY OF MATERIALS:
(1) Carbon dioxide. Generated in a Kipp apparatus using marble and hydrochloric acid.
(2) (Chloromethyl)-benzene. No information.

ESTIMATED ERROR:
\[ \delta L/L = 0.03 \text{ (compiler)} \]

REFERENCES:
1. Timofejew, W.
Z. Phys. Chem. 1890, 6, 141.
2. Steiner, P.
COMPONENTS:
(1) Carbon dioxide; CO₂; [124-38-9]  
(2) (Trichloromethyl)benzene or benzotrichloride; C₇H₅Cl₃; [98-07-7]

ORIGINAL MEASUREMENTS:
Just, G.  
Z. Phys. Chem. 1901, 37, 342 - 367.

VARIABLES:

\[ T/K = 298.15 \]
\[ p/KPa = 101.325 \ (1 \ atm) \]

PREPARED BY:
M. E. Derrick  
H. L. Clever

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>Mol Fraction</th>
<th>Bunsen Coefficient ( a/cm^3(STP)cm^{-3}atm^{-1} )</th>
<th>Ostwald Coefficient ( L/cm^3cm^{-3} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>298.15</td>
<td>9.50</td>
<td>1.505</td>
<td>1.643</td>
</tr>
</tbody>
</table>

The author measured the Ostwald coefficient at a pressure of about 746 mmHg. The compiler assumed the Ostwald coefficient to be independent of pressure, and calculated the mole fraction and Bunsen coefficient values at 101.325 kPa (1 atm) partial pressure of the gas.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
An Ostwald apparatus as modified by Timofejew (1), and Steiner (2) is used. The apparatus consists of a gas buret, an absorption flask, and a mercury manometer. The system is thermostated with a water jacket.

The gas is introduced into the degassed liquid. The gas volume absorbed is determined by the gas buret. The solvent volume is determined at the end of the experiment by pouring the solvent into a graduated flask.

SOURCE AND PURITY OF MATERIALS:
(1) Carbon dioxide. Generated in a Kipp apparatus using marble and hydrochloric acid.
(2) Trichloromethylbenzene. No information.

ESTIMATED ERROR:
\[ \delta L/L = 0.03 \ (\text{compiler}) \]

REFERENCES:
1. Timofejew, W.  
Z. Phys. Chem. 1890, 6, 141.
2. Steiner, P.  
COMPONENTS:
1. Carbon dioxide; \( \text{CO}_2 \); [124-38-9]
2. Solvents Containing Nitrogen

EVALUATOR:
Peter G.T. Fogg,
School of Applied Chemistry,
Polytechnic of North London,
Holloway Road, London, N7 8DB, U.K.
July 1991

CRITICAL EVALUATION:
Solubility of carbon dioxide in solvents containing nitrogen

Solubility in benzene was measured at or near to 101.3 kPa by Just (1) from 288.2 K to 298.2 K, by Kunerth (2) from 293.2 K to 309.2 K, by Gjaldbaek and Andersen (3) at 298.2 K and by Luhring and Schumpe (4) at 293.2 K. There is good correlation between these measurements with a maximum discrepancy of about 3.5%. Values of the mole fraction solubility based on data at 293.2 K are 0.005426 (Luhring) and 0.00524 (Kunerth). Lenoir et al. (5) published a limiting value of Henry's constant from chromatographic measurements at 298.2 K. The mole fraction solubility at a partial pressure of 101.3 kPa estimated from this value is clearly too large (0.0079). The following smoothing equation is based upon data from Just, Kunerth, and from Gjalbaek and Andersen.

\[
\ln x_{\text{CO}_2} = -193.85 + 9531.6/(T/K) + 27.478 \ln(T/K)
\]

temperature range = 288.2-309.2 K
standard deviation in \( x_{\text{CO}_2} = 4.2 \times 10^{-5} \)

Just (1) measured solubility in 2-methylbenzenamine and in 3-methylbenzenamine at 101.3 kPa and 288.2 K to 298.2 K. The measurements indicate a greater mole fraction solubility in these solvents than in benzene under the same conditions. These measurements can be accepted on a provisional basis until they are confirmed by other workers.

Just (1), Kunerth (2) and also Gjaldbaek and Andersen (3) measured solubility in pyridine at about 101.3 kPa. There is good correlation between the different measurements. The following smoothing equation for a partial pressure of 101.3 kPa is based upon these measurements.

\[
\ln x_{\text{CO}_2} = 23.871 + 54.519/(T/K) - 5.0006 \ln(T/K)
\]

temperature range = 291.2-309.2 K
standard deviation in \( x_{\text{CO}_2} = 0.00013 \)

Henry's constants for solubility in quinoline have been measured by Horvath et al. (6) at 300 K and by Chai and Paulaitis (7) from 298.6 K to 330.2 K. The measurements by Chai and Paulaitis are self consistent and can be provisionally recommended. Values of mole fraction solubility at a partial pressure of 101.3 kPa from these measurements fit the equation below.

\[
\ln x_{\text{CO}_2} = -76.227 + 4508.7/(T/K) + 9.9003 \ln(T/K)
\]

temperature range = 298.6-330.2 K
standard deviation in \( x_{\text{CO}_2} = 6.0 \times 10^{-5} \)

The value of the mole fraction solubility at 300 K from this equation is 0.00884 compared with 0.00939 from Horvath's data.

Solubility in perfluorotributylamine was measured by Kobatake and Hildebrand (8) at 101.3 kPa and 277.2 K to 304.3 K. Sargent and Seffl (9) measured solubility at 298.2 K and 310.2 K but the purity of the solvent in this case is uncertain. The values of the mole fraction solubility at a pressure of 101.3 kPa and 298.2 K are 0.0200 (Kobatake) and 0.0218 (Sargent). Data from Kobatake and Hildebrand are likely to be a better measure of the solubility in the pure solvent.

Jou et al. (10) measured solubility in N-formyl morpholine at partial pressures of gas of 0.452 kPa to 7090 kPa at 298.2 K to 403.15 K. The data are self-consistent. Kassim et al. (11) measured solubilities at pressures of about 101.3 kPa from 303.2 K to 333.2 K. Mole fraction
COMPONENTS:
1. Carbon dioxide; CO₂; [124-38-9]
2. Solvents Containing Nitrogen

CRITICAL EVALUATION:

Solubilities at a partial pressure of 101.3 kPa from the two sources do not agree. Values for 313.2 K are 0.0114 (Jou) and 0.0137 (Kassim). Data from Jou et al. extend over a wider temperature and pressure range than those published by Kassim et al. The evaluator considers Jou's data are more likely to be reliable but confirmation is desirable.

Solubilities in 3-methyl-1H-pyrazole and N-substituted pyrazoles at 24 kPa to 2533 kPa at 273.2 K to 313.2 K have been reported by Egorova et al. (12) in a deposited document. Substitution on a nitrogen increases mole fraction solubility under these conditions. No other measurements on these systems are available for comparison.

Solubility in p-azoxyphenetole was measured by Homfray (13) at 407.2 K to 442.2 K and 118 kPa. There was an apparent decrease in solubility from 418.7 K to 422.2 K followed by a small increase from 429.7 K to 439.7 K. At this temperature there was a marked increase as the solvent changed from a nematic liquid to an isotropic liquid. The solubility then decreased with rise in temperature. Values of the mole fraction solubility at 439.7 K, estimated from the data are 0.00401 (nematic phase) and 0.00549 (isotropic phase). No other work on this system is available for confirmation of these findings.

Solubility in 1-methyl-2-pyrrolidinone has been measured by at least fourteen groups (5, 11, 14-25) over various temperature ranges. Measurements by Demidova et al. (14) and by Murrrieta-Guevara et al. (15) extended to 1026 kPa and 1439 kPa respectively. Values of mole fractions solubility for a partial pressure of 101.3 kPa are scattered. Usyukin et al. (16) reported measurements from 253.2 K to 293.2 K. These measurements do not seem to be compatible with data given in the later paper from the same group (14). The evaluator considers that the most reliable measurements are those published in references (11, 15, 17, 19-23, 25) over the temperature range 263.2 K to 393.2 K. Mole fraction solubility at a partial pressure of 101.3 kPa from these sources fit the equation

\[
\ln x_{\text{CO}_2} = -14.820 + 1888.2/(T/\text{K}) + 0.7623\ln(T/\text{K})
\]

temperature range = 263.15-393.15 K
standard deviation in \(x_{\text{CO}_2}\) = 0.0011

The solubility in \(N,N\)-dimethylformamide at 27 kPa to 120 kPa from 278 K to 313 K has been published by Haldeger et al. (26). Braude et al. (27) also made measurements over a pressure range at 298.15 K to 353.15 K and reported limiting values of Henry's constant. Rosenthal (28) measured the solubility at 293.2 K and a partial pressure of 101.3 kPa and Byeseda et al. (17) at 297.1 K and 101.6 kPa. A value of the Bunsen coefficient at 298.2 K has been published by du Pont (29). Bunsen coefficients for 213.2 K to 293.2 K have been published by Usyukin and Shleynikov (16). The following equations (I) and (II) are based upon the available data for a partial pressure of 101.3 kPa.

\[
\ln x_{\text{CO}_2} = 47.613 - 159.64/(T/\text{K}) - 9.0213\ln(T/\text{K})
\]

temperature range = 213.15-353.15 K
standard deviation in \(x_{\text{CO}_2}\) = 0.0026

\[
\ln x_{\text{CO}_2} = -123.79 + 6771.8/(T/\text{K}) + 16.994\ln(T/\text{K})
\]

temperature range = 273.15-353.15 K
standard deviation in \(x_{\text{CO}_2}\) = 0.0014

Shenderei (30) measured the solubility of carbon dioxide in solutions of ethyne in \(N,N\)-dimethylformamide at 218.15 K and pressures of carbon...
CRITICAL EVALUATION:

Carbon dioxide from 13.3 kPa to 101.3 kPa. Extrapolation of the data to zero concentration of ethyne gives a mole fraction solubility of carbon dioxide of 0.169 at a partial pressure of 101.3 kPa. The corresponding value from equation (1) above is 0.1827 ±0.0026.

Solubility in nitrobenzene has been measured at pressures close to 101.3 kPa by Gjaldbaek and Andersen (3) at 298.2 K, by Luhring and Schumpe (4) at 293.2 K and by Just (1) from 288.2 K to 298.2 K. Lenoir et al. (5) published a limiting value from chromatographic measurements at 298.2 K. The value of the mole fraction solubility at 298.2 K and a partial pressure of 101.3 kPa from Gjalbaek's data is 0.01015 and from Just's data is 0.0103. The value from Lenoir's data is 0.0130 and is subject to uncertainty because of the possibility of surface adsorption during the chromatographic process. Values at 293.2 K are 0.0112 (Just) and 0.0114 (Luhring). A smoothing equation based upon work by Gjalbaek and Andersen, Just and by Luhring and Schumpe can be recommended for the limited temperature range covered.

\[
\ln x_{\text{CO}_2} = -9.583 + \frac{1492.6}{T/\text{K}}
\]

Solubility in hydrogen cyanide (31) and various nitriles (3,32,33) have been measured. A selection of values of solubilities at a partial pressure of 101.3 kPa are shown in Table 1. No estimation of the reliability of these measurements can be given.

Wehner et al. (34) reported the solubility of carbon dioxide in N-methyl-\text{c}-caprolactam at 293.2 K. Mole fraction solubility at a partial pressure of 101.3 kPa calculated from the data is close to that for dissolution in propanenitrile at 298.2 K reported by Gjalbaek and Andersen (3) but no estimation of the reliability of the measurement can be made.

The solubility in formamide at 298 K has been given by Takahashi et al. (35). The indirect method which was used is of uncertain reliability.

Selected values of mole fraction solubilities at a partial pressure of 101.3 kPa in compounds containing nitrogen are shown in Table 1 and Fig 1.

REFERENCES

COMPONENTS:
1. Carbon dioxide; CO₂; [124-38-9]
2. Solvents Containing Nitrogen

EVALUATOR:
Peter G.T. Fogg,
School of Applied Chemistry,
Polytechnic of North London,
Holloway Road, London, N7 8DB, U.K.
July 1991

CRITICAL EVALUATION:

COMPONENTS:
1. Carbon dioxide; CO₂; [124-38-9]
2. Solvents Containing Nitrogen

CRITICAL EVALUATION:


Table 1.
Mole fraction solubilities of carbon dioxide at a partial pressure of 101.3 kPa in solvents containing nitrogen

<table>
<thead>
<tr>
<th>Solvent</th>
<th>T/K</th>
<th>X_CO₂</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Benzenamine</td>
<td>298.15</td>
<td>0.00488 ±0.00004</td>
<td>*</td>
</tr>
<tr>
<td>2-Methylbenzenamine</td>
<td>298.15</td>
<td>0.00605</td>
<td>1</td>
</tr>
<tr>
<td>3-Methylbenzenamine</td>
<td>298.15</td>
<td>0.00634</td>
<td>1</td>
</tr>
<tr>
<td>Pyridine</td>
<td>298.15</td>
<td>0.01182 ±0.00013</td>
<td>*</td>
</tr>
<tr>
<td>Quinoline</td>
<td>298.15</td>
<td>0.00912</td>
<td>7†</td>
</tr>
<tr>
<td>1,1,2,2,3,3,4,4,4-Nonafluoro-N,N-bis(nonafluorobutyl)-1-butanamine</td>
<td>298.15</td>
<td>0.0200</td>
<td>8</td>
</tr>
<tr>
<td>N-Formyl morpholine</td>
<td>298.15</td>
<td>0.01475</td>
<td>10</td>
</tr>
<tr>
<td>3-Methyl-1H-pyrazole</td>
<td>298.15</td>
<td>0.0063</td>
<td>12</td>
</tr>
<tr>
<td>1,3-Dimethyl-1H-pyrazole</td>
<td>298.15</td>
<td>0.0092</td>
<td>12</td>
</tr>
<tr>
<td>1-Ethyl-3-methyl-1H-pyrazole</td>
<td>298.15</td>
<td>0.0166</td>
<td>12</td>
</tr>
<tr>
<td>Methyl(1-methylethyl)-1H-pyrazole</td>
<td>298.15</td>
<td>0.0166</td>
<td>12</td>
</tr>
<tr>
<td>Methyl(3-methylbutyl)-1H-pyrazole</td>
<td>298.15</td>
<td>0.0136</td>
<td>12</td>
</tr>
<tr>
<td>1-Methyl-2-pyrrolidinone</td>
<td>298.15</td>
<td>0.0159 ±0.0011</td>
<td>*</td>
</tr>
<tr>
<td>N,N-Dimethylformamide</td>
<td>298.15</td>
<td>0.0142 ±0.0014</td>
<td>*</td>
</tr>
<tr>
<td>Nitrobenzene</td>
<td>298.15</td>
<td>0.01029 ±0.00016</td>
<td>*</td>
</tr>
<tr>
<td>Propanenitrile</td>
<td>298.15</td>
<td>0.0169</td>
<td>3</td>
</tr>
<tr>
<td>Benzeneacetonitrile</td>
<td>298.15</td>
<td>0.0105</td>
<td>3</td>
</tr>
<tr>
<td>Hexanenitrile</td>
<td>298.15</td>
<td>0.01368</td>
<td>32</td>
</tr>
<tr>
<td>3-(Dimethylamino)propionitrile</td>
<td>303.15</td>
<td>0.0289</td>
<td>33</td>
</tr>
<tr>
<td>Hexahydro-1-methyl-2H-azepin-2-one</td>
<td>293.15</td>
<td>0.0166</td>
<td>34</td>
</tr>
</tbody>
</table>

† extrapolated
* from the equation given by the evaluator on a previous page
Fig. 1  Mole fraction solubility of carbon dioxide in various solvents containing nitrogen at a partial pressure of gas of 101.3 kPa.

a - 1-methyl-2-pyrrolidinone  
b - N,N-dimethylformamide  
c - pyridine  
d - nitrobenzene  
e - quinoline  
f - benzenamine  
g - perfluorotributylamine (8)

The curves showing the variation of solubility with temperature correspond to equations derived by the evaluator.

A reference line corresponding to values from the Raoult's law equation is also shown.
COMPONENTS:
(1) Carbon dioxide; CO₂; [124-38-9]
(2) Benzenamine or aniline; C₆H₇N; [62-53-3]

ORIGINAL MEASUREMENTS:
Just, G.
Z. Phys. Chem. 1901, 37, 342 - 367.

VARIABLES:
\[ T/K = 288.15 - 298.15 \]
\[ P_j/kPa = 101.325 \text{ (1 atm)} \]

PREPARED BY:
M. E. Derrick
H. L. Clever

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>( T/K )</th>
<th>Mol Fraction ( 10^3x_j )</th>
<th>Bunsen Coefficient ( a/cm^3(\text{STP})\text{cm}^{-3}\text{atm}^{-1} )</th>
<th>Ostwald Coefficient ( L/cm^3\text{cm}^{-3} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>288.15</td>
<td>5.84</td>
<td>1.45</td>
<td>1.531</td>
</tr>
<tr>
<td>293.15</td>
<td>5.40</td>
<td>1.34</td>
<td>1.434</td>
</tr>
<tr>
<td>298.15</td>
<td>4.93</td>
<td>1.21</td>
<td>1.324</td>
</tr>
</tbody>
</table>

The author measured the Ostwald coefficient at a pressure of about 746 mmHg. The compiler assumed the Ostwald coefficient to be independent of pressure, and calculated the mole fraction and Bunsen coefficient values at 101.325 kPa (1 atm) partial pressure of the gas.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
An Ostwald apparatus as modified by Timofejew (1), and Steiner (2) is used. The apparatus consists of a gas buret, an absorption flask, and a mercury manometer. The system is thermostated with a water jacket.

The gas is introduced into the degassed liquid. The gas volume absorbed is determined by the gas buret. The solvent volume is determined at the end of the experiment by pouring the solvent into a graduated flask.

SOURCE AND PURITY OF MATERIALS:
(1) Carbon dioxide. Generated in a Kipp apparatus using marble and hydrochloric acid.
(2) Benzenamine. No information.

ESTIMATED ERROR:
\[ \delta L/L = 0.03 \text{ (compiler)} \]

REFERENCES:
1. Timofejew, W.
   Z. Phys. Chem. 1890, 6, 141.
2. Steiner, P.
COMPONENTS:
1. Carbon dioxide; CO₂; [124-38-9]
2. Pyridine, CsH₅N; [110-86-1]
   Benzenamine (aniline); C₆H₇N; [62-53-3]

VARIABLES:
T/K = 291.15-309.15  P/kPa = 101.3

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>Solvent</th>
<th>T/K</th>
<th>Ostwald coefficient L</th>
<th>x₃O₂ at P₃O₂ = 101.3 kPa*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pyridine</td>
<td>291.15</td>
<td>3.95</td>
<td>0.01320</td>
</tr>
<tr>
<td></td>
<td>293.15</td>
<td>3.85</td>
<td>0.01281</td>
</tr>
<tr>
<td></td>
<td>295.15</td>
<td>3.75</td>
<td>0.01242</td>
</tr>
<tr>
<td></td>
<td>297.15</td>
<td>3.63</td>
<td>0.01197</td>
</tr>
<tr>
<td></td>
<td>299.15</td>
<td>3.53</td>
<td>0.01159</td>
</tr>
<tr>
<td></td>
<td>301.15</td>
<td>3.45</td>
<td>0.01128</td>
</tr>
<tr>
<td></td>
<td>303.15</td>
<td>3.33</td>
<td>0.01084</td>
</tr>
<tr>
<td></td>
<td>305.15</td>
<td>3.25</td>
<td>0.01053</td>
</tr>
<tr>
<td></td>
<td>307.15</td>
<td>3.13</td>
<td>0.01010</td>
</tr>
<tr>
<td></td>
<td>309.15</td>
<td>3.03</td>
<td>0.00974</td>
</tr>
<tr>
<td>Benzenamine</td>
<td>293.15</td>
<td>1.38</td>
<td>0.00524</td>
</tr>
<tr>
<td></td>
<td>295.15</td>
<td>1.35</td>
<td>0.00510</td>
</tr>
<tr>
<td></td>
<td>297.15</td>
<td>1.32</td>
<td>0.00496</td>
</tr>
<tr>
<td></td>
<td>299.15</td>
<td>1.29</td>
<td>0.00483</td>
</tr>
<tr>
<td></td>
<td>301.15</td>
<td>1.25</td>
<td>0.00465</td>
</tr>
<tr>
<td></td>
<td>303.15</td>
<td>1.22</td>
<td>0.00452</td>
</tr>
<tr>
<td></td>
<td>305.15</td>
<td>1.21</td>
<td>0.00446</td>
</tr>
<tr>
<td></td>
<td>307.15</td>
<td>1.19</td>
<td>0.00437</td>
</tr>
</tbody>
</table>
|             | 309.15| 1.17                  | 0.00427                   * calculated by the compiler

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
The method is based upon that described by McDaniel (1). The apparatus consisted of a gas buret attached to a levelling tube containing mercury and to the absorption cell containing the solvent under test. The volume of gas absorbed by a measured volume of liquid was measured at a total pressure equal to barometric pressure. The mercury in the gas buret was covered with a layer of solvent so that the gas in the buret was saturated with solvent vapor. Buret and absorption cell were surrounded by heating wire and water jackets fitted with thermometers.

SOURCE AND PURITY OF MATERIALS:
1. produced by heating NaHCO₃; dried with CaCl₂; frozen in liquid air and volatile impurities pumped away; passed over P₂O₅.
2. commercial sample; purity attested by boiling point and density.

ESTIMATED ERROR:
δx₃O₂ = ±5%  (compiler)

REFERENCES:
COMPONENTS:
(1) Carbon dioxide; CO₂; [124-38-9]
(2) Benzenamine or aniline; C₆H₇N; [62-53-3]

VARIABLES:
T/K = 298.15
P₁/kPa = 101.325 (1 atm)

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>Mol Fraction (x₁)</th>
<th>Bunsen Coefficient (a/cm³(STP)cm⁻³atm⁻¹)</th>
<th>Ostwald Coefficient (L/cm³cm⁻³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>298.15</td>
<td>4.99</td>
<td>1.22</td>
<td>1.33</td>
</tr>
<tr>
<td></td>
<td>4.83</td>
<td>1.18</td>
<td>1.29</td>
</tr>
</tbody>
</table>

The mole fraction and Ostwald coefficient values were calculated by the compiler.

METHOD/APPARATUS/PROCEDURE:
The apparatus consists of a calibrated all-glass manometer and bulb enclosed in an air thermostat. The solvent is added and degassed in the apparatus. The gas is added. The apparatus and contents are shaken until equilibrium is attained. Mercury is used for calibration and as the confining liquid.
The absorbed volume of gas is calculated from the initial and final amounts of gas, both saturated with solvent vapor. The amount of solvent is determined by the weight of displaced mercury. Further details are in the references (1, 2).
The mole fraction values are at one atm pressure assuming Henry's law is obeyed.

SOURCE AND PURITY OF MATERIALS:
(1) Carbon dioxide. Prepared from potassium bicarbonate and sulfuric acid. 99.8 - 99.9% CO₂.
(2) Benzenamine. Merck and Co. Puriss. Fractional distillation in vacuum. B.p. (760 mmHg)/°C = 184.32 - 184.34, refractive index nD(20°C) = 1.5864.

ESTIMATED ERROR:
\[\delta T/K = \pm 0.05\]
\[\delta x_1 / x_1 = \pm 0.015\]

REFERENCES:
COMPONENTS:
1. Carbon dioxide; CO₂; [124-38-9]
2. Benzenamine, (aniline); C₆H₇N; [62-53-3]

ORIGIANAL MEASUREMENTS:
Lenoir, J-Y.; Renault, P.; Renon, H.

VARIABLES:
T/K = 298.2

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>Henry's constant, H/ atm</th>
<th>CO₂ at P_CO₂ = 101.3 kPa*</th>
</tr>
</thead>
<tbody>
<tr>
<td>298.2</td>
<td>127</td>
<td>12868</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.00787</td>
</tr>
</tbody>
</table>

* calculated by the compiler assuming that x_CO₂ = P_CO₂ / H

AUXILIARY INFORMATION

METHOD APPARATUS/PROCEDURE:
A conventional gas-liquid chromatographic unit was used with helium as carrier gas. Values of Henry's constant were calculated from retention times extrapolated to zero sample size. Values correspond to very low partial pressure of carbon dioxide. Surface adsorption can cause appreciable errors in this method of measuring Henry's law constants.

SOURCE AND PURITY OF MATERIALS:
1. Sample from L'Air Liquide; minimum purity 99.9 mol%
2. Sample from Touzart and Matignon or from Serlabo of purity 99 mol%

ESTIMATED ERROR:
δT/K = ±0.1 (estimated by compiler)

REFERENCES:
COMPONENTS:
1. Carbon dioxide; CO₂; [124-38-9]
2. Nitrobenzene; C₆H₅NO₂; [98-95-3]
   or Benzenamine, (aniline); C₆H₅N; [62-53-3]

ORIGINAL MEASUREMENTS:
Luhring, P.; Schumpe, A.

VARIABLES:
T/K = 293.2

PREPARED BY:
C.L. Young

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>Henry's Constant†/(Pa m²/mol⁻¹)</th>
<th>Mole fraction of CO₂ at 101.3 kPa (1 atm) partial pressure*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>293.2</td>
<td>905</td>
<td>0.01146</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>293.2</td>
<td>1702</td>
<td>0.005426</td>
</tr>
</tbody>
</table>

†referred to as Henry’s constant in source but appears to be usual Henry’s constant multiplied by molar volume.
*calculated by compiler using density data taken from ref. (1).

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE
Little information given in source. Method consisted of equilibrating known amounts of degassed liquid and gas and measuring the change in pressure. Equilibration was reached in 3 to 6 minutes. Some details given in ref.

SOURCE AND PURITY OF MATERIALS:
Obtained from Merck at the highest available purity. No other details given.

ESTIMATED ERROR:
δT/K = ± 0.1 (authors)
δx/x = ± 0.01 to 0.15 (compiler)

REFERENCES:
COMPONENTS:
(1) Carbon dioxide; CO₂; [124-38-9]
(2) 3-Methyl-benzenamine or m-toluidine; C₇H₉N; [108-44-1]

ORIGINAL MEASUREMENTS:
Just, G.
Z. Phys. Chem. 1901, 37, 342 - 367.

VARIABLES:
\[ T/K = 288.15 - 298.15 \]
\[ P_1/kPa = 101.325 \text{ (1 atm)} \]

PREPARED BY:
M. E. Derrick
H. L. Clever

EXPERIMENTAL VALUES:
<table>
<thead>
<tr>
<th>T/K</th>
<th>Mol Fraction $10^3x_1$</th>
<th>Bunsen Coefficient $a/cm^3(STP)cm^{-3}atm^{-1}$</th>
<th>Ostwald Coefficient $L/cm^3cm^{-3}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>288.15</td>
<td>7.83</td>
<td>1.64</td>
<td>1.730</td>
</tr>
<tr>
<td>293.15</td>
<td>7.07</td>
<td>1.47</td>
<td>1.581</td>
</tr>
<tr>
<td>298.15</td>
<td>6.34</td>
<td>1.32</td>
<td>1.436</td>
</tr>
</tbody>
</table>

The author measured the Ostwald coefficient at a pressure of about 746 mmHg. The compiler assumed the Ostwald coefficient to be independent of pressure, and calculated the mole fraction and Bunsen coefficient values at 101.325 kPa (1 atm) partial pressure of the gas.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
An Ostwald apparatus as modified by Timofejew (1), and Steiner (2) is used. The apparatus consists of a gas buret, an absorption flask, and a mercury manometer. The system is thermostated with a water jacket.

The gas is introduced into the degassed liquid. The gas volume absorbed is determined by the gas buret. The solvent volume is determined at the end of the experiment by pouring the solvent into a graduated flask.

SOURCE AND PURITY OF MATERIALS:
(1) Carbon dioxide. Generated in a Kipp apparatus using marble and hydrochloric acid.
(2) 3-Methyl-benzenamine. No information.

ESTIMATED ERROR:
\[ \delta L/L = 0.03 \text{ (compiler)} \]

REFERENCES:
1. Timofejew, W.
Z. Phys. Chem. 1890, 8, 141.
2. Steiner, P.
COMPONENTS:
(1) Carbon dioxide; CO₂; [124-38-9]
(2) 2-Methyl-benzenamine or o-toluidine; C₇H₉N; [95-53-4]

VARIABLES:
\[ T/K = 288.15 - 298.15 \]
\[ p_f/kPa = 101.325 \text{ (1 atm)} \]

PREPARED BY:
M. E. Derrick
H. L. Clever

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>Mol Fraction</th>
<th>Bunsen Coefficient ( a/cm^3 \text{(STP)}cm^{-3} \text{atm}^{-1} )</th>
<th>Ostwald Coefficient ( L/cm^3 \text{cm}^{-3} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>288.15</td>
<td>6.91</td>
<td>1.46</td>
<td>1.539</td>
</tr>
<tr>
<td>293.15</td>
<td>6.53</td>
<td>1.37</td>
<td>1.473</td>
</tr>
<tr>
<td>298.15</td>
<td>6.05</td>
<td>1.27</td>
<td>1.381</td>
</tr>
</tbody>
</table>

The author measured the Ostwald coefficient at a pressure of about 746 mmHg. The compiler assumed the Ostwald coefficient to be independent of pressure, and calculated the mole fraction and Bunsen coefficient values at 101.325 kPa (1 atm) partial pressure of the gas.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
An Ostwald apparatus as modified by Timofejew (1), and Steiner (2) is used. The apparatus consists of a gas buret, an absorption flask, and a mercury manometer. The system is thermostated with a water jacket.

The gas is introduced into the degassed liquid. The gas volume absorbed is determined by the gas buret. The solvent volume is determined at the end of the experiment by pouring the solvent into a graduated flask.

SOURCE AND PURITY OF MATERIALS:
(1) Carbon dioxide. Generated in a Kipp apparatus using marble and hydrochloric acid.
(2) 2-Methyl-benzenamine. No information.

ESTIMATED ERROR:
\[ \delta L/L = 0.03 \text{ (compiler)} \]

REFERENCES:
1. Timofejew, W.
   Z. Phys. Chem. 1890, 6, 141.
2. Steiner, P.
COMPONENTS:
(1) Carbon dioxide; CO\textsubscript{2}; [124-38-9]
(2) Pyridine; C\textsubscript{5}H\textsubscript{5}N; [110-86-1]

ORIGINAL MEASUREMENTS:
Just, G.
Z. Phys. Chem. 1901, 37, 342 - 367.

VARIABLES:
\[ T/K = 288.15 - 298.15 \]
\[ p_j/kPa = 101.325 \text{ (1 atm)} \]

PREPARED BY:
M. E. Derrick
H. L. Clever

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>Mol Fraction (10^2x_j)</th>
<th>Bunsen Coefficient (a/cm^3\text{(STP)}cm^{-3}\text{atm}^{-1})</th>
<th>Ostwald Coefficient (L/cm^3\text{cm}^{-3})</th>
</tr>
</thead>
<tbody>
<tr>
<td>288.15</td>
<td>14.32</td>
<td>4.07</td>
<td>4.291</td>
</tr>
<tr>
<td>293.15</td>
<td>12.75</td>
<td>3.60</td>
<td>3.862</td>
</tr>
<tr>
<td>298.15</td>
<td>11.94</td>
<td>3.35</td>
<td>3.656</td>
</tr>
</tbody>
</table>

The author measured the Ostwald coefficient at a pressure of about 746 mmHg. The compiler assumed the Ostwald coefficient to be independent of pressure, and calculated the mole fraction and Bunsen coefficient values at 101.325 kPa (1 atm) partial pressure of the gas.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
An Ostwald apparatus as modified by Timofejew (1), and Steiner (2) is used. The apparatus consists of a gas buret, an absorption flask, and a mercury manometer. The system is thermostated with a water jacket.

The gas is introduced into the degassed liquid. The gas volume absorbed is determined by the gas buret. The solvent volume is determined at the end of the experiment by pouring the solvent into a graduated flask.

SOURCE AND PURITY OF MATERIALS:
(1) Carbon dioxide. Generated in a Kipp apparatus using marble and hydrochloric acid.
(2) Pyridine. No information.

ESTIMATED ERROR:
\( \delta L/L = 0.03 \) (compiler)

REFERENCES:
1. Timofejew, W.
   Z. Phys. Chem. 1890, 6, 141.
2. Steiner, P.
COMPONENTS:
(1) Carbon dioxide; CO₂; [124-38-9]
(2) Pyridine; C₅H₅N; [110-86-1]

ORIGINAL MEASUREMENTS:
Gjaldbaek, J. C.; Andersen, E. K.

VARIABLES:

\[
\begin{align*}
T/K &= 298.15 \\
P_I/kPa &= 101.325 \text{ (1 atm)}
\end{align*}
\]

PREPARED BY:
J. Chr. Gjaldbaek

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>Mol Fraction</th>
<th>Bunsen Coefficient (a/cm^3\text{(STP)}\text{cm}^{-3}\text{atm}^{-1})</th>
<th>Ostwald Coefficient (L/cm^3\text{cm}^{-3})</th>
</tr>
</thead>
<tbody>
<tr>
<td>298.15</td>
<td>1.22</td>
<td>3.38</td>
<td>3.69</td>
</tr>
<tr>
<td></td>
<td>1.20</td>
<td>3.34</td>
<td>3.65</td>
</tr>
</tbody>
</table>

The mole fraction and Ostwald coefficient values were calculated by the compiler.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
The apparatus consists of a calibrated all-glass manometer and bulb enclosed in an air thermostat. The solvent is added and degassed in the apparatus. The gas is added. The apparatus and contents are shaken until equilibrium is attained. Mercury is used for calibration and as the confining liquid.

The absorbed volume of gas is calculated from the initial and final amounts of gas, both saturated with solvent vapor. The amount of solvent is determined by the weight of displaced mercury. Further details are in the references (1, 2).

The mole fraction values are at one atm pressure assuming Henry's law is obeyed.

SOURCE AND PURITY OF MATERIALS:
(1) Carbon dioxide. Prepared from potassium bicarbonate and sulfuric acid. 99.8 - 99.9 % CO₂
(2) Pyridine. Fractionated by distillation. B.p. (760 mmHg)/°C = 115.51 - 115.55, refractive index \(n_D(20 \degree C) = 1.5100 - 1.5101\).

ESTIMATED ERROR:
\[
\begin{align*}
\delta T/K &= \pm 0.05 \\
\delta x_I/x_I &= \pm 0.015
\end{align*}
\]

REFERENCES:
1. Lannung, A.
J. Am. Chem. Soc. 1930, 52, 68.
2. Gjaldbaek, J. C.
COMPONENTS:
1. Carbon dioxide; CO₂; [124-38-9]
2. Quinoline; C₉H₇N; [91-22-5]

ORIGINAL MEASUREMENTS:
Horvath, M. J.; Sebastian, H. M.; Chao, K.-C.

VARIABLES:
\[ T/K = 300 \]
\[ P/kPa = 101.3 \]

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>Henry's constant /atm</th>
<th>Mole fraction of carbon dioxide in liquid, ( x_{CO₂} ) †</th>
</tr>
</thead>
<tbody>
<tr>
<td>300</td>
<td>106</td>
<td>0.00939</td>
</tr>
</tbody>
</table>

† at a partial pressure of carbon dioxide of 101.3 kPa calculated by compiler assuming \( \phi = 0.995 \).

METHOD/APPARATUS/PROCEDURE:
Gas chromatographic analysis of a saturated solution at barometric pressure. Henry's constants determined from formula

\[ H = (p - p_o) \phi (m + 1)/m \]

where \( p \) is the total pressure, \( p_o \) the vapor pressure of the solvent and \( \phi \) is the fugacity coefficient of the gas. The mole ratio, \( m \), is defined by

\[ m = \frac{\text{Moles of carbon dioxide in gas phase}}{\text{Moles of carbon dioxide in liquid phase}} \]

REFERENCES:

1. No details given.
2. Purity 99.75 mole per cent.

ESTIMATED ERROR:
\( \delta T/K = \pm 0.25; \delta H/atm = \pm 3\%
(estimated by compiler).

SOURCE AND PURITY OF MATERIALS:

1. No details given.
2. Purity 99.75 mole per cent.
COMPONENTS:

1. Carbon dioxide; CO$_2$; [124-38-9]
2. Quinoline; C$_9$H$_7$N; [91-22-5]

ORIGINAL MEASUREMENTS:

Chai, C-P.; Paulaitis, M. E.;

VARIABLES:

$T/K = 298.6 - 330.2$

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>$T/K$</th>
<th>Henry's constant /atm of carbon dioxide</th>
<th>Mole fraction$^a$</th>
<th>$T/K$</th>
<th>Henry's constant /atm of carbon dioxide</th>
<th>Mole fraction$^a$</th>
</tr>
</thead>
<tbody>
<tr>
<td>298.6</td>
<td>110.51</td>
<td>0.0090490</td>
<td>316.2</td>
<td>146.97</td>
<td>0.0068041</td>
</tr>
<tr>
<td>298.6</td>
<td>111.66</td>
<td>0.0089558</td>
<td>316.2</td>
<td>144.79</td>
<td>0.0069066</td>
</tr>
<tr>
<td>302.7</td>
<td>110.36</td>
<td>0.0084488</td>
<td>320.2</td>
<td>153.72</td>
<td>0.0065053</td>
</tr>
<tr>
<td>302.7</td>
<td>117.17</td>
<td>0.0085346</td>
<td>320.2</td>
<td>151.20</td>
<td>0.0066138</td>
</tr>
<tr>
<td>302.7</td>
<td>118.09</td>
<td>0.0084681</td>
<td>320.2</td>
<td>152.81</td>
<td>0.0065440</td>
</tr>
<tr>
<td>307.1</td>
<td>127.15</td>
<td>0.0078647</td>
<td>323.6</td>
<td>160.83</td>
<td>0.0062177</td>
</tr>
<tr>
<td>307.1</td>
<td>128.68</td>
<td>0.0077712</td>
<td>323.6</td>
<td>162.81</td>
<td>0.0061421</td>
</tr>
<tr>
<td>311.0</td>
<td>134.52</td>
<td>0.0074338</td>
<td>323.6</td>
<td>160.03</td>
<td>0.0062488</td>
</tr>
<tr>
<td>311.0</td>
<td>133.06</td>
<td>0.0075154</td>
<td>330.2</td>
<td>172.07</td>
<td>0.0058116</td>
</tr>
<tr>
<td>316.2</td>
<td>144.74</td>
<td>0.0069089</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

$^a$ Calculated by compiler for a partial pressure of

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Volumetric apparatus similar to that described in ref.(1). Known amount of carbon dioxide brought into contact with known amount of solvent. Reduction in pressure measured.

SOURCE AND PURITY OF MATERIALS:

1. Linde "bone dry" grade.
2. Fisher certified grade.

ESTIMATED ERROR:

REFERENCES:

1. Dymond, J. H.; Hildebrand, J. H.;
COMPONENTS:
(1) Carbon dioxide; CO_2; [124-38-9]
(2) 1,1,2,2,3,3,4,4,4-Nonafluoro-N,N-bis(nonafluorobutyl)-1-
butanamine or perfluorotributylamine; [311-89-7]

ORIGINAL MEASUREMENTS:
Kobatake, Y.; Hildebrand, J. H.

VARIABLES:
T/K: 277.16 - 304.30
P/kPa: 101.325 (1 atm)

PREPARED BY:
M. E. Derrick
H. L. Clever

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>Temperature (°C)</th>
<th>Mol Fraction (10^2 x_i)</th>
<th>Bunsen Coefficient (a/cm^2(STP) cm^-1 atm^-1)</th>
<th>Ostwald Coefficient (L/cm s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.01 277.16</td>
<td>2.606</td>
<td>1.76</td>
<td>1.79</td>
</tr>
<tr>
<td>9.52 282.67</td>
<td>2.363</td>
<td>1.57</td>
<td>1.62</td>
</tr>
<tr>
<td>17.98 291.13</td>
<td>2.179</td>
<td>1.42</td>
<td>1.51</td>
</tr>
<tr>
<td>24.87 298.02</td>
<td>2.000</td>
<td>1.28</td>
<td>1.40</td>
</tr>
<tr>
<td>25.00 298.15</td>
<td>2.000</td>
<td>1.28</td>
<td>1.40</td>
</tr>
<tr>
<td>31.15 304.30</td>
<td>1.850</td>
<td>1.17</td>
<td>1.30</td>
</tr>
</tbody>
</table>

The Bunsen and Ostwald coefficients were calculated by the compiler.

Smoothed Data: For use between 277.16 and 304.30 K.

\[ \ln x_i = -7.3441 + 10.2213/(T/100K) \]

The standard error about the regression line is 2.54 x 10^-4.

<table>
<thead>
<tr>
<th>Temperature (T/K)</th>
<th>Mol Fraction (10^2 x_i)</th>
</tr>
</thead>
<tbody>
<tr>
<td>278.15</td>
<td>2.549</td>
</tr>
<tr>
<td>283.15</td>
<td>2.389</td>
</tr>
<tr>
<td>288.15</td>
<td>2.244</td>
</tr>
<tr>
<td>293.15</td>
<td>2.112</td>
</tr>
<tr>
<td>298.15</td>
<td>1.992</td>
</tr>
<tr>
<td>303.15</td>
<td>1.883</td>
</tr>
</tbody>
</table>

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
The apparatus consists of a gas measuring buret, an absorption pipet, and a reservoir for the solvent. The buret is thermostatted at 25°C, the pipet at any temperature from 5 to 30°C. The pipet contains an iron bar in glass for magnetic stirring. The pure solvent is degassed by freezing with liquid nitrogen, evacuating, then boiling with a heat lamp. The degassing process is repeated three times. The solvent is flowed into the pipet where it is again boiled for final degassing. Manipulation of the apparatus is such that the solvent never comes in contact with stopcock grease. The liquid in the pipet is sealed off by mercury. Its volume is the difference between the capacity of the pipet and the volume of mercury that confines it. Gas is admitted into the pipet. Its exact amount is determined by P-V measurements in the buret before and after introduction of the gas into the pipet. The stirrer is set in motion. Equilibrium is attained within 24 hours.

SOURCE AND PURITY OF MATERIALS:
(1) Carbon dioxide. California Dry Ice Co. Standard grade. Dried by passing through a trap at dry ice-acetone temperature, and tubes containing CaCl_2 then P_2O_5. The dried gas was distilled at liquid N_2 temperature several times.
(2) Perfluorotributylamine. Minnesota Mining and Manufacturing Co. Dried, fractionated, boiling point 178.5 - 179.0°C. Density, g/cm^3 = 1.872.

ESTIMATED ERROR:
\[ \delta T/K = 0.02 \]
\[ \delta x_i/x_i = 0.003 \]

REFERENCES;
COMPONENTS:
(1) Carbon dioxide; CO₂; [124-38-9]
(2) FC-47, which is largely perfluorotributylamine or 1,1,2,2,3,3,4,4,4-nonafluoro-N,N-bis (nonafluorobutyl)-1-butanamine; C₁₂F₂₇N; [311-89-7]

VARIABLES:
T/K: 298.15, 310.15
Total P/kPa: 101.325 (1 atm)

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>Temperature</th>
<th>Carbon Dioxide Solubility</th>
</tr>
</thead>
<tbody>
<tr>
<td>t/°C</td>
<td>T/K</td>
</tr>
<tr>
<td>25</td>
<td>298.15</td>
</tr>
<tr>
<td>37</td>
<td>310.15</td>
</tr>
</tbody>
</table>

The authors solubility, cm³ CO₂ 100 cm⁻³, appears to be the Ostwald coefficient times 100.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
The equilibrium apparatus is a 50 cm³ three neck flask equipped with a water condenser, a thermometer, and a gas dispersing tube extending below the fluid surface level. Between 25 and 35 cm³ of solvent are placed in the flask. Gas is bubbled through the solvent for 2 - 3 h. An 80 micro-liter sample is slowly taken into a gas tight syringe. The sample is injected into a gas chromatograph. The results of three sampling and analyses are averaged.

The chromatograph is an F and M Model 720 equipped with a thermal conductivity detector at 320 °C, and a 6' by 4" stainless steel column packed with 50/80 mesh Parapak-P at room temperature. The apparatus is calibrated with pure gas samples.

Details of the procedure were furnished by R. D. Danielson of the 3 M Co.

SOURCE AND PURITY OF MATERIALS:
(1) Carbon dioxide. Source not given. Commercial cylinder, or dry ice.
(2) FC-47. Minnesota Mining and Manufacturing Co. All H in an organic compound are replaced by F by Simons electrochemical process (1)

ESTIMATED ERROR:
ΔT/K = 0.1
Δc/c = 0.01 (reproducibility)
0.05 (absolute)
(c = concentration of carbon dioxide)

REFERENCES:
1. Simons, J. H., Editor
Fluorine Chemistry
COMPONENTS:
1. Carbon dioxide; CO₂; [124-38-9]
2. 4-Morpholinecarboxaldehyde (4-formylmorpholine); C₅H₇NO₂; [4394-85-8]

ORIGINAL MEASUREMENTS:
Kassim, D.M.; Zainel, H.A.; Al-Asof, S.A.; Talib, E.K.
Fluid Phase Equilibria

VARIABLES:
T/K = 303.15-333.15
P/kPa = 101.3

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>Mole fraction of carbon dioxide in liquid, x_CO₂, at P_CO₂ = 101.3 kPa</th>
</tr>
</thead>
<tbody>
<tr>
<td>303.15</td>
<td>0.0157</td>
</tr>
<tr>
<td>313.15</td>
<td>0.0137</td>
</tr>
<tr>
<td>323.15</td>
<td>0.0120</td>
</tr>
<tr>
<td>333.15</td>
<td>0.0098</td>
</tr>
</tbody>
</table>

METHOD/APPARATUS/PROCEDURE:
Falling film flow apparatus similar to that of Morrison and Billet (1). Apparatus consisted of (i) degassing section in which solvent could be degassed by freezing and thawing under vacuum and (ii) absorption section. The latter consisted of a gas buret and absorption spiral. Mole fraction solubility corrected to 1 atm partial pressure by assuming Henry's law was valid.

SOURCE AND PURITY OF MATERIALS:
1. Purity 99.99 mole per cent.
2. Fluka AG puriss grade sample, purity better than 99 mole per cent.

ESTIMATED ERROR:
δT/K = ±0.1; δx/x = ±0.02
(estimated by compiler).

REFERENCES:
1. Morrison, T.J.; Billet, F.J.
COMPONENTS:

1. Carbon dioxide; CO₂; [124-38-9]
2. 4-Morpholinecarboxaldehyde, (N-formyl morpholine); C₅H₈NO₂; [4394-85-8]

VARIABLES:

\[ P/\text{kPa} = 0.8-7000 \]
\[ T/K = 398.15-403.15 \]

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>Henry's Constant ( k_{21}/\text{kPa} )</th>
<th>( \bar{V}^\infty/\text{cm}^3\text{mol}^{-1} )</th>
<th>( A/RT )</th>
<th>( x_{\text{CO}} ) at 101.3 kPa*</th>
</tr>
</thead>
<tbody>
<tr>
<td>298.15</td>
<td>6890</td>
<td>35.55</td>
<td>0.099</td>
<td>0.01475</td>
</tr>
<tr>
<td>313.15</td>
<td>8920</td>
<td>36.60</td>
<td>0.105</td>
<td>0.01139</td>
</tr>
<tr>
<td>343.15</td>
<td>13800</td>
<td>38.93</td>
<td>0.121</td>
<td>0.00735</td>
</tr>
<tr>
<td>373.15</td>
<td>19600</td>
<td>41.60</td>
<td>0.142</td>
<td>0.00518</td>
</tr>
<tr>
<td>403.15</td>
<td>25900</td>
<td>44.69</td>
<td>0.168</td>
<td>0.00392</td>
</tr>
</tbody>
</table>

* calculated by the compiler from the parameters for the Krichevsky-Il'inskaya equation given above.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The solubility of carbon dioxide in N-formyl morpholine was measured at five temperatures over a partial pressure range from 0.8 kPa to about 7000 kPa using apparatus and procedure described earlier (1). Where necessary nitrogen was added to maintain a total pressure above 200 kPa. The gas phase was analysed by gas chromatography. The liquid phase was analysed by absorption of dissolved gas in sodium hydroxide solution and subsequent estimation of carbonate by precipitation as barium carbonate. The data were correlated by the Peng-Robinson equation of state as described earlier (2). Relationships described by Bender et al. (3) were used to obtain parameters of the Krichevsky-Il'inskaya equation (4) which are given above.

SOURCE AND PURITY OF MATERIALS:

No information

ESTIMATED ERROR:

\( \delta T/K = \pm 0.5 \)

REFERENCES:

COMPONENTS:

1. Carbon dioxide; CO₂; [124-38-9]
2. 3-Methyl-1H-pyrazole; C₄H₆N₂; [1453-58-3]

VARIABLES:

\[ P/\text{kPa} = 60-2533; \ T/K = 273-313 \]

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>( T/K )</th>
<th>( P/\text{mmHg} )</th>
<th>( P/\text{kPa} )</th>
<th>Solubility* vol/vol</th>
<th>( H/\text{mmHg} )**</th>
<th>( x_{\text{CO}_2} )+</th>
</tr>
</thead>
<tbody>
<tr>
<td>273.15</td>
<td>760</td>
<td>101.33</td>
<td>83500</td>
<td>0.0091</td>
<td></td>
</tr>
<tr>
<td>283.15</td>
<td>760</td>
<td>101.33</td>
<td>87600</td>
<td>0.0087</td>
<td></td>
</tr>
<tr>
<td>298.15</td>
<td>450</td>
<td>60.00</td>
<td>1.02 f</td>
<td>120600</td>
<td>0.0063</td>
</tr>
<tr>
<td>313.15</td>
<td>760</td>
<td>101.33</td>
<td>1.56 f</td>
<td>158300</td>
<td>0.0048</td>
</tr>
</tbody>
</table>

* Solubility of carbon dioxide was given as the volume of gas, reduced to 273.15 K and 101.325 kPa absorbed by unit volume of the solvent.

** Henry's law constant, \( H \), was defined by the authors as mole fraction solubility at a pressure of 760 mmHg

\( 760 \ \text{mmHg} \)

It is not constant over the pressure range at which measurements were made.

† calculated by the compiler

‡ extrapolated value

Measurements were also given for 100 and 200 mmHg at 298.15 K. These appear to have been subject to typing errors. Solubilities at 273.15 and 313.15 K in the range 10 to 25 atm (1013-2533 kPa) are given in graphical form.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The volume of gas absorbed by the solvent held in a thermostatted cell was measured at various pressures. The temperature was controlled to \( \pm 0.1 \) K.

SOURCE AND PURITY OF MATERIALS:

2. b.pt 204°C.

ESTIMATED ERROR:

\( \delta T/K = \pm 0.1 \)

REFERENCES:
COMPONENTS:
1. Carbon dioxide; CO₂; [124-38-9]
2. 1,3-Dimethyl-1H-pyrazole; C₅H₆N₂; [694-48-4]

Egorova, V.I.; Grishko, N.I.; Neokladnova, L.N.; Furmanov, A.S.; Podvigailova, I.G.
Deposited Document 1976, VINITI 2907-76

VARIABLES:
P/kPa = 29-2533; T/K = 273-313

PREPARED BY:
P.G.T. Fogg

EXPERIMENTAL VALUES:
<table>
<thead>
<tr>
<th>T/K</th>
<th>P/mmHg</th>
<th>P/kPa</th>
<th>Solubility* vol/vol</th>
<th>H/mmHg**</th>
<th>x₉Co₂†</th>
</tr>
</thead>
<tbody>
<tr>
<td>273.15</td>
<td>760</td>
<td>101.33</td>
<td>36310</td>
<td>0.0209</td>
<td></td>
</tr>
<tr>
<td>283.15</td>
<td>760</td>
<td>101.33</td>
<td>38090</td>
<td>0.0200</td>
<td></td>
</tr>
<tr>
<td>298.15</td>
<td>760</td>
<td>101.33</td>
<td>36740</td>
<td>0.0200</td>
<td></td>
</tr>
<tr>
<td>298.15</td>
<td>760</td>
<td>101.33</td>
<td>38090</td>
<td>0.0200</td>
<td></td>
</tr>
</tbody>
</table>

* Solubility of carbon dioxide was given as the volume of gas, reduced to 273.15 K and 101.325 kPa absorbed by unit volume of the solvent.

** Henry's law constant, H, was defined by the authors as mole fraction solubility at a pressure of 760 mmHg.

† calculated by the compiler. The density was taken to be equal to 0.936, the value for 1-ethyl-3-methyl-1H-pyrazole at 293.15 K (1).

REFERENCES:
COMPONENTS:

1. Carbon dioxide; CO₂; [124-38-9]
2. 1-Ethyl-3-methyl-1H-pyrazole; C₆H₁₀N₂; [30433-57-9]

VARIABLES:

P/kPa = 25-101; T/K = 298

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>P/mmHg</th>
<th>P/kPa</th>
<th>Solubility* vol/vol</th>
<th>x₁CO₂ **</th>
</tr>
</thead>
<tbody>
<tr>
<td>298.15</td>
<td>189</td>
<td>25.20</td>
<td>0.82</td>
<td>0.0043</td>
</tr>
<tr>
<td>257</td>
<td>34.26</td>
<td>1.09</td>
<td>0.0057</td>
<td></td>
</tr>
<tr>
<td>392</td>
<td>52.26</td>
<td>1.68</td>
<td>0.0088</td>
<td></td>
</tr>
<tr>
<td>447</td>
<td>59.60</td>
<td>1.93</td>
<td>0.0101</td>
<td></td>
</tr>
<tr>
<td>760</td>
<td>101.33</td>
<td>3.20†</td>
<td>0.0166</td>
<td></td>
</tr>
</tbody>
</table>

* Solubility of carbon dioxide was given as the volume of gas, reduced to 273.15 K and 101.325 kPa absorbed by unit volume of the solvent.

** calculated by the compiler from the density of solvent given in ref.(1).

† extrapolated value

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
The volume of gas absorbed by the solvent held in a thermostatted cell was measured at various pressures. The temperature was controlled to ±0.1 K.

SOURCE AND PURITY OF MATERIALS:
No information

ESTIMATED ERROR:
δT/K = ±0.1

REFERENCES:
**COMPONENTS:**

1. Carbon dioxide; CO₂; [124-38-9]
2. Methyl(1-methylethyl)-1H-pyrazole; C₇H₁₂N₂; [67759-35-7]

**VARIABLES:**

P/kPa = 24-101; T/K = 298

**EXPERIMENTAL VALUES:**

<table>
<thead>
<tr>
<th>T/K</th>
<th>P/mmHg</th>
<th>P/kPa</th>
<th>Solubility* vol/vol</th>
<th>x_CO₂ **</th>
</tr>
</thead>
<tbody>
<tr>
<td>298.15</td>
<td>183</td>
<td>24.40</td>
<td>0.65</td>
<td>0.00386</td>
</tr>
<tr>
<td>286</td>
<td>38.13</td>
<td>0.91</td>
<td>0.0054</td>
<td></td>
</tr>
<tr>
<td>431</td>
<td>57.46</td>
<td>1.57</td>
<td>0.0093</td>
<td></td>
</tr>
<tr>
<td>495</td>
<td>65.99</td>
<td>1.87</td>
<td>0.0110</td>
<td></td>
</tr>
<tr>
<td>760</td>
<td>101.33</td>
<td>2.83 †</td>
<td>0.0166</td>
<td></td>
</tr>
</tbody>
</table>

* Solubility of carbon dioxide was given as the volume of gas, reduced to 273.15 K and 101.325 kPa absorbed by unit volume of the solvent.

** calculated by the compiler. The density was taken to be equal to 0.936, the value for 1-ethyl-3-methyl-1H-pyrazole at 293.15 K (1).

† extrapolated value

**AUXILIARY INFORMATION**

**METHOD/APPARATUS/PROCEDURE:**

The volume of gas absorbed by the solvent held in a thermostatted cell was measured at various pressures. The temperature was controlled to ±0.1 K.

**SOURCE AND PURITY OF MATERIALS:**

No information

**ESTIMATED ERROR:**

δT/K = ±0.1

**REFERENCES:**

**COMPONENTS:**

1. Carbon dioxide; CO₂; [124-38-9]
   
2. Methyl(3-methylbutyl)-1H-pyrazole; C₉H₁₆N₂; [67759-37-9]

**ORIGINAL MEASUREMENTS:**

Egorova, V.I.; Grishko, N.I.; Neokladnova, L.N.; Furmanov, A.S.; Podvigailova, I.G.

*Deposited Document 1976, VINITI 2907-76*

**VARIABLES:**

\[ P/\text{kPa} = 30-101; \ T/K = 298 \]

**EXPERIMENTAL VALUES:**

<table>
<thead>
<tr>
<th>( T/K )</th>
<th>( P/\text{mmHg} )</th>
<th>( P/\text{kPa} )</th>
<th>Solubility* vol/vol</th>
<th>( x_{\text{CO}_2} ) **</th>
</tr>
</thead>
<tbody>
<tr>
<td>298.15</td>
<td>223</td>
<td>29.73</td>
<td>0.52</td>
<td>0.0038</td>
</tr>
<tr>
<td>342</td>
<td>45.60</td>
<td>67.06</td>
<td>1.26</td>
<td>0.0091</td>
</tr>
<tr>
<td>503</td>
<td>74.66</td>
<td>101.33</td>
<td>1.88†</td>
<td>0.0136</td>
</tr>
</tbody>
</table>

* Solubility of carbon dioxide was given as the volume of gas, reduced to 273.15 K and 101.325 kPa absorbed by unit volume of the solvent.

** calculated by the compiler. The density of the solvent was assumed to be the same as that of 1-ethyl-3-methyl-1H-pyrazole, 0.936 g cm⁻³ at 293 K (1).

† extrapolated value

**AUXILIARY INFORMATION**

**METHOD/APPARATUS/PROCEDURE:**

The volume of gas absorbed by the solvent held in a thermostatted cell was measured at various pressures. The temperature was controlled to ±0.1 K.

**SOURCE AND PURITY OF MATERIALS:**

No information

**ESTIMATED ERROR:**

\[ \delta T/K = \pm 0.1 \quad \delta x_{\text{CO}_2} = \pm 3\% \] due to uncertainty in the value of the density of solvent.

**REFERENCES:**

COMPONENTS:
(1) Carbon dioxide; CO₂; [124-38-9]
(2) Diazene, bis(4-ethoxyphenyl)-
1-oxide or p-azoxyphenetole; C₁₆H₁₈N₂O₃; [4792-83-0]

ORIGINAL MEASUREMENTS:
Homfray, I. F.

VARIABLES:
T/K = 407.2 - 442.2
P₁/kPa = 118 (88.5 cmHg)

PREPARED BY:
H. L. Clever

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>Temperature/t/°C</th>
<th>Physical State of Solvent</th>
<th>Manometer Scale, N/cm</th>
<th>Volume Absorbed v/cm³</th>
<th>Volume Absorbed in 100 cm³ Solvent</th>
</tr>
</thead>
<tbody>
<tr>
<td>134.0</td>
<td>Solid</td>
<td>31.0</td>
<td>0.0</td>
<td>0</td>
</tr>
<tr>
<td>139.5</td>
<td>Solid</td>
<td>34.8</td>
<td>33.4</td>
<td>-1.4</td>
</tr>
<tr>
<td>145.5</td>
<td>Nematic</td>
<td>17.7</td>
<td>35.8</td>
<td>18.1</td>
</tr>
<tr>
<td>149.0</td>
<td>Liquid</td>
<td>19.6</td>
<td>37.2</td>
<td>17.6</td>
</tr>
<tr>
<td>156.5</td>
<td>Liquid</td>
<td>22.5</td>
<td>40.1</td>
<td>17.6</td>
</tr>
<tr>
<td>160.0</td>
<td>Liquid</td>
<td>23.0</td>
<td>41.4</td>
<td>18.4</td>
</tr>
<tr>
<td>164.5</td>
<td>Liquid</td>
<td>24.2</td>
<td>43.0</td>
<td>18.8</td>
</tr>
<tr>
<td>166.5</td>
<td>Liquid</td>
<td>24.3</td>
<td>43.8</td>
<td>19.5</td>
</tr>
<tr>
<td>166.5</td>
<td>Isotropic</td>
<td>17.4</td>
<td>43.8</td>
<td>26.4</td>
</tr>
<tr>
<td>167.5</td>
<td>Liquid</td>
<td>18.0</td>
<td>44.2</td>
<td>26.2</td>
</tr>
<tr>
<td>169.0</td>
<td>Liquid</td>
<td>18.6</td>
<td>44.7</td>
<td>26.1</td>
</tr>
</tbody>
</table>

The calculated manometer reading is the value expected if there is no gas absorption.

The difference between the calculated and the observed manometer reading is a measure of the gas absorbed. The manometer tube had a volume of 0.03 cm³ per cm of length.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
A 2 g sample is enclosed in a bulb and manometer system of known volume. The bulb and contents are in a refluxing aniline bath. The temperature is controlled by the pressure over the aniline.

At each temperature the gas volume is compared with a gas volume calculated assuming ideal gas behavior and no gas absorption by the solvent. The difference in the volumes is the gas volume absorbed by the sample at a temperature of 293 K and a pressure of 118 kPa (88.5 cmHg).

The solvent volume is stated to be 1.824 cm³ at 145.5 °C and 1.866 cm³ at 166.5 °C. The compiler calculated the CO₂ absorption in the sample and in 100 cm³ of solvent assuming the sample volumes above.

REFERENCE:
(1) Carbon dioxide. Dry gas.


ESTIMATED ERROR:
5 - 10 per cent (Compiler)
**COMPONENTS:**

1. Carbon dioxide; CO₂; [124-38-9]
2. 1-Methyl-2-pyrrolidinone, \( \text{N-methylpyrrolidone} \); C₅H₇NO; [872-50-4]

**VARIABLES:**

\[ P/\text{kPa} = 13-101 \]
\[ T/K = 273.15-318.15 \]

**EXPERIMENTAL VALUES:**

<table>
<thead>
<tr>
<th>T/K</th>
<th>Henry's constant, ( H ) /mmHg</th>
<th>( x_{\text{CO}_2} \times \text{kPa} ) at 101.3 kPa*</th>
</tr>
</thead>
<tbody>
<tr>
<td>273.15</td>
<td>26650</td>
<td>3553 0.0285</td>
</tr>
<tr>
<td>283.15</td>
<td>32200</td>
<td>4293 0.0236</td>
</tr>
<tr>
<td>288.15</td>
<td>36600</td>
<td>4880 0.0208</td>
</tr>
<tr>
<td>298.15</td>
<td>42800</td>
<td>5706 0.0178</td>
</tr>
<tr>
<td>308.15</td>
<td>54550</td>
<td>7273 0.0139</td>
</tr>
<tr>
<td>318.15</td>
<td>61900</td>
<td>8253 0.0123</td>
</tr>
</tbody>
</table>

Henry's constant, \( H \), is defined by the equation:

\[
H = \frac{P_{\text{CO}_2}}{x_{\text{CO}_2}}
\]

The authors published a graph which showed that the variation of mole fraction solubility with partial pressure of carbon dioxide was linear in the experimental pressure range (13-101 kPa).

* calculated by the compiler.

**METHOD/APPARATUS/PROCEDURE:**

Experimental method given in ref. (1).

**SOURCE AND PURITY OF MATERIALS:**

2. b.pt. = 206°C (760 mmHg)
\[ \rho = 1.0220 \text{ g cm}^{-3} \]
\[ \eta^{29} = 1.4700 \]
\[ \eta (20^\circ C) = 1.84 \times 10^{-4} \text{ Pa s} \]

**REFERENCES:**

### COMPONENTS:

1. Carbon dioxide; CO₂; [124-38-9]
2. 1-Methyl-2-pyrrolidinone (N-methylpyrrolidone); C₅H₉NO; [872-50-4]

### ORIGINAL MEASUREMENTS:

### VARIABLES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>P/kPa</th>
<th>Mole fraction solubility ( x_{CO_2} )</th>
<th>Volume of gas* /vol. of solvent</th>
</tr>
</thead>
<tbody>
<tr>
<td>253.2</td>
<td>101.3</td>
<td>0.0719</td>
<td>17.20</td>
</tr>
<tr>
<td>263.2</td>
<td>101.3</td>
<td>0.0506</td>
<td>12.00</td>
</tr>
<tr>
<td>273.2</td>
<td>101.3</td>
<td>0.0353</td>
<td>8.30</td>
</tr>
<tr>
<td>283.2</td>
<td>101.3</td>
<td>0.0261</td>
<td>6.10</td>
</tr>
<tr>
<td>293.2</td>
<td>101.3</td>
<td>0.0175</td>
<td>4.05</td>
</tr>
</tbody>
</table>

* volume of gas reduced to 273.15 K and 101.3 kPa

† calculated by the compiler

### AUXILIARY INFORMATION

**METHOD/APPARATUS/PROCEDURE:**
No information

**SOURCE AND PURITY OF MATERIALS:**
No information

**ESTIMATED ERROR:**

**REFERENCES:**
COMPONENTS:

1. Carbon dioxide; CO₂; [124-38-9]
2. 1-Methyl-2-pyrrolidinone (N-methylpyrrolidone); C₅H₇NO; [872-50-4]

VARIABLES:

T/K = 253.2-293.2
P/kPa = 101.3-1026.25

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>P/kPa</th>
<th>xCO₂</th>
<th>Volume of gas</th>
<th>Henry's law constant, H, atm</th>
<th>Coeff. S</th>
</tr>
</thead>
<tbody>
<tr>
<td>253.2</td>
<td>101.3</td>
<td>0.0404*</td>
<td>22.4</td>
<td>2270</td>
<td>-0.159</td>
</tr>
<tr>
<td>253.2</td>
<td>202.6</td>
<td>0.091</td>
<td>32.4</td>
<td>3280</td>
<td>-0.146</td>
</tr>
<tr>
<td>263.2</td>
<td>101.3</td>
<td>0.0306*</td>
<td>42.6</td>
<td>4320</td>
<td>0.029</td>
</tr>
<tr>
<td>263.2</td>
<td>202.6</td>
<td>0.064</td>
<td>65.4</td>
<td>6630</td>
<td>0.189</td>
</tr>
<tr>
<td>273.2</td>
<td>101.3</td>
<td>0.0235*</td>
<td>7.34</td>
<td>101.4</td>
<td>0.20</td>
</tr>
<tr>
<td>273.2</td>
<td>202.6</td>
<td>0.0154*</td>
<td>4.38</td>
<td>102.70</td>
<td></td>
</tr>
<tr>
<td>283.2</td>
<td>101.3</td>
<td>0.0099*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>283.2</td>
<td>202.6</td>
<td>0.019</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

** volume of gas reduced to 273.15 K and 101.3 kPa

Measurements made over the pressure range 202.6 kPa to 2026 kPa were fitted to the Krivechevsky-Il'inskaya equation in the form:

\[ RT \ln \frac{f_1}{x_1} = RT \ln H - \beta(1-x) \]

where \( f_1 \) is the fugacity of carbon dioxide in the gas phase;

\( x_1 \) is the mole fraction of solvent in the liquid phase;

\( x_1 \) is the mole fraction of gas in the liquid phase;

\( H \) is the limiting value of Henry's law constant at zero pressure;

\( \beta \) is a coefficient.

* values at 101.3 kPa calculated by the compiler from the above equation.

AUXILIARY INFORMATION

METHOD APPARATUS PROCEDURE:
The method is described in ref. (1).

SOURCE AND PURITY OF MATERIALS:
No information

ESTIMATED ERROR:

REFERENCES:
1. Usyukin, I.P.; Shleynikov, V.M. Timofeev, A.I.; Shekina, G.I.
COMPONENTS:
1. Carbon dioxide; CO₂; [124-38-9]
2. 1-Methyl-2-pyrrolidinone, (N-methylpyrrolidone); C₅H₉NO [872-50-4]

VARIABLES:
T/K = 283-393
P/kPa = 12-98

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>P CO₂/mmHg</th>
<th>P CO₂/kPa*</th>
<th>Solubility†</th>
<th>Mole fraction of vol./vol. CO₂</th>
</tr>
</thead>
<tbody>
<tr>
<td>283.15</td>
<td>130.0</td>
<td>17.33</td>
<td>0.843</td>
<td>0.00359</td>
</tr>
<tr>
<td>283.15</td>
<td>201.0</td>
<td>26.80</td>
<td>1.31</td>
<td>0.00556</td>
</tr>
<tr>
<td>283.15</td>
<td>282.5</td>
<td>35.00</td>
<td>1.71</td>
<td>0.00725</td>
</tr>
<tr>
<td>283.15</td>
<td>311.5</td>
<td>41.53</td>
<td>1.98</td>
<td>0.00839</td>
</tr>
<tr>
<td>283.15</td>
<td>384.5</td>
<td>51.26</td>
<td>2.47</td>
<td>0.01040</td>
</tr>
<tr>
<td>283.15</td>
<td>452.5</td>
<td>60.33</td>
<td>2.91</td>
<td>0.01230</td>
</tr>
<tr>
<td>283.15</td>
<td>467.5</td>
<td>62.33</td>
<td>3.10</td>
<td>0.01310</td>
</tr>
<tr>
<td>283.15</td>
<td>497.0</td>
<td>66.26</td>
<td>3.20</td>
<td>0.01350</td>
</tr>
<tr>
<td>283.15</td>
<td>560.5</td>
<td>77.39</td>
<td>3.76</td>
<td>0.01580</td>
</tr>
<tr>
<td>283.15</td>
<td>611.0</td>
<td>81.46</td>
<td>3.95</td>
<td>0.01660</td>
</tr>
<tr>
<td>283.15</td>
<td>644.5</td>
<td>85.93</td>
<td>4.28</td>
<td>0.01790</td>
</tr>
<tr>
<td>283.15</td>
<td>710.0</td>
<td>94.66</td>
<td>4.62</td>
<td>0.01930</td>
</tr>
<tr>
<td>288.15</td>
<td>131.0</td>
<td>17.47</td>
<td>0.782</td>
<td>0.00334</td>
</tr>
<tr>
<td>288.15</td>
<td>153.5</td>
<td>20.46</td>
<td>0.885</td>
<td>0.00378</td>
</tr>
<tr>
<td>288.15</td>
<td>177.0</td>
<td>23.60</td>
<td>1.01</td>
<td>0.00431</td>
</tr>
<tr>
<td>288.15</td>
<td>288.0</td>
<td>38.40</td>
<td>1.70</td>
<td>0.00724</td>
</tr>
<tr>
<td>288.15</td>
<td>295.5</td>
<td>39.40</td>
<td>1.76</td>
<td>0.00748</td>
</tr>
<tr>
<td>288.15</td>
<td>379.0</td>
<td>50.53</td>
<td>2.19</td>
<td>0.00931</td>
</tr>
<tr>
<td>288.15</td>
<td>418.0</td>
<td>55.73</td>
<td>2.47</td>
<td>0.01050</td>
</tr>
<tr>
<td>288.15</td>
<td>430.0</td>
<td>57.33</td>
<td>2.54</td>
<td>0.01070</td>
</tr>
<tr>
<td>288.15</td>
<td>505.5</td>
<td>67.39</td>
<td>2.96</td>
<td>0.01260</td>
</tr>
<tr>
<td>288.15</td>
<td>615.5</td>
<td>82.06</td>
<td>3.68</td>
<td>0.01550</td>
</tr>
<tr>
<td>288.15</td>
<td>672.0</td>
<td>89.59</td>
<td>4.00</td>
<td>0.01690</td>
</tr>
<tr>
<td>288.15</td>
<td>695.5</td>
<td>92.73</td>
<td>4.15</td>
<td>0.01750</td>
</tr>
<tr>
<td>298.15</td>
<td>90.0</td>
<td>12.00</td>
<td>0.418</td>
<td>0.00180</td>
</tr>
<tr>
<td>298.15</td>
<td>156.5</td>
<td>20.86</td>
<td>0.693</td>
<td>0.00299</td>
</tr>
<tr>
<td>298.15</td>
<td>160.0</td>
<td>21.35</td>
<td>0.74</td>
<td>0.00319</td>
</tr>
<tr>
<td>298.15</td>
<td>192.0</td>
<td>25.60</td>
<td>0.893</td>
<td>0.00383</td>
</tr>
<tr>
<td>298.15</td>
<td>290.0</td>
<td>38.66</td>
<td>1.37</td>
<td>0.00589</td>
</tr>
<tr>
<td>298.15</td>
<td>305.0</td>
<td>40.66</td>
<td>1.43</td>
<td>0.00615</td>
</tr>
<tr>
<td>298.15</td>
<td>352.0</td>
<td>46.93</td>
<td>1.62</td>
<td>0.00696</td>
</tr>
<tr>
<td>298.15</td>
<td>392.5</td>
<td>52.33</td>
<td>1.86</td>
<td>0.00797</td>
</tr>
<tr>
<td>298.15</td>
<td>465.5</td>
<td>62.06</td>
<td>2.17</td>
<td>0.00930</td>
</tr>
<tr>
<td>298.15</td>
<td>496.0</td>
<td>66.13</td>
<td>2.37</td>
<td>0.01010</td>
</tr>
<tr>
<td>298.15</td>
<td>600.0</td>
<td>79.99</td>
<td>2.87</td>
<td>0.01230</td>
</tr>
<tr>
<td>298.15</td>
<td>738.5</td>
<td>98.46</td>
<td>3.45</td>
<td>0.01470</td>
</tr>
</tbody>
</table>

* calculated by the compiler
† volume of gas, reduced to 101.3 kPa and 273.15 K, absorbed by one volume of solvent.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
A static method was used as described in ref. (1).

SOURCE AND PURITY OF MATERIALS:
1. 99.98% pure by chromatographic analysis.
2. 99.7% pure by chromatographic analysis.

REFERENCES:
1. Braude, G.E.; Leites, I.L.; Dedova, I.V.

ESTIMATED ERROR:
### COMPONENTS:

1. Carbon dioxide; CO₂; [124-38-9]

2. 1-Methyl-2-pyrrolidinone, (N-methylpyrrolidone); C₅H₅NO [872-50-4]

### ORIGINAL MEASUREMENTS:

Shakhova, S.F.; Bondareva, T.I.; Sergeeva, L.B.

### EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>PCO₂/mmHg</th>
<th>PCO₂/kPa*</th>
<th>Solubility†</th>
<th>Mole fraction of vol./vol. CO₂ in liquid, xCO₂</th>
</tr>
</thead>
<tbody>
<tr>
<td>308.15</td>
<td>131.0</td>
<td>17.47</td>
<td>0.488</td>
<td>0.00212</td>
</tr>
<tr>
<td>308.15</td>
<td>280.5</td>
<td>37.40</td>
<td>1.04</td>
<td>0.00452</td>
</tr>
<tr>
<td>308.15</td>
<td>395.0</td>
<td>52.66</td>
<td>1.51</td>
<td>0.00653</td>
</tr>
<tr>
<td>308.15</td>
<td>454.5</td>
<td>60.60</td>
<td>1.69</td>
<td>0.00731</td>
</tr>
<tr>
<td>308.15</td>
<td>527.0</td>
<td>70.26</td>
<td>2.04</td>
<td>0.00883</td>
</tr>
<tr>
<td>308.15</td>
<td>547.0</td>
<td>72.93</td>
<td>2.05</td>
<td>0.00885</td>
</tr>
<tr>
<td>308.15</td>
<td>628.0</td>
<td>83.73</td>
<td>2.41</td>
<td>0.01040</td>
</tr>
<tr>
<td>308.15</td>
<td>645.5</td>
<td>86.06</td>
<td>2.45</td>
<td>0.01050</td>
</tr>
<tr>
<td>308.15</td>
<td>689.5</td>
<td>91.93</td>
<td>2.60</td>
<td>0.01120</td>
</tr>
<tr>
<td>308.15</td>
<td>709.0</td>
<td>94.53</td>
<td>2.68</td>
<td>0.01150</td>
</tr>
<tr>
<td>363.15</td>
<td>148.0</td>
<td>19.73</td>
<td>0.258</td>
<td>0.00118</td>
</tr>
<tr>
<td>363.15</td>
<td>191.0</td>
<td>20.40</td>
<td>0.268</td>
<td>0.00121</td>
</tr>
<tr>
<td>363.15</td>
<td>260.5</td>
<td>40.06</td>
<td>0.525</td>
<td>0.00240</td>
</tr>
<tr>
<td>363.15</td>
<td>329.0</td>
<td>43.86</td>
<td>0.561</td>
<td>0.00256</td>
</tr>
<tr>
<td>363.15</td>
<td>472.5</td>
<td>62.99</td>
<td>0.811</td>
<td>0.00370</td>
</tr>
<tr>
<td>363.15</td>
<td>473.5</td>
<td>63.13</td>
<td>0.827</td>
<td>0.00377</td>
</tr>
<tr>
<td>363.15</td>
<td>568.0</td>
<td>75.73</td>
<td>0.979</td>
<td>0.00447</td>
</tr>
<tr>
<td>363.15</td>
<td>602.0</td>
<td>80.26</td>
<td>1.05</td>
<td>0.00477</td>
</tr>
<tr>
<td>363.15</td>
<td>669.0</td>
<td>89.19</td>
<td>1.16</td>
<td>0.00528</td>
</tr>
<tr>
<td>363.15</td>
<td>713.0</td>
<td>95.06</td>
<td>1.24</td>
<td>0.00564</td>
</tr>
<tr>
<td>373.15</td>
<td>162.0</td>
<td>21.60</td>
<td>0.248</td>
<td>0.00115</td>
</tr>
<tr>
<td>373.15</td>
<td>168.0</td>
<td>22.40</td>
<td>0.262</td>
<td>0.00121</td>
</tr>
<tr>
<td>373.15</td>
<td>291.5</td>
<td>38.86</td>
<td>0.442</td>
<td>0.00204</td>
</tr>
<tr>
<td>373.15</td>
<td>355.0</td>
<td>47.33</td>
<td>0.548</td>
<td>0.00253</td>
</tr>
<tr>
<td>373.15</td>
<td>455.5</td>
<td>60.73</td>
<td>0.703</td>
<td>0.00324</td>
</tr>
<tr>
<td>373.15</td>
<td>496.0</td>
<td>66.13</td>
<td>0.777</td>
<td>0.00358</td>
</tr>
<tr>
<td>373.15</td>
<td>566.0</td>
<td>75.46</td>
<td>0.87</td>
<td>0.00401</td>
</tr>
<tr>
<td>373.15</td>
<td>607.0</td>
<td>80.93</td>
<td>0.929</td>
<td>0.00428</td>
</tr>
<tr>
<td>373.15</td>
<td>673.0</td>
<td>89.73</td>
<td>1.03</td>
<td>0.00474</td>
</tr>
<tr>
<td>373.15</td>
<td>714.0</td>
<td>95.19</td>
<td>1.09</td>
<td>0.00500</td>
</tr>
<tr>
<td>393.15</td>
<td>143.5</td>
<td>19.13</td>
<td>0.177</td>
<td>0.00083</td>
</tr>
<tr>
<td>393.15</td>
<td>166.0</td>
<td>22.13</td>
<td>0.216</td>
<td>0.00102</td>
</tr>
<tr>
<td>393.15</td>
<td>279.0</td>
<td>37.20</td>
<td>0.348</td>
<td>0.00164</td>
</tr>
<tr>
<td>393.15</td>
<td>331.0</td>
<td>44.13</td>
<td>0.438</td>
<td>0.00206</td>
</tr>
<tr>
<td>393.15</td>
<td>419.5</td>
<td>55.93</td>
<td>0.535</td>
<td>0.00251</td>
</tr>
<tr>
<td>393.15</td>
<td>452.0</td>
<td>60.26</td>
<td>0.598</td>
<td>0.00281</td>
</tr>
<tr>
<td>393.15</td>
<td>528.5</td>
<td>70.46</td>
<td>0.694</td>
<td>0.00326</td>
</tr>
<tr>
<td>393.15</td>
<td>535.5</td>
<td>71.39</td>
<td>0.683</td>
<td>0.00321</td>
</tr>
<tr>
<td>393.15</td>
<td>613.5</td>
<td>81.79</td>
<td>0.763</td>
<td>0.00358</td>
</tr>
<tr>
<td>393.15</td>
<td>657.0</td>
<td>87.59</td>
<td>0.836</td>
<td>0.00392</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>T/K</th>
<th>Henry's constant, H, /mmHg</th>
<th>/kPa*</th>
</tr>
</thead>
<tbody>
<tr>
<td>283.15</td>
<td>36700</td>
<td>4809</td>
</tr>
<tr>
<td>288.15</td>
<td>40000</td>
<td>5330</td>
</tr>
<tr>
<td>298.15</td>
<td>49700</td>
<td>6630</td>
</tr>
<tr>
<td>308.15</td>
<td>61500</td>
<td>8200</td>
</tr>
<tr>
<td>363.15</td>
<td>126000</td>
<td>16800</td>
</tr>
<tr>
<td>373.15</td>
<td>141000</td>
<td>18800</td>
</tr>
<tr>
<td>393.15</td>
<td>166000</td>
<td>22100</td>
</tr>
</tbody>
</table>

* calculated by the compiler
† volume of gas, reduced to 101.3 kPa and 273.15 K, absorbed by one volume of solvent.
COMPONENTS:
1. Carbon dioxide; CO₂; [124-38-9]
2. 1-Methyl-2-pyrrolidinone
   CsH₉NO; [872-50-4]

ORIGINAL MEASUREMENTS:
Lenoir, J-Y.; Renault, P.; Renon, H.

VARIABLES:

\[ T/K = 298.15 \]

PREPARED BY:
C.L. Young

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>Henry's Constant ( H_{CO₂}/\text{atm} )</th>
<th>Mole fraction at 101.3 kPa ( x_{CO₂} ) (1 atm)*</th>
</tr>
</thead>
<tbody>
<tr>
<td>298.15</td>
<td>59.1</td>
<td>0.0169</td>
</tr>
</tbody>
</table>

* Calculated by compiler assuming a linear function of \( p_{CO₂} \) vs \( x_{CO₂} \),
ie. \( x_{CO₂} \) (1 atm) = \( 1/H_{CO₂} \)

A conventional gas-liquid chromatographic unit fitted with a thermal conductivity detector was used. The carrier gas was helium. The value of Henry's law constant was calculated from the retention time. The value applies to very low partial pressures of gas and there may be a substantial difference from that measured at 1 atm. pressure. There is also considerable uncertainty in the value of Henry's constant since surface adsorption was not allowed for although its possible existence was noted.

SOURCE AND PURITY OF MATERIALS:
(1) L'Air Liquide sample, minimum purity 99.9 mole per cent.
(2) Touzart and Matignon or Serlabo sample, purity 99 per cent cent.

ESTIMATED ERROR:
\[ \delta T/K = \pm 0.1; \delta H/\text{atm} = \pm 6\% \]
(estimated by compiler).

REFERENCES:
COMPONENTS:

1. Carbon dioxide; CO₂; [124-38-9]
2. 1-Methyl-2-pyrrolidinone; C₅H₇NO; [872-50-4]

ORIGINAL MEASUREMENTS:

Rivas, O.R.; Prausnitz, J.M.

VARIABLES:

\[ T/K = 263.2 - 373.2 \]
\[ P/kPa < 101.3 \]

PREPARED BY:

P.G.T. Fogg

EXPERIMENTAL VALUES:

\[
\begin{array}{cccc}
T/K & \text{Henry's constant, } H/\text{MPa} & x_{\text{CO}_2} \text{ at } P_{\text{CO}_2} = 101.3 \text{ kPa}^* \\
263.15 & 2.80 & 2800 & 0.0362 \\
298.15 & 6.69 & 6690 & 0.01515 \\
323.15 & 10.00 & 10000 & 0.01013 \\
348.15 & 13.90 & 13900 & 0.00729 \\
373.15 & 18.26 & 18260 & 0.00555 \\
\end{array}
\]

* calculated by the compiler

AUXILIARY INFORMATION

METHOD APPARATUS/PROCEDURE:

The apparatus is described in ref. (1). The volume of gas absorbed was measured. Pressures were measured with a high precision bourdon pressure gauge. Temperatures were controlled to 0.05 K by a thermostat bath.

SOURCE AND PURITY OF MATERIALS:

Supplied by standard laboratory reagent suppliers; purities at least 99%

ESTIMATED ERROR:

\[ \delta T/K = \pm 0.05 \]

REFERENCES:

1. Rivas, O.R.; Prausnitz, J.M.
COMPONENTS:
1. Carbon dioxide; CO₂; [124-38-9]
2. 1-Methyl-2-pyrrolidinone; CsH₇NO; [872-50-4]

ORIGINAL MEASUREMENTS:
Rivas, O.R.; Prausnitz, J.M.

VARIABLES:
T/K = 293.15, 308.15

EXPERIMENTAL VALUES:
<table>
<thead>
<tr>
<th>T/K</th>
<th>Henry's constant / atm</th>
<th>Mole fraction at 101.3 kPa (1 atm) partial pressure*</th>
</tr>
</thead>
<tbody>
<tr>
<td>293.15</td>
<td>60.1</td>
<td>0.0166</td>
</tr>
<tr>
<td>308.15</td>
<td>77.8</td>
<td>0.0129</td>
</tr>
</tbody>
</table>

* Calculated by compiler assuming mole fraction solubility linear with pressure.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
Volumetric apparatus with a fused quartz precision bourdon pressure gauge. Solubility apparatus carefully thermostatted. Solvent degassed in situ. Apparatus described in ref (1) and modifications given in source.

SOURCE AND PURITY OF MATERIALS:
No details given.

ESTIMATED ERROR:
δT/K = ±0.05; δx₃CO₂ = ±1%.

REFERENCES:
1. Cukor, P.M.; Prausnitz, J.M.
COMPONENTS:

1. Carbon dioxide; CO₂; [124-38-9]

2. 1-Methyl-2-pyrrolidinone, (N-methyl pyrrolidone); C₅H₉NO; [872-50-4]

ORIGINAL MEASUREMENTS:

Zubchenko, Yu.P.; Shakhova, C.F.; Ladigina, O.P.


VARIABLES:

T/K = 258.2-313.2
P/kPa = 380-55600

PREPARED BY:

P.G.T. Fogg

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>H/kPa</th>
<th>x.CO₂ *</th>
</tr>
</thead>
<tbody>
<tr>
<td>258.2</td>
<td>2840</td>
<td>0.0357</td>
</tr>
<tr>
<td>273.2</td>
<td>4050</td>
<td>0.0250</td>
</tr>
<tr>
<td>288.2</td>
<td>5470</td>
<td>0.0185</td>
</tr>
<tr>
<td>298.2</td>
<td>6790</td>
<td>0.0149</td>
</tr>
<tr>
<td>313.2</td>
<td>8440</td>
<td>0.0120</td>
</tr>
</tbody>
</table>

The authors measured solubilities at pressures from 380 kPa to 55600 kPa. Solubilities in this pressure range were given in the paper. At each temperature Henry's constant was found from the slope of the linear part of a plot of mole fraction solubility against partial pressure of carbon dioxide.

* calculated by the compiler

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

A static method was used as described in ref. (1)

SOURCE AND PURITY OF MATERIALS:

ESTIMATED ERROR:

REFERENCES:

COMPONENTS:
1. Carbon dioxide; CO₂; [124-38-9]
2. 1-Methyl-2-pyrrolidinone, (N-methyl pyrrolidone); C₅H₉NO; [872-50-4]

ORIGINAL MEASUREMENTS:
Byeseda, J.J.; Deetz, J.A.; Manning, W.P.

VARIABLES:
\[ T/K = 297.1 \quad P/kPa = 101.6 \]

PREPARED BY:
P.G.T. Fogg

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>( P_{CO₂}/\text{psia} )</th>
<th>( P_{CO₂}/\text{kPa} )</th>
<th>Ostwald coeff.</th>
<th>Mole fraction in liquid* ( x_{CO₂} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>297.1</td>
<td>14.73</td>
<td>101.6</td>
<td>3.80</td>
<td>0.0150</td>
</tr>
</tbody>
</table>

* calculated by compiler using the density given in ref. (1).

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
The CO₂ was contained in a thermostatted metal cylinder connected to a pressure gage, vacuum pump and supply of gas. A tight fitting internal piston sealed with an O-ring fitted into the cylinder so that the volume of gas could be changed by controlled movement of the piston. A measured volume of solvent was injected into the cylinder by a syringe. The absorption of gas was found from the movement of the piston which was necessary to maintain constant pressure.

SOURCE AND PURITY OF MATERIALS:
2. Sample referred to as "MPYROL."

ESTIMATED ERROR:

REFERENCES:
1. Riddick, J.A.; Bunger, W.B.; Sakano, T.K.
COMPONENTS:
- Carbon dioxide; CO₂; [124-38-9]
- 1-Methyl-2-pyrrolidinone (N-methylpyrrolidone); C₅H₉NO; [872-50-4]

VARIABLES:
- T/K = 298.15
- P/kPa = 101.3

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>P/kPa</th>
<th>Henry's constant, H /bar</th>
<th>Oswald coeff. L/cm³cm⁻¹</th>
<th>Mole fraction* x₃O₂</th>
</tr>
</thead>
<tbody>
<tr>
<td>298.15</td>
<td>101.3</td>
<td>650</td>
<td>6500</td>
<td>1.885</td>
</tr>
</tbody>
</table>

* calculated by the compiler.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
The volume of gas which was absorbed by a weighed quantity of solute was measured with a gas buret to ±0.02 cm³. The solute was weighed to an accuracy of ±5 x 10⁻⁷ g. The cell containing the solvent was magnetically stirred and the temperature of the apparatus was controlled to ±0.01 K by a thermostat. The apparatus and procedure have been described in ref. (1).

SOURCE AND PURITY OF MATERIALS:
1. Purity better than 99.9 vol.%
2. A sample provided by Merck of minimum purity of 99%. was treated with molecular sieve 4X to reduce the water content to less than 0.01 wt.% as indicated by Karl-Fischer titration. Chromatographic analysis indicated a purity of 99.9% The material was also degassed before use.

ESTIMATED ERROR:
- δL/L = ±0.01
- δT/K = ±0.01

REFERENCES:
COMPONENTS:
1. Carbon dioxide; \( \text{CO}_2; \) [124-38-9]
2. 1-Methyl-2-pyrrolidinone; \( \text{C}_5\text{H}_7\text{NO}; \) [872-50-4]

ORIGINAL MEASUREMENTS:
Kassim, D.M.; Zainel, H.A.; Al-Asaf, S.A.; Talib, E.K.
Fluid Phase Equilibria

VARIABLES:
Temperature

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>Mole fraction of carbon dioxide in liquid, ( x_{\text{CO}_2} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>303.15</td>
<td>0.0138</td>
</tr>
<tr>
<td>313.15</td>
<td>0.0126</td>
</tr>
<tr>
<td>323.15</td>
<td>0.0106</td>
</tr>
<tr>
<td>333.15</td>
<td>0.0097</td>
</tr>
</tbody>
</table>

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
Falling film flow apparatus similar to that of Morrison and Billet (1). Apparatus consisted of (i) degassing section in which solvent could be degassed by freezing and thawing under vacuum and (ii) absorption section. The latter consisted of a gas buret and absorption spiral. Mole fraction solubility corrected to 1 atm partial pressure by assuming Henry's law was valid.

SOURCE AND PURITY OF MATERIALS:
1. Purity 99.99 mole per cent.
2. Fluka AG puriss grade sample, purity better than 99 mole per cent.

ESTIMATED ERROR:
\( \delta T/K = \pm 0.1; \ \delta x/x = \pm 0.02 \) (estimated by compiler).

REFERENCES:
1. Morrison, T.J.; Billet, F.J.
COMPONENTS:
1. Carbon dioxide; CO₂; [124-38-9]
2. 1-Methyl-2-pyrrolidinone, (N-methylpyrrolidone); CsH₉NO; [872-50-4]

VARIABLES:
T/K = 298.15-373.15
P/kPa = 184.8-1438.5

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>Henry's law constant x CO₂(101.3 kPa)*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>H/MPa</td>
</tr>
<tr>
<td>298.15</td>
<td>6.38</td>
</tr>
<tr>
<td>323.15</td>
<td>10.13</td>
</tr>
<tr>
<td>373.15</td>
<td>23.91</td>
</tr>
</tbody>
</table>

* estimated by the compiler as Pco₂/H

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
The apparatus and method of calculation have been described in previous publications (refs. 1 and 2). The limiting values of Henry's law constant which are given above were found by fitting the experimental data to the Krichevsky-Kasarnovsky equation (3).

SOURCE AND PURITY OF MATERIALS:
1. Supplied by Infra S.A.; reported purity 99.7 mol%.
2. Purity better than 99.5 mol%.

ESTIMATED ERROR
ΔT/K = ±0.02 to 343 K; ±0.5 at 373 K. (authors)
ΔP/kPa = ±3.5

REFERENCES:
COMPONENTS:
(1) Carbon dioxide; CO₂; [124-38-9]
(2) N,N-Dimethylformamide; C₃H₇NO; [68-12-2]

VARIABLES:
T/K = 293.15
p/kPa = 101.325

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>Ostwald Coefficient a</th>
<th>Bunsen Coefficient b</th>
<th>Mole Fraction b</th>
</tr>
</thead>
<tbody>
<tr>
<td>293.15</td>
<td>5.10</td>
<td>4.75</td>
<td>0.0164</td>
</tr>
</tbody>
</table>

a Original data.
b Calculated by compiler using real gas molar volumes.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
The prepared solvent solution was charged into an evacuated cell after degassing, and the mass of solvent was determined by weight. Gas was introduced into the cell from a measuring burette in which the gas was stored over mercury. The cell was agitated while the gas pressure was maintained by adjusting the gas volume. The Ostwald coefficient was determined from the mass of solvent and volume of gas used. Solubilities were measured at pressures above and below atmospheric.

SOURCE AND PURITY OF MATERIALS:
(1) Carbon dioxide. Source and purity not given. An aqueous "soda" solution absorbed 99.8% of the gas.

ESTIMATED ERROR:

\[ \delta T/K = \pm 0.2 \]
\[ \delta p/\text{kPa} = \pm 0.1 \]
\[ \delta L/L = \pm 0.02 \] (compiler)

REFERENCES:
Some data in the thesis have been published. See:

COMPONENTS:
1. Carbon dioxide; CO₂; [124-38-9]
2. N,N-Dimethylformamide; C₃H₇NO; [68-12-2]

ORIGINAL MEASUREMENTS:
Du Pont de Nemours and Co., (Inc.)

VARIABLES:
T/K = 298.2
P/kPa = 101.3

PREPARED BY:
P.G.T. Fogg

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>P_{CO₂}/kPa</th>
<th>Bunsen coefficient α</th>
<th>x_{CO₂}^*</th>
</tr>
</thead>
<tbody>
<tr>
<td>298.2</td>
<td>101.3</td>
<td>4.4</td>
<td>0.0142</td>
</tr>
</tbody>
</table>

* calculated by the compiler

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
Not stated.

SOURCE AND PURITY OF MATERIALS:
Not stated.

ESTIMATED ERROR:

REFERENCES:
COMPONENTS:
(1) Carbon dioxide; CO₂; [124-38-9]
(2) N,N-Dimethylformamide; C₃H₇NO; [68-12-2]

VARIABLES:

\[ T/K = 278.15 - 313.15 \]
\[ p₁/kPa = 26.66 - 119.99 \]

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>t/°C</th>
<th>T/K</th>
<th>P₁/mmHg</th>
<th>Absorption Coefficient /cm³(STP)cm⁻³</th>
<th>Bunsen Coefficient α/cm³(STP)cm⁻³atm⁻¹</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>278.15</td>
<td>200</td>
<td>1.51</td>
<td>5.74</td>
</tr>
<tr>
<td></td>
<td></td>
<td>400</td>
<td>3.15</td>
<td>5.99</td>
</tr>
<tr>
<td></td>
<td></td>
<td>600</td>
<td>4.72</td>
<td>5.98</td>
</tr>
<tr>
<td></td>
<td></td>
<td>760</td>
<td>5.96</td>
<td>5.96</td>
</tr>
<tr>
<td></td>
<td></td>
<td>900</td>
<td>7.25</td>
<td>6.12</td>
</tr>
<tr>
<td>20</td>
<td>293.15</td>
<td>200</td>
<td>1.15</td>
<td>4.37</td>
</tr>
<tr>
<td></td>
<td></td>
<td>400</td>
<td>2.38</td>
<td>4.52</td>
</tr>
<tr>
<td></td>
<td></td>
<td>600</td>
<td>3.61</td>
<td>4.57</td>
</tr>
<tr>
<td></td>
<td></td>
<td>760</td>
<td>4.60</td>
<td>4.60</td>
</tr>
<tr>
<td></td>
<td></td>
<td>900</td>
<td>5.49</td>
<td>4.64</td>
</tr>
<tr>
<td>40</td>
<td>313.15</td>
<td>200</td>
<td>0.49</td>
<td>1.86</td>
</tr>
<tr>
<td></td>
<td></td>
<td>400</td>
<td>1.30</td>
<td>2.47</td>
</tr>
<tr>
<td></td>
<td></td>
<td>600</td>
<td>2.15</td>
<td>2.72</td>
</tr>
<tr>
<td></td>
<td></td>
<td>760</td>
<td>2.75</td>
<td>2.75</td>
</tr>
<tr>
<td></td>
<td></td>
<td>900</td>
<td>3.30</td>
<td>2.79</td>
</tr>
</tbody>
</table>

The compiler calculated the Bunsen coefficients.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
The apparatus consists of an absorption flask in a thermostated bath and a water-jacketed buret.

SOURCE AND PURITY OF MATERIALS:
(1) Carbon dioxide. No information.
(2) N,N-Dimethylformamide. Distilled, dried. Refractive index \( n^\circ_{D} = 1.4265 \), density \( \rho^\circ_{D} = 0.9451 \) g cm⁻³. The water content was 0.2 wt percent.

ESTIMATED ERROR:

\[ \Delta a/a = ± 0.03 \] (compiler)

At pressures 600 mmHg and above.

REFERENCES:
COMPONENTS:
1. Carbon dioxide; CO₂; [124-38-9]
2. N,N-Dimethylformamide; C₉H₁₄NO; [68-12-2]

VARIABLES:
\( T/K = 298-353 \)
\( P/kPa = 13.3-53.3 \)

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>( T/K )</th>
<th>Henry's law constant /mmHg</th>
<th>( x_{CO_2} ) at ( P_{CO_2} = 101.3 ) kPa*</th>
</tr>
</thead>
<tbody>
<tr>
<td>298.15</td>
<td>47000</td>
<td>6270</td>
</tr>
<tr>
<td>313.15</td>
<td>58500</td>
<td>7800</td>
</tr>
<tr>
<td>333.15</td>
<td>86000</td>
<td>11470</td>
</tr>
<tr>
<td>353.15</td>
<td>107000</td>
<td>14270</td>
</tr>
</tbody>
</table>

The Henry's law constant is the limiting value of \( P_{CO_2}/x_{CO_2} \) at zero partial pressure, \( P_{CO_2} \), of carbon dioxide.

* calculated by the compiler.

AUXILIARY INFORMATION

METHOD APPARATUS PROCEDURE:
A static method was used with the partial pressure of the carbon dioxide from 100 mmHg to 400 mmHg. The absorption vessel was magnetically stirred and held in a thermostat bath. Details of the apparatus are given in the paper.

SOURCE AND PURITY OF MATERIALS:
2. Contained 0.03 wt% of water.

REFERENCES:
COMPONENTS:

1. Carbon dioxide; CO₂; [124-38-9]
2. N,N-Dimethylformamide; C₃H₇NO; [68-12-2]

VARIABLES:

T/K = 213.2-293.2
P/kPa = 101.3

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>P/kPa</th>
<th>Volume of gas*</th>
<th>Mole fraction solubility(^\dagger) (x_{CO₂})</th>
</tr>
</thead>
<tbody>
<tr>
<td>213.15</td>
<td>101.3</td>
<td>83.0</td>
<td>0.2241</td>
</tr>
<tr>
<td>223.15</td>
<td>53.4</td>
<td>35.0</td>
<td>0.1567</td>
</tr>
<tr>
<td>233.15</td>
<td>23.5</td>
<td>16.0</td>
<td>0.1086</td>
</tr>
<tr>
<td>243.15</td>
<td>16.0</td>
<td>11.5</td>
<td>0.0756</td>
</tr>
<tr>
<td>253.15</td>
<td>8.0</td>
<td>8.0</td>
<td>0.0527</td>
</tr>
<tr>
<td>263.15</td>
<td>6.0</td>
<td>6.0</td>
<td>0.0385</td>
</tr>
<tr>
<td>273.15</td>
<td>4.0</td>
<td>4.0</td>
<td>0.0271</td>
</tr>
</tbody>
</table>

* Volume of gas reduced to 273.15 K and 101.3 kPa

\(^\dagger\) Calculated by the compiler

ORIGINAL MEASUREMENTS:

Usykin, I.P.; Shleynikov, V.M.

PREPARED BY:

P.G.T. Fogg

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

No information

SOURCE AND PURITY OF MATERIALS:

No information

ESTIMATED ERROR:

REFERENCES:
COMPONENTS:
1. Carbon dioxide; CO₂; [124-38-9]
2. N,N-Dimethylformamide; C₃H₇NO; [68-12-2]

VARIABLES:
T/K = 297.1  P/kPa = 101.6

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>P_{CO₂}/psia</th>
<th>P_{CO₂}/kPa</th>
<th>Ostwald coeff.</th>
<th>Mole fraction in liquid*</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>297.1</td>
<td>14.73</td>
<td>101.6</td>
<td>4.91</td>
<td>0.0155</td>
<td></td>
</tr>
</tbody>
</table>

* calculated by compiler

METHOD/APPARATUS/PROCEDURE:
The CO₂ was contained in a thermostatted metal cylinder connected to a pressure gage, vacuum pump and supply of gas. A tight fitting internal piston sealed with an O-ring fitted into the cylinder so that the volume of gas could be changed by controlled movement of the piston. A measured volume of solvent was injected into the cylinder by a syringe. The absorption of gas was found from the movement of the piston which was necessary to maintain constant pressure.

SOURCE AND PURITY OF MATERIALS:
No information.

REFERENCES:
COMPONENTS:
1. Carbon dioxide; \( \text{CO}_2 \); [124-38-9]
2. \( \text{N,\text{N-Dimethylformamide}}; \text{C}_3\text{H}_7\text{NO}; [68-12-2] \)
3. Ethyne; \( \text{C}_2\text{H}_2 \); [74-86-2]

ORIGINAL MEASUREMENTS:
Shenderei, E.R.

VARIABLES:
\( \frac{T}{K} = 218.15 \)
\( P_{\text{CO}_2} \)/kPa = 13.3-101.3
\( x_{\text{C}_2\text{H}_2} = 0.085-0.444 \)

PREPARED BY:
P.G.T. Fogg

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>( T/K )</th>
<th>Conc. of ethyne /cm(^3)g(^{-1})*</th>
<th>( x_{\text{C}_2\text{H}_2} )</th>
<th>( P_{\text{CO}_2} )/mmHg</th>
<th>( x_{\text{CO}_2} )/kPa</th>
<th>Solubility of ( \text{CO}_2 )/cm(^3)g(^{-1})**</th>
</tr>
</thead>
<tbody>
<tr>
<td>218.15</td>
<td>33.8</td>
<td>0.0984</td>
<td>100</td>
<td>13.33</td>
<td>0.02023</td>
</tr>
<tr>
<td></td>
<td>33.8</td>
<td>0.0944</td>
<td>300</td>
<td>40.00</td>
<td>0.06054</td>
</tr>
<tr>
<td></td>
<td>33.8</td>
<td>0.0903</td>
<td>500</td>
<td>66.66</td>
<td>0.10090</td>
</tr>
<tr>
<td></td>
<td>33.8</td>
<td>0.0850</td>
<td>760</td>
<td>101.32</td>
<td>0.15340</td>
</tr>
<tr>
<td></td>
<td>101</td>
<td>0.2458</td>
<td>100</td>
<td>13.33</td>
<td>0.01746</td>
</tr>
<tr>
<td></td>
<td>101</td>
<td>0.2371</td>
<td>300</td>
<td>40.00</td>
<td>0.05237</td>
</tr>
<tr>
<td></td>
<td>101</td>
<td>0.2283</td>
<td>500</td>
<td>66.66</td>
<td>0.08729</td>
</tr>
<tr>
<td></td>
<td>101</td>
<td>0.2170</td>
<td>760</td>
<td>101.32</td>
<td>0.13270</td>
</tr>
<tr>
<td></td>
<td>164</td>
<td>0.3457</td>
<td>100</td>
<td>13.33</td>
<td>0.01618</td>
</tr>
<tr>
<td></td>
<td>164</td>
<td>0.3343</td>
<td>300</td>
<td>40.00</td>
<td>0.04853</td>
</tr>
<tr>
<td></td>
<td>164</td>
<td>0.3230</td>
<td>500</td>
<td>66.66</td>
<td>0.08089</td>
</tr>
<tr>
<td></td>
<td>164</td>
<td>0.3082</td>
<td>760</td>
<td>101.32</td>
<td>0.12290</td>
</tr>
<tr>
<td></td>
<td>249</td>
<td>0.4444</td>
<td>100</td>
<td>13.33</td>
<td>0.01524</td>
</tr>
<tr>
<td></td>
<td>249</td>
<td>0.4307</td>
<td>300</td>
<td>40.00</td>
<td>0.04572</td>
</tr>
<tr>
<td></td>
<td>249</td>
<td>0.4170</td>
<td>500</td>
<td>66.66</td>
<td>0.07619</td>
</tr>
<tr>
<td></td>
<td>249</td>
<td>0.3992</td>
<td>760</td>
<td>101.32</td>
<td>0.11580</td>
</tr>
</tbody>
</table>

* calculated by the compiler.
** concentrations were expressed as volume of gas, corrected to 273.15 K and 101.325 kPa, dissolved by one gram of dimethylformamide.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
Method described in ref. (1).

SOURCE AND PURITY OF MATERIALS:
No information

ESTIMATED ERROR:

REFERENCES:
1. Shenderei, E.R.; Zel'venskii, F.P.; Ivanovskii, F.P.
COMPONENTS:
(1) Carbon dioxide; CO₂; [124-38-9]
(2) Nitrobenzene; C₆H₅NO₂; [98-95-3]

VARIABLES:
$$T/K = 288.15 - 298.15$$
$$P_1/kPa = 101.325 \text{ (1 atm)}$$

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>MoI Fraction</th>
<th>Bunsen Coefficient a/cm³(STP)cm⁻³atm⁻¹</th>
<th>Ostwald Coefficient L/cm³cm⁻³</th>
</tr>
</thead>
<tbody>
<tr>
<td>288.15</td>
<td>1.21</td>
<td>2.70</td>
<td>2.845</td>
</tr>
<tr>
<td>293.15</td>
<td>1.12</td>
<td>2.47</td>
<td>2.655</td>
</tr>
<tr>
<td>298.15</td>
<td>1.03</td>
<td>2.25</td>
<td>2.456</td>
</tr>
</tbody>
</table>

The author measured the Ostwald coefficient at a pressure of about 746 mmHg. The compiler assumed the Ostwald coefficient to be independent of pressure, and calculated the mole fraction and Bunsen coefficient values at 101.325 kPa (1 atm) partial pressure of the gas.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
An Ostwald apparatus as modified by Timofejew (1), and Steiner (2) is used. The apparatus consists of a gas buret, an absorption flask, and a mercury manometer. The system is thermostated with a water jacket.

The gas is introduced into the degassed liquid. The gas volume absorbed is determined by the gas buret. The solvent volume is determined at the end of the experiment by pouring the solvent into a graduated flask.

SOURCE AND PURITY OF MATERIALS:
(1) Carbon dioxide. Generated in a Kipp apparatus using marble and hydrochloric acid.
(2) Nitrobenzene. No information.

ESTIMATED ERROR:
$$\delta L/L = 0.03 \text{ (compiler)}$$

REFERENCES:
1. Timofejew, W.
   Z. Phys. Chem. 1890, 6, 141.
2. Steiner, P.
### COMPONENTS:
1. Carbon dioxide; CO$_2$; [124-38-9]
2. Nitrobenzene; C$_6$H$_5$NO$_2$; [98-95-3]

### ORIGINAL MEASUREMENTS:
Gjaldbaek, J. C.; Andersen, E. K.

### VARIABLES:
- $T/K = 298.15$
- $p_1/kPa = 101.325$ (1 atm)

### PREPARED BY:
J. Chr. Gjaldbaek

### EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>$T/K$</th>
<th>Mol Fraction</th>
<th>Bunsen Coefficient $a$/cm$^3$(STP)cm$^{-3}$atm$^{-1}$</th>
<th>Ostwald Coefficient $L$/cm$^3$cm$^{-3}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>298.15</td>
<td>1.02</td>
<td>2.23</td>
<td>2.43</td>
</tr>
<tr>
<td></td>
<td>1.01</td>
<td>2.17</td>
<td>2.37</td>
</tr>
</tbody>
</table>

The mole fraction and Ostwald coefficient values were calculated by the compiler.

### AUXILIARY INFORMATION

**METHOD/APPARATUS/PROCEDURE:**
Carbon dioxide from a cylinder (99.61% CO$_2$) was bubbled through the solvent until saturation. A portion of the saturated solution was titrated as described in the paper.

**SOURCE AND PURITY OF MATERIALS:**
2. Nitrobenzene. Purified by fractional freezing and by fractional distillation in vacuum. M.p./°C = 5.75, b.p. (760 mmHg)/°C = 211.94 - 211.95, refractive index, $n_D(20°C) = 1.5524 - 1.5527$.

**ESTIMATED ERROR:**
- $\delta T/K = \pm 0.05$
- $\delta x_1/x_1 = \pm 0.015$

**REFERENCES:**
<table>
<thead>
<tr>
<th>COMPONENTS:</th>
<th>ORIGINAL MEASUREMENTS:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Carbon dioxide; CO₂; [124-38-9]</td>
<td>Lenoir, J-Y.; Renault, P.; Renon, H.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>VARIABLES:</th>
<th>PREPARED BY:</th>
</tr>
</thead>
<tbody>
<tr>
<td>T/K = 298.2</td>
<td>C. L. Young</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>EXPERIMENTAL VALUES:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>T/K</td>
<td>Henry's constant HₖCO₂/atm</td>
</tr>
<tr>
<td>298.2</td>
<td>Mole fraction at 101.3 kPa (1 atm)* x C₇O₂</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>76.7</td>
</tr>
<tr>
<td></td>
<td>0.0130</td>
</tr>
</tbody>
</table>

* Calculated by compiler assuming a linear function of

\[ P_{CO₂} \text{ vs } x_{CO₂}, \text{ ie, } x_{CO₂}(1 \text{ atm}) = \frac{1}{H_{CO₂}} \]

AUXILIARY INFORMATION

<table>
<thead>
<tr>
<th>METHOD/APPARATUS/PROCEDURE:</th>
<th>SOURCE AND PURITY OF MATERIALS:</th>
</tr>
</thead>
<tbody>
<tr>
<td>A conventional gas-liquid chromatographic unit fitted with a thermal conductivity detector was used. The carrier gas was helium. The value of Henry's law constant was calculated from the retention time. The value applies to very low partial pressures of gas and there may be a substantial difference from that measured at 1 atm. pressure. There is also considerable uncertainty in the value of Henry's constant since surface adsorption was not allowed for although its possible existence was noted.</td>
<td>(1) L'Air Liquide sample, minimum purity 99.9 mole per cent.</td>
</tr>
<tr>
<td></td>
<td>(2) Touzart and Matignon or Serlabo sample, purity 99 mole per cent.</td>
</tr>
</tbody>
</table>

ESTIMATED ERROR:

\[ \delta T/K = \pm 0.1; \ \delta H/\text{atm} = \pm 6\% \]

(estimated by compiler).
COMPONENTS:

1. Carbon dioxide; CO₂; [124-38-9]
2. Hydrocyanic acid; HCN; [74-90-8]

ORIGINAL MEASUREMENTS:

Quinchon, J.; Gerber, A.; Molinet, G

VARIABLES:

\[ T/\text{K} = 268.15-283.15 \]
\[ P/\text{kPa} = 101.3 \]

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/\text{K}</th>
<th>Absorption vol. of gas/vol. of solvent*</th>
</tr>
</thead>
<tbody>
<tr>
<td>268.15</td>
<td>6.8</td>
</tr>
<tr>
<td>273.15</td>
<td>5.9</td>
</tr>
<tr>
<td>278.15</td>
<td>2.5</td>
</tr>
<tr>
<td>283.15</td>
<td>0.9</td>
</tr>
</tbody>
</table>

* volumes of gas were reduced to 273.15 K and 101.3 kPa

The compiler assumes that the absorption corresponds to a total pressure equal to barometric pressure rather than a partial pressure equal to barometric pressure. The vapor pressure of pure hydrocyanic acid is about 28 kPa at 268.15 K and about 54.5 kPa at 283.15 K.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Solubilities were measured by a static method. Liquid hydrocyanic acid was introduced into a calibrated buret. A second calibrated buret contained carbon dioxide over mercury. Burets were maintained at the required temperature by circulation of a coolant through outer jackets. The reduction in volume of carbon dioxide at a total pressure equal to barometric pressure was measured when taps connecting the burets were opened. The volumes of gas were corrected to 273.15 K.

SOURCE AND PURITY OF MATERIALS:

1. Commercial sample dried with Actigel before use.
2. Refluxed for 2.5 h to remove dissolved gases and then sealed in ampoules.

REFERENCES:
COMPONENTS:
(1) Carbon dioxide; CO₂; [124-38-9]
(2) Propanenitrile; C₃H₅N; [107-12-0]

ORIGINAL MEASUREMENTS:
Gjaldbaek, J. C.; Andersen, E. K.

VARIABLES:
\[ T/K = 298.15 \]
\[ P_1/kPa = 101.325 \text{ (1 atm)} \]

EXPERIMENTAL VALUES:
<table>
<thead>
<tr>
<th>T/K</th>
<th>Mol Fraction</th>
<th>Bunsen Coefficient</th>
<th>Ostwald Coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>[10^2x_1]</td>
<td>(a/cm^3\text{ (STP)}cm^{-3}\text{ atm}^{-1})</td>
<td>(L/cm^3cm^{-3})</td>
</tr>
<tr>
<td>298.15</td>
<td>1.69</td>
<td>5.39</td>
<td>5.88</td>
</tr>
<tr>
<td>1.69</td>
<td>5.38</td>
<td>5.87</td>
<td></td>
</tr>
</tbody>
</table>

The mole fraction and Ostwald coefficient values were calculated by the compiler.

METHOD/APPARATUS/PROCEDURE:
The apparatus consists of a calibrated all-glass manometer and bulb enclosed in an air thermostat. The solvent is added and degassed in the apparatus. The gas is added. The apparatus and contents are shaken until equilibrium is attained. Mercury is used for calibration and as the confining liquid.

The absorbed volume of gas is calculated from the initial and final amounts of gas, both saturated with solvent vapor. The amount of solvent is determined by the weight of displaced mercury. Further details are in the references (1, 2).

The mole fraction values are at one atm pressure assuming Henry's law is obeyed.

REFERENCES:
1. Lannung, A.
   J. Am. Chem. Soc. 1930, 52, 68.

2. Gjaldbaek, J. C.

AUXILIARY INFORMATION
SOURCE AND PURITY OF MATERIALS:
(1) Carbon dioxide. Prepared from potassium bicarbonate and sulfuric acid. 99.8 - 99.9% CO₂.
(2) Propanenitrile. Rubber Industries and Sherman Chemicals. Fractionated by distillation. B.p. (760 mmHg)/°C = 97.31 - 97.35, refractive index n_D(20°C) = 1.3664 - 1.3665.

ESTIMATED ERROR:
\[ \delta T/K = \pm 0.05 \]
\[ \delta x_1/x_1 = \pm 0.015 \]
COMPONENTS:
1. Carbon dioxide; CO₂; [124-38-9]
2. Hexanedinitrile, (adiponitile); C₆H₈N₂; [111-69-3]

VARIABLES:
T/K = 288.2-373.2
P/kPa = 12-103 kPa

EXPERIMENTAL VALUES:
A small scale graph showed that the mole ratio solubility of carbon dioxide varied linearly with pressure, within experimental error, at 15, 25, 40, 55, 70 and 100°C over the pressure range of 12-103 kPa. The mole fraction solubility may be considered to vary linearly with pressure over this pressure range, within the experimental error of the measurements.

The authors also gave the following equation for Henry's law constant over the pressure and temperature range

\[ \log_{10}(H/mmHg) = 7.83 - \frac{920}{(T/K)} \]

Henry's law constant, \( H \), was defined by the equation

\[ H = \frac{P_{CO₂}}{x_{CO₂}} \]

\[ \begin{array}{ccc}
T/K & H^* & x_{CO₂}^* \\
288.2 & 43400 & 5790 & 0.01750 \\
298.2 & 55600 & 7410 & 0.01368 \\
313.2 & 78100 & 10400 & 0.00973 \\
328.2 & 106400 & 14200 & 0.00714 \\
343.2 & 141000 & 18800 & 0.00539 \\
373.2 & 232000 & 30900 & 0.00328 \\
\end{array} \]

* calculated by the compiler from the equation above.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
The authors used a static method. Details have been published in earlier papers (1-3).

SOURCE AND PURITY OF MATERIALS:
No information

ESTIMATED ERROR:

REFERENCES:
COMPONENTS:
(1) Carbon dioxide; CO₂; [124-38-9]
(2) Benzenecetonitrile or benzyl cyanide; C₈H₇N; [140-29-4]

ORIGINAL MEASUREMENTS:
Gjaldbaek, J. C.; Andersen, E. K.

VARIABLES:
T/K = 298.15
P₁/kPa = 101.325 (1 atm)

PREPARED BY:
J. Chr. Gjaldbaek

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>Mol Fraction</th>
<th>Bunsen Coefficient</th>
<th>Ostwald Coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>10²x₁</td>
<td>a/cm³(STP)cm⁻³atm⁻¹</td>
<td>L/cm³cm⁻¹</td>
</tr>
<tr>
<td>298.15</td>
<td>1.06</td>
<td>2.07</td>
<td>2.26</td>
</tr>
<tr>
<td></td>
<td>1.04</td>
<td>2.03</td>
<td>2.22</td>
</tr>
</tbody>
</table>

The mole fraction and Ostwald coefficient values were calculated by the compiler.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
Carbon dioxide from a cylinder (99.61% CO₂) was bubbled through the solvent until saturation. A portion of the saturated solution was titrated as described in the paper.

SOURCE AND PURITY OF MATERIALS:
(1) Carbon dioxide. Commercial cylinder, source not given. 99.61 per cent carbon dioxide.
(2) Benzenecetonitrile. Fractional distillation in vacuum. B.p. (760 mmHg)/°C = 233.49 - 233.55, refractive index n₀(20°C) = 1.5233.

ESTIMATED ERROR:
δT/K = ± 0.05
δx₁/x₁ = ± 0.015

REFERENCES:
COMPONENTS:
1. Carbon dioxide; CO₂; [124-38-9]
2. 3-(Dimethylamino)propanenitrile; C₉H₁₀N₂; [1738-25-6]

ORIGINALL MEASUREMENTS:
Bryukhanova, L.A.; Nikitina A.K.

VARIABLES:
T/K = 303.15-333.15

PREPARED BY:
P.G.T. Fogg

EXPERIMENTAL VALUES:
Solubilities were measured at various pressures to a maximum of about 60 atm (6080 kPa) and interpreted by the Krichevskii-Il'inskaya equation in the form

\[ \log_{10}(P_2/x_2) = \log_{10}H - \beta(1-x_1) \]

* \(P_2\) is the partial pressure of carbon dioxide, \(x_2\) the mole fraction of carbon dioxide in the liquid phase, \(H\) the limiting value of the Henry's law constant, \(\beta\) a constant and \(x_1\) the mole fraction of 3-(dimethylamino)propanenitrile in the liquid phase. Henry's law constant is taken to be the ratio of the pressure of the partial pressure of carbon dioxide to the mole fraction of carbon dioxide in the liquid phase.

<table>
<thead>
<tr>
<th>T/K</th>
<th>Henry's law constant, (H/\text{kPa})</th>
<th>(\beta)</th>
<th>(H/\text{atm})</th>
<th>(x_2) at (P_2 = 101.3\ \text{kPa})</th>
</tr>
</thead>
<tbody>
<tr>
<td>303.15</td>
<td>32.43</td>
<td>-0.49801</td>
<td>3286</td>
<td>0.02889</td>
</tr>
<tr>
<td>313.15</td>
<td>51.52</td>
<td>-0.3333</td>
<td>5220</td>
<td>0.01886</td>
</tr>
<tr>
<td>323.15</td>
<td>79.43</td>
<td>-0.1739</td>
<td>8048</td>
<td>0.01247</td>
</tr>
<tr>
<td>333.15</td>
<td>122.2</td>
<td>-0.01555</td>
<td>12382</td>
<td>0.00818</td>
</tr>
</tbody>
</table>

* calculated by the compiler

** given as a positive quantity in the original paper. This appears to be a mistake.

AUXILIARY INFORMATION

METHOD APPARATUS/PROCEDURE:
A static method was used as described in ref. (1).

SOURCE AND PURITY OF MATERIALS:
2. Pure sample, distilled in vacuum.

ESTIMATED ERROR:

REFERENCES:
1. Freudlin, G.N.; Vyshinskiy, V.I.
COMPONENTS:
1. Carbon dioxide; CO₂; [124-38-9]
2. Hexahydro-1-methyl-2H-azepin-2-one, (N-methyl-ε-caprolactam); C₇H₁₃NO; [2556-73-2]

VARIABLES:
T/K = 293.2

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>Kuenen coefficient, S,* /cm³g⁻¹atm⁻¹</th>
<th>Mole fraction (101.3kPa)** xCO₂</th>
</tr>
</thead>
<tbody>
<tr>
<td>293.2</td>
<td>2.90</td>
<td>0.0166</td>
</tr>
</tbody>
</table>

The authors also gave a small scale graph showing the variation of Kuenen coefficient with temperature from about 280 K to about 400 K.

* This is the volume of gas, reduced to 273.15 and 1 atm, which is dissolved by one gram of solvent, divided by the partial pressure of the gas in atmospheres.

** Calculated by the compiler on the assumption that the value of S is applicable to a partial pressure of 1.013 kPa.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
The measurements were made by staff at VEB Leuna-Werke 'Walter Ulbricht'. No other details were given.

SOURCE AND PURITY OF MATERIALS:
No information given.

REFERENCES:
Components:

1. Carbon dioxide; CO$_2$; [124-38-9]
2. Compounds of Phosphorus, Silicon or Sulfur

Evaluators:

Peter G.T. Fogg,
School of Applied Chemistry,
Polytechnic of North London,
Holloway Road, London, N7 8DB, U.K.

July 1991

Critical Evaluation:

Solubility of carbon dioxide in solvents containing phosphorus, silicon or sulfur.

Solubility in solvents containing phosphorus

Mole fraction solubility in hexamethylphosphoric triamide at a partial pressure of 101.3 kPa may be estimated from data published by Bryukhanova and Nikitina (1), Schay et al. (2), Lenoir et al. (3) and Bratzler et al. (4). There is poor agreement between the sets of data. A selection of values of mole fraction solubility at 101.3 kPa are given below.

<table>
<thead>
<tr>
<th>Temperature (K)</th>
<th>Bryukhanova and Nikitina</th>
<th>Schay et al.</th>
<th>Lenoir et al.</th>
<th>Bratzler et al.</th>
</tr>
</thead>
<tbody>
<tr>
<td>293.2</td>
<td>0.0338*</td>
<td>0.0303</td>
<td>0.037</td>
<td></td>
</tr>
<tr>
<td>298.2</td>
<td>0.0313*</td>
<td>0.0282</td>
<td>0.0329</td>
<td></td>
</tr>
<tr>
<td>333.2</td>
<td>0.0194</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* extrapolated

The following equation based upon data from the four sources can be used as an approximate guide to solubility at 101.3 kPa in this solvent. Further measurements are needed to resolve discrepancies between the solubility data.

$$\ln x_{CO_2} = -9.074 + \frac{1667.6}{(T/K)}$$

Temperature range = 273.2-363.2 K

Standard deviation in values of $x_{CO_2} = 0.0030$

Solubility in tributyl phosphate at 223.2 K to 313.2 K from 13.6 kPa to 101.0 kPa has been published by Kosyakov et al. (5). Henry's constant at various temperatures from 243.2 K to 383.2 K have been published by Lenoir et al. (3), Gudasheva and Furmer (6), Sweeney (7), and Vei et al. (8). There is satisfactory agreement between mole fraction solubilities at a partial pressure of 101.3 kPa calculated from data from the five sources. The recommended smoothing equation is given below.

$$\ln x_{CO_2} = 17.505 + \frac{591.57}{(T/K)} - 4.0173\ln(T/K)$$

Temperature range = 223.2-383.2 K

Standard deviation in values of $x_{CO_2} = 0.0055$

Solubility in triethyl phosphate was measured at 298.15 K; 101.3 kPa by Schay et al. (2). Lenoir et al. (3) reported a limiting value of Henry's constant at 325.7 K measured by gas-liquid chromatography. The corresponding values of mole fraction solubility at a partial pressure of 101.3 kPa are compatible with each other.

Lenoir et al. (3) also reported values of Henry's constant for the trimethyl, tripropyl and tris(2-methylpropyl) esters of phosphoric acid. No other measurements on these systems are available for comparison.

Solubility in solvents containing silicon

Wilcock et al. (9) measured solubility in octamethylcyclotetrasiloxane at 292.2 K to 313.1 K; 101.3 kPa. The data are likely to be reliable but no other measurements on this system are available for comparison. Mole fraction solubility is high compared with a reference line based upon Raoult's law.
COMPONENTS:
1. Carbon dioxide; CO₂; [124-38-9]
2. Compounds of Phosphorus, Silicon or Sulfur

EVALUATOR:
Peter G.T. Fogg,
School of Applied Chemistry,
Polytechnic of North London,
Holloway Road, London, N7 8DB, U.K.
July 1991

CRITICAL EVALUATION:

Solubility in tetramethyl silane at 291.5 K has been reported by Horsman-van den O0001 and Warman (10). The solubility measurement needs to be confirmed by other workers before it can be recommended.

Solubility in solvents containing sulfur

Kassim et al. (11) measured solubility in tetrahydrothiophene, 1,1-dioxide at 303.2 K to 333.2 K; 101.3 kPa. Xu et al. (12) reported solubility measured at about 100 kPa from 303.2 K to 359.9 K. Roberts and Mather (13) measured solubility to high pressures at 313.2 K and 373.2 K. Rivas and Prausnitz (14) published Henry's constants for 303.2 K to 373.2 K. Murrieta-Guevara et al. (15) reported limiting values of Henry's constants from 303.2 K to 373.2 K.

The evaluator recommends the following equation based upon data from references (11-14) for the mole fraction solubility at a partial pressure of 101.3 kPa.

\[ \ln x_{CO₂} = -67.177 + 4443.1/(T/K) + 8.4001\ln(T/K) \]

temperature range = 303.2-373.2 K

standard deviation in \( x_{CO₂} = 1.9 \times 10^{-4} \)

Values estimated from Henry's constants published by Murrieta-Guevara et al. (15) differ from values from this equation by 8%, 2% and 12% at 303.2 K, 323.2 K and 373.2 K respectively.

Solubility in carbon disulfide at or close to 101.3 kPa has been reported by Just (16) from 288.2 K to 298.2 K and Kobatake and Hildebrand (17) from 281.7 K to 306.4 K. Solubility at lower pressures has been reported by Woukoloff (18) from 280.2 K to 293.7 K and Gjaldbaek (19) from 298.1 to 298.5 K. There is good agreement between values of mole fraction solubility corrected to a partial pressure of 101.3 kPa from data given by Kobatake and Hildebrand, Woukoloff, and by Gjaldbaek. A smoothing equation for these values are given below. Data published by Just are very low when compared with that from the other sources.

\[ \ln x_{CO₂} = 65.328 - 2496.8/(T/K) - 11.0008\ln(T/K) \]

temperature range = 280.2-306.4 K

standard deviation in \( x_{CO₂} = 3.8 \times 10^{-5} \)

The value mole fraction solubility in sulfinylbismethane at 101.3 kPa and 298.2 K published by Dymond (20) is 0.00908. Lenoir et al. (3) reported a limiting value of Henry's law constant measured by gas-liquid chromatography at this temperature. This corresponds to a mole fraction solubility at 101.3 kPa of about 0.00943. Solubilities measured by gas chromatography are always subject to uncertainty because of the possibility of surface effects affecting the result. Dymond's value may therefore be the more reliable one but confirmation by other measurements is needed.

Selected values of solubilities in solvents containing phosphorus or silicon are given in Table 1 and shown in Fig 1.
COMPONENTS:
1. Carbon dioxide; CO₂; [124-38-9]
2. Compounds of Phosphorus, Silicon or Sulfur

CRITICAL EVALUATION:

REFERENCES


EVALUATOR:
Peter G.T. Fogg,
School of Applied Chemistry,
Polytechnic of North London,
Holloway Road, London, N7 8DB, U.K.
July 1991
COMPONENTS:
1. Carbon dioxide; CO₂; [124-38-9]
2. Compounds of Phosphorus, Silicon or Sulfur

EVALUATOR:
Peter G.T. Fogg,
School of Applied Chemistry,
Polytechnic of North London,
Holloway Road, London, N7 8DB, U.K.
July 1991

Fig. 1 Mole fraction solubility of carbon dioxide in various solvents containing phosphorus, silicon or sulfur at a partial pressure of gas of 101.3 kPa.

a - tributyl phosphate
b - hexamethyolphosphoric triamide
c - octamethylcyclotetrasiloxane
d - tetrahydrothiophene, 1,1-dioxide (sulfolane)
e - sulfinylbismethane (dimethylsulfoxide) (20)
f - carbon disulfide

The curves showing the variation of solubility with temperature correspond to equations derived by the evaluator.

A reference line corresponding to values from the Raoult's law equation is also shown.
**Components:**

1. Carbon dioxide; CO₂; [124-38-9]
2. Compounds of Phosphorus, Silicon or Sulfur

**Critical Evaluation:**

Table 1.
Solubility of carbon dioxide at a partial pressure of 101.3 kPa in solvents containing sulfur, phosphorus or silicon.

<table>
<thead>
<tr>
<th>Solvent</th>
<th>( T/K )</th>
<th>( x_{CO2} )</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hexamethylphosphoric triamide</td>
<td>298.15</td>
<td>0.0308 ±0.0030</td>
<td>*</td>
</tr>
<tr>
<td>Tributyl phosphate</td>
<td>298.15</td>
<td>0.0334 ±0.0055</td>
<td>*</td>
</tr>
<tr>
<td>Triethyl phosphate</td>
<td>298.15</td>
<td>0.0275</td>
<td>2</td>
</tr>
<tr>
<td>Octamethylcyclotetrasiloxane</td>
<td>298.04</td>
<td>0.02633</td>
<td>9</td>
</tr>
<tr>
<td>Tetrahydrothiophene, 1,1-dioxide</td>
<td>298.15</td>
<td>0.01223 ±0.00008</td>
<td>*</td>
</tr>
<tr>
<td>Carbon disulfide</td>
<td>298.15</td>
<td>0.00327 ±0.00004</td>
<td>*</td>
</tr>
<tr>
<td>Sulfinylbismethane</td>
<td>298.15</td>
<td>0.00908</td>
<td>20</td>
</tr>
</tbody>
</table>

* from the equation given by the evaluator on a previous page
COMPONENTS:

1. Carbon dioxide; CO₂; [124-38-9]
2. Phosphoric acid, triethyl ester, (triethylphosphate); C₆H₁₅O₄P; [78-40-0]
   Phosphoric triamide, hexamethyl; (hexamethylphosphorictriamide); C₆H₁₅N₃OP; [680-31-9]

VARIABLES:

T/K = 273.2-363.2
P/kPa = 27-108 kPa

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>Solvent</th>
<th>P CO₂/kPa</th>
<th>T/K</th>
<th>Volume of gas absorbed†/cm³ g⁻¹</th>
<th>Mole fraction solubility* x CO₂</th>
</tr>
</thead>
<tbody>
<tr>
<td>TEP</td>
<td>101.3</td>
<td>298.15</td>
<td>3.45</td>
<td>0.0275</td>
</tr>
<tr>
<td>HMP</td>
<td>101.3</td>
<td>273.15</td>
<td>6.06 ‰</td>
<td>0.0465</td>
</tr>
<tr>
<td></td>
<td>101.3</td>
<td>298.15</td>
<td>3.60</td>
<td>0.0282</td>
</tr>
<tr>
<td></td>
<td>101.3</td>
<td>333.15</td>
<td>1.82 ‰</td>
<td>0.0144</td>
</tr>
<tr>
<td></td>
<td>101.3</td>
<td>363.15</td>
<td>1.18 ‰</td>
<td>0.0094</td>
</tr>
</tbody>
</table>

TEP = triethylphosphate
HMP = hexamethylphosphorictriamide

† volumes of gas have been reduced to 273.2 K and 101.3 kPa

* values were given for 298.15 K in a table. Small scale graphs (4cm x 4cm) showing a linear variation of absorption of gas in HMP with change in partial pressure were also published. The values which have been estimated by the compiler from the graphs are marked with ‰.

* calculated by the compiler.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
Static methods were used. For measurements above room temperature condensation of solvent vapor in the cooler parts of the system was reduced by use of capillary tubes to connect parts of the apparatus and by measuring the pressure by a null method. A magnetic stirrer was used to stir the solvent in the absorption cell.

SOURCE AND PURITY OF MATERIALS:
No information

ESTIMATED ERROR:
Error of about 0.15 cm³ g⁻¹ in reading data from the graphs (compiler).

REFERENCES:
COMPONENTS:
1. Carbon dioxide; CO$_2$; [124-38-9]
2. Phosphoric triamide, hexamethyl-; C$_6$H$_{18}$N$_3$OP; [680-31-9]

ORIGINAL MEASUREMENTS:
Lenoir, J-Y.; Renault, P.; Renon, H.

VARIABLES:
$T/K = 298.2$

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>$T/K$</th>
<th>Henry's constant $H_{CO_2}/$atm</th>
<th>Mole fraction at 101.3 kPa (1 atm) $x_{CO_2}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>298.2</td>
<td>30.4</td>
<td>0.0329</td>
</tr>
</tbody>
</table>

* Calculated by compiler assuming a linear function of $P_{CO_2}$ vs $x_{CO_2}$, i.e., $x_{CO_2}$ (1 atm) = $1/H_{CO_2}$.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
A conventional gas-liquid chromatographic unit fitted with a thermal conductivity detector was used. The carrier gas was helium. The value of Henry's law constant was calculated from the retention time. The value applies to very low partial pressures of gas and there may be a substantial difference from that measured at 1 atm. pressure. There is also considerable uncertainty in the value of Henry's constant since surface adsorption was not allowed for although its possible existence was noted.

SOURCE AND PURITY OF MATERIALS:
(1) L'Air Liquide sample, minimum purity 99.9 mole per cent.
(2) Touzart and Matignon or Serlabo sample, purity 99 mole per cent.

ESTIMATED ERROR:
$\delta T/K = \pm 0.1; \delta H_{atm} = \pm 6\%$
(estimated by compiler).

REFERENCES:
COMPONENTS:
1. Carbon dioxide; CO₂; [124-38-9]
2. Hexamethylphosphoric triamide, (hexametapol); C₆H₁₃N₃OP; [680-31-9]

VARIABLES:
T/K = 313.15-348.15

EXPERIMENTAL VALUES:
Solubilities were measured at various pressures to a maximum of 40 atm (4053 kPa) and interpreted by the Krichevskii-Ilin'skaya equation in the form
\[
\log(P_2/x_2) = \log H - \beta(1-x_2^s)
\]

\(P_2\) is the partial pressure of carbon dioxide, \(x_2\) the mole fraction of carbon dioxide in the liquid phase, \(H\) the limiting value of the Henry's law constant, \(\beta\) a constant and \(x_1\) the mole fraction of hexametapol in the liquid phase. Henry's law constant is taken to be the ratio of the partial pressure of carbon dioxide to the mole fraction of carbon dioxide in the liquid phase.

<table>
<thead>
<tr>
<th>T/K</th>
<th>Henry's law constant, (H/\text{atm})</th>
<th>(\beta^*)</th>
<th>(H/\text{kPa}^*)</th>
<th>(x_2) at (P_2 = 101.3\ \text{kPa}^*)</th>
</tr>
</thead>
<tbody>
<tr>
<td>313.15</td>
<td>37.93</td>
<td>-0.33085</td>
<td>3843</td>
<td>0.02538</td>
</tr>
<tr>
<td>333.15</td>
<td>50.12</td>
<td>-0.30709</td>
<td>5078</td>
<td>0.01942</td>
</tr>
<tr>
<td>348.15</td>
<td>59.02</td>
<td>-0.28876</td>
<td>5980</td>
<td>0.01658</td>
</tr>
</tbody>
</table>

* calculated by the compiler
** given as a positive quantity in the original paper. This appears to be a mistake.

AUXILIARY INFORMATION

METHOD APPARATUS/PROCEDURE:
A static method was used as described in ref.(1).

SOURCE AND PURITY OF MATERIALS:
2. Pure sample, distilled in vacuum.

ESTIMATED ERROR:

REFERENCES:
1. Freidlin, G.N.; Bushinskii, V.I.
**COMPONENTS:**

1. Carbon dioxide; CO$_2$; [124-38-9]

2. Phosphoric acid, tributyl ester, (tributyl phosphate); C$_{12}$H$_{27}$PO$_4$; [126-73-8]

**ORIGINAL MEASUREMENTS:**

Kosyakov, N. Ya.; Yushko, V.L.; Sergienko, I.D.; Khokhlov, S.F.; Taraba, R.F.

*Khim. Prom. (Moscow) 1972, 48, (6), 432-3.*

**VARIABLES:**

<table>
<thead>
<tr>
<th>T/K</th>
<th>P/kPa</th>
</tr>
</thead>
<tbody>
<tr>
<td>223.15 - 313.15</td>
<td>13.6 - 101.0</td>
</tr>
</tbody>
</table>

**EXPERIMENTAL VALUES:**

<table>
<thead>
<tr>
<th>T/K</th>
<th>P/Torr</th>
<th>P/kPa</th>
<th>$x_{CO_2}$</th>
<th>Henry's law constant, $H/kPa^*$</th>
</tr>
</thead>
<tbody>
<tr>
<td>223.15</td>
<td>102</td>
<td>13.6</td>
<td>0.0316</td>
<td></td>
</tr>
<tr>
<td>223.15</td>
<td>344</td>
<td>45.9</td>
<td>0.1068</td>
<td></td>
</tr>
<tr>
<td>223.15</td>
<td>449</td>
<td>59.8</td>
<td>0.1358</td>
<td></td>
</tr>
<tr>
<td>223.15</td>
<td>569</td>
<td>75.8</td>
<td>0.1684</td>
<td></td>
</tr>
<tr>
<td>223.15</td>
<td>682</td>
<td>91.0</td>
<td>0.1960</td>
<td></td>
</tr>
<tr>
<td>223.15</td>
<td>760</td>
<td>101.3</td>
<td>0.2201 *</td>
<td>418</td>
</tr>
<tr>
<td>223.15</td>
<td>124</td>
<td>16.6</td>
<td>0.0264</td>
<td></td>
</tr>
<tr>
<td>223.15</td>
<td>316</td>
<td>42.1</td>
<td>0.0681</td>
<td></td>
</tr>
<tr>
<td>223.15</td>
<td>491</td>
<td>65.5</td>
<td>0.1055</td>
<td></td>
</tr>
<tr>
<td>223.15</td>
<td>502</td>
<td>67.0</td>
<td>0.1099</td>
<td></td>
</tr>
<tr>
<td>223.15</td>
<td>544</td>
<td>72.6</td>
<td>0.1165</td>
<td></td>
</tr>
<tr>
<td>223.15</td>
<td>602</td>
<td>80.3</td>
<td>0.1279</td>
<td></td>
</tr>
<tr>
<td>223.15</td>
<td>631</td>
<td>84.1</td>
<td>0.1323</td>
<td></td>
</tr>
<tr>
<td>223.15</td>
<td>760</td>
<td>101.3</td>
<td>0.1623 *</td>
<td>622</td>
</tr>
</tbody>
</table>

* estimated by the compiler by fitting the experimental data to the Krichevsky-Il'inskaya equation in the form

$$\log_{10} \frac{P}{kPa} = \log_{10} (H/kPa) - \beta (1 - x_{tbp}^2)$$

where $H$ is the Henry's law constant, $\beta$ is a constant and $x_{tbp}$ is the mole fraction of tributyl phosphate.

**AUXILIARY INFORMATION**

**METHOD/APPARATUS/PROCEDURE:**

Solubility measured by a static method described in the literature (1).

**SOURCE AND PURITY OF MATERIALS:**

1. Purified by freezing. Chromatographic analysis indicated that impurities did not exceed 0.1 vol.%

2. Pure grade material used.

**REFERENCES:**

COMPONENTS:

1. Carbon dioxide; CO$_2$; [124-38-9]
2. Phosphoric acid, tributyl ester, (tributyl phosphate); C$_{12}$H$_{27}$PO$_4$; [126-73-8]

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>$T/K$</th>
<th>$P/Torr$</th>
<th>$P/kPa$</th>
<th>$x_{CO_2}$</th>
<th>Henry's law constant, $H$/kPa</th>
</tr>
</thead>
<tbody>
<tr>
<td>253.15</td>
<td>124</td>
<td>16.6</td>
<td>0.0145</td>
<td></td>
</tr>
<tr>
<td>253.15</td>
<td>369</td>
<td>49.2</td>
<td>0.0422</td>
<td></td>
</tr>
<tr>
<td>253.15</td>
<td>433</td>
<td>57.8</td>
<td>0.0527</td>
<td></td>
</tr>
<tr>
<td>253.15</td>
<td>500</td>
<td>66.7</td>
<td>0.0593</td>
<td></td>
</tr>
<tr>
<td>253.15</td>
<td>660</td>
<td>88.0</td>
<td>0.0791</td>
<td></td>
</tr>
<tr>
<td>253.15</td>
<td>698</td>
<td>93.0</td>
<td>0.0774</td>
<td></td>
</tr>
<tr>
<td>253.15</td>
<td>760</td>
<td>101.3</td>
<td>0.0887</td>
<td>*</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1137</td>
</tr>
<tr>
<td>273.15</td>
<td>156</td>
<td>20.7</td>
<td>0.0110</td>
<td></td>
</tr>
<tr>
<td>273.15</td>
<td>440</td>
<td>58.7</td>
<td>0.0308</td>
<td></td>
</tr>
<tr>
<td>273.15</td>
<td>462</td>
<td>61.6</td>
<td>0.0352</td>
<td></td>
</tr>
<tr>
<td>273.15</td>
<td>600</td>
<td>80.0</td>
<td>0.0440</td>
<td></td>
</tr>
<tr>
<td>273.15</td>
<td>644</td>
<td>85.9</td>
<td>0.0444</td>
<td></td>
</tr>
<tr>
<td>273.15</td>
<td>718</td>
<td>95.7</td>
<td>0.0510</td>
<td></td>
</tr>
<tr>
<td>273.15</td>
<td>760</td>
<td>101.3</td>
<td>0.0546</td>
<td>*</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1866</td>
</tr>
<tr>
<td>293.15</td>
<td>398</td>
<td>53.0</td>
<td>0.0207</td>
<td></td>
</tr>
<tr>
<td>293.15</td>
<td>562</td>
<td>75.0</td>
<td>0.0295</td>
<td></td>
</tr>
<tr>
<td>293.15</td>
<td>620</td>
<td>82.7</td>
<td>0.0303</td>
<td></td>
</tr>
<tr>
<td>293.15</td>
<td>676</td>
<td>90.1</td>
<td>0.0360</td>
<td></td>
</tr>
<tr>
<td>293.15</td>
<td>758</td>
<td>101.0</td>
<td>0.0396</td>
<td>*</td>
</tr>
<tr>
<td>293.15</td>
<td>760</td>
<td>101.3</td>
<td>0.0396</td>
<td>*</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2650</td>
</tr>
<tr>
<td>313.15</td>
<td>191</td>
<td>25.5</td>
<td>0.0066</td>
<td></td>
</tr>
<tr>
<td>313.15</td>
<td>176</td>
<td>23.4</td>
<td>0.0084</td>
<td></td>
</tr>
<tr>
<td>313.15</td>
<td>378</td>
<td>50.4</td>
<td>0.0132</td>
<td></td>
</tr>
<tr>
<td>313.15</td>
<td>520</td>
<td>69.3</td>
<td>0.0185</td>
<td></td>
</tr>
<tr>
<td>313.15</td>
<td>653</td>
<td>87.1</td>
<td>0.0220</td>
<td></td>
</tr>
<tr>
<td>313.15</td>
<td>658</td>
<td>87.7</td>
<td>0.0264</td>
<td></td>
</tr>
<tr>
<td>313.15</td>
<td>756</td>
<td>100.7</td>
<td>0.0273</td>
<td></td>
</tr>
<tr>
<td>313.15</td>
<td>760</td>
<td>101.3</td>
<td>0.0275</td>
<td>*</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3384</td>
</tr>
</tbody>
</table>

* estimated by the compiler by fitting the experimental data to the Krichevsky-Il'inskaya equation in the form

$$\log_{10}\frac{P/kPa \times x_{CO_2}}{P/kPa} = \log_{10}(H/kPa) - \beta(1 - x_{tbp}^2)$$

where $H$ is the Henry's law constant, $\beta$ is a constant and $x_{tbp}$ is the mole fraction of tributyl phosphate.

ORIGINAL MEASUREMENTS:

Kosyakov, N. Ya.; Yushko, V.L. Sergienko, I.D.; Khokhlov, S.F.; Taraba, R.F.

### COMPONENTS:

1. Carbon dioxide; CO$_2$; [124-38-9]
   - Phosphoric acid, tributyl ester (tributyl phosphate); C$_{12}$H$_{27}$O$_4$P; [126-73-8]

### VARIABLES:

- $T/K = 243.15-358.15$
- $P/kPa = 0-101.3$

### EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>$T/K$</th>
<th>$H/mmHg$</th>
<th>$H/kPa^*$</th>
<th>$x_{CO_2}^*$ at $P_{CO_2} = 101.3$ kPa,</th>
</tr>
</thead>
<tbody>
<tr>
<td>243.15</td>
<td>7300</td>
<td>973</td>
<td>0.1041</td>
</tr>
<tr>
<td>263.15</td>
<td>11900</td>
<td>1587</td>
<td>0.0639</td>
</tr>
<tr>
<td>273.15</td>
<td>15500</td>
<td>2066</td>
<td>0.0490</td>
</tr>
<tr>
<td>298.15</td>
<td>21400</td>
<td>2853</td>
<td>0.0355</td>
</tr>
<tr>
<td>313.15</td>
<td>28200</td>
<td>3760</td>
<td>0.0270</td>
</tr>
<tr>
<td>328.15</td>
<td>35400</td>
<td>4720</td>
<td>0.0215</td>
</tr>
<tr>
<td>343.15</td>
<td>50000</td>
<td>6666</td>
<td>0.0152</td>
</tr>
<tr>
<td>358.15</td>
<td>69100</td>
<td>9213</td>
<td>0.0110</td>
</tr>
</tbody>
</table>

*$Calculated by the compiler. Mole fraction solubility was proportional to pressure, within experimental error, in the pressure range from 0 to 101.3 kPa.

Solubilities at pressures to 5066 kPa in the temperature range 288-313 K were also measured.

### AUXILIARY INFORMATION

**METHOD APPARATUS/PROCEDURE:**

A static method was used as described in refs. (1) and (2).

**SOURCE AND PURITY OF MATERIALS:**

2. 'Pure' grade tributyl phosphate was vacuum distilled.

**ESTIMATED ERROR:**

**REFERENCES:**

COMPONENTS:
1. Carbon dioxide; CO₂; [124-38-9]
2. Phosphoric acid, tributyl ester (tributyl phosphate); C₁₂H₂₇O₄P; [126-73-8]

VARIABLES:
T/K = 343.15-383.15
P/kPa = 0-101.3

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>Henry's constant, H, /mmHg</th>
<th>Mole fraction x CO₂* at P CO₂ = 101.3 kPa, /kPa*</th>
</tr>
</thead>
<tbody>
<tr>
<td>343.15</td>
<td>50300</td>
<td>6706</td>
</tr>
<tr>
<td>363.15</td>
<td>80400</td>
<td>10719</td>
</tr>
<tr>
<td>383.15</td>
<td>119800</td>
<td>15972</td>
</tr>
</tbody>
</table>

* calculated by the compiler on the assumption that 
  x CO₂ = P CO₂ / H

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
A static method was used. The compiler was not able to consult the original Russian paper. Literature references could not be included in the English translation from which the compilation was prepared (1).

REFERENCES:
1. British Gas Corporation Translations, T5408/BG/LRS/LRST492/80

ORIGINAL MEASUREMENTS:
COMPONENTS:
1. Carbon dioxide; $\text{CO}_2$; [124-38-9]
2. Esters of phosphoric acid.

ORIGINAL MEASUREMENTS:
Lenoir, J-Y.; Renault, P.; Renon, H.

VARIABLES:
$T/K = 298.2-343.2$

PREPARED BY:
C. L. Young

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>$T/K$</th>
<th>$H_{\text{CO}_2}/\text{atm}$</th>
<th>Mole fraction at 1 atm* $x_{\text{CO}_2}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>325.2</td>
<td>87.1</td>
<td>0.0115</td>
</tr>
<tr>
<td>325.7</td>
<td>54.4</td>
<td>0.0184</td>
</tr>
<tr>
<td>298.2</td>
<td>28.1</td>
<td>0.0356</td>
</tr>
<tr>
<td>323.2</td>
<td>42.4</td>
<td>0.0236</td>
</tr>
<tr>
<td>343.2</td>
<td>28.1</td>
<td>0.0168</td>
</tr>
</tbody>
</table>

Phosphoric acid, trimethyl ester; $\text{C}_3\text{H}_9\text{O}_4\text{P}$; [512-56-1]

Phosphoric acid, triethyl ester; $\text{C}_6\text{H}_{15}\text{O}_4\text{P}$; [78-40-0]

Phosphoric acid, tripropyl ester; $\text{C}_9\text{H}_{21}\text{O}_4\text{P}$; [513-08-6]

Phosphoric acid, tributyl ester; $\text{C}_{12}\text{H}_{27}\text{O}_4\text{P}$; [126-73-8]

Phosphoric acid, tris(2-methylpropyl) ester; $\text{C}_{12}\text{H}_{27}\text{O}_4\text{P}$; [126-71-6]

* Calculated by compiler assuming a linear function of $P_{\text{CO}_2}$ vs $x_{\text{CO}_2}$, i.e., $x_{\text{CO}_2}(1 \text{ atm}) = 1/H_{\text{CO}_2}$.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
A conventional gas-liquid chromatographic unit fitted with a thermal conductivity detector was used. The carrier gas was helium. The value of Henry's law constant was calculated from the retention time. The value applies to very low partial pressures of gas and there may be a substantial difference from that measured at 1 atm. pressure. There is also considerable uncertainty in the value of Henry's constant since surface adsorption was not allowed for although its possible existence was noted.

SOURCE AND PURITY OF MATERIALS:
(1) L'Air Liquide sample, minimum purity 99.9 mole per cent.
(2) Touzart and Matignon or Serlabo sample, purity 99 mole per cent.

ESTIMATED ERROR:
$\delta T/K = \pm 0.1$; $\delta H/\text{atm} = \pm 6$
(estimated by compiler).

REFERENCES:
COMPONENTS:
(1) Carbon dioxide; CO₂; [124-38-9]
(2) Octamethylcyclotetrasiloxane; C₈H₂₄O₄Si₄; [556-67-2]

ORIGINAL MEASUREMENTS:
Wilcock, R. J.; McHale, J. L.; Battino, R.; Wilhelm, E.

VARIABLES:
T/K: 292.15 - 313.05
p/kPa: 101.325 (1 atm)

PREPARED BY:
H. L. Clever

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>Mol Fraction</th>
<th>Bunsen Coefficient</th>
<th>Ostwald Coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>10²x_I</td>
<td>a/cm³(STP)cm⁻³atm⁻¹</td>
<td>L/cm³cm⁻³</td>
</tr>
<tr>
<td>292.15</td>
<td>2.794</td>
<td>2.068</td>
<td>2.212</td>
</tr>
<tr>
<td>298.04</td>
<td>2.633</td>
<td>1.933</td>
<td>2.109</td>
</tr>
<tr>
<td>313.05</td>
<td>2.209</td>
<td>1.586</td>
<td>1.818</td>
</tr>
</tbody>
</table>

The solubility values were adjusted to a gas partial pressure of 101.325 kPa by Henry's law.

The Bunsen coefficients were calculated by the compiler.

Smoothed Data: For use between 292.15 and 313.05 K.

\[ \ln x_I = -7.1315 + 10.3956/(T/100K) \]

The standard error about the regression line 2.15 x 10⁻⁴.

<table>
<thead>
<tr>
<th>T/K</th>
<th>Mol Fraction</th>
<th>10²x_I</th>
</tr>
</thead>
<tbody>
<tr>
<td>298.15</td>
<td>2.613</td>
<td></td>
</tr>
<tr>
<td>308.15</td>
<td>2.333</td>
<td></td>
</tr>
</tbody>
</table>

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
The apparatus is based on the design of Morrison and Billett (1), and the version used is described by Battino, Evans, and Danforth (2). The degassing apparatus and procedure are described by Battino, Banzhof, Bogan, and Wilhelm (3).

Degassing. Up to 500 cm³ of solvent is placed in a flask of such size that the liquid is about 4 cm deep. The liquid is rapidly stirred, and vacuum is applied intermittently through a liquid N₂ trap until the permanent gas residual pressure drops to 5 microns.

Solubility Determination. The degassed solvent is passed in a thin film down a glass spiral tube containing the solute gas plus the solvent vapor at a total pressure of one atm. The volume of gas absorbed is found by difference between the initial and final volumes in the buret system. The solvent is collected in a tared flask and weighed.

SOURCE AND PURITY OF MATERIALS:
(1) Carbon dioxide. Air Products and Chemicals, Inc. Stated to be 99.8 mole percent minimum purity.
(2) Octamethylcyclotetrasiloxane. General Electric Co. Distilled, density at 298.15 K was 0.9500 g cm⁻³.

ESTIMATED ERROR:
\[ \delta T/K = 0.03 \]
\[ \delta p/mmHg = 0.5 \]
\[ \delta x_I/x_I = 0.1 \]

REFERENCES:
COMPONENTS:
(1) Carbon dioxide; \( \text{CO}_2 \); [124-38-9]
(2) Tetramethyl silane; \( \text{C}_4\text{H}_{12}\text{Si} \); [75-76-3]

VARIABLES:
\[
\begin{align*}
T/\text{K} & = 291.5 \\
p_1/\text{kPa} & = \text{not given}
\end{align*}
\]

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>Temperature ( T/\text{K} )</th>
<th>Ostwald Coefficient ( L/\text{cm}^3 \text{ cm}^{-3} )</th>
<th>Number of Runs</th>
</tr>
</thead>
<tbody>
<tr>
<td>18.3</td>
<td>3.59</td>
<td>3</td>
</tr>
</tbody>
</table>

ORIGINAL MEASUREMENTS:
Horsman-van den Dool, L. E. W.; Warman, J. W.
Interuniversity Reactor Institute (IRI)-Report 134-81-01

PREPARED BY:
H. L. Clever

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
A cylindrical glass container of approximately 15 cm³ volume is partly filled with solvent and closed with a half-hole septum. An amount of the gaseous solute is added to the container. The closed container is shaken for 30 minutes. Samples of both the vapor and liquid phases are taken in a calibrated syringes. The samples are injected into a gas chromatograph. The Ostwald coefficient is calculated from the known sample size and the measured peak areas.

The chromatograph is a Hewlett-Packard model 5750 equipped with a thermal conductivity cell detector. The carrier gas is helium. A 200 cm Porapak Q column is used for the separation.

SOURCE AND PURITY OF MATERIALS:
(2) Tetramethyl silane. Merck. Uvasol grade. Impurities which give the same retention time as the gas are removed before the experiment by adsorption or distillation.

ESTIMATED ERROR:
\[ \delta L/L = \pm 0.05 \]

REFERENCES:
COMPONENTS:
1. Carbon dioxide; CO₂; [124-38-9]
2. Tetrahydrothiophene, 1,1-dioxide (Sulfolane); C₄H₆O₂S; [126-33-0]

VARIABLES:
\[ T/K = 303.15-373.15 \]

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>Henry’s constant, ( H )/MPa</th>
<th>Mole fraction of + carbon dioxide in liquid, ( x_{CO_2} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>303.15</td>
<td>9.26</td>
<td>0.01094</td>
</tr>
<tr>
<td>323.15</td>
<td>13.30</td>
<td>0.007618</td>
</tr>
<tr>
<td>348.15</td>
<td>18.89</td>
<td>0.005364</td>
</tr>
<tr>
<td>373.15</td>
<td>25.07</td>
<td>0.004042</td>
</tr>
</tbody>
</table>

+ at a partial pressure of 101.3 kPa calculated by compiler assuming Henry’s law applies at that pressure.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
Volumetric apparatus with a fused quartz precision bourdon pressure gauge. Solubility apparatus carefully thermostatted. Solvent degassed in situ. Apparatus described in ref. (1) and modifications given in source.

SOURCE AND PURITY OF MATERIALS:
1. and 2. Purity at least 99 mole per cent.

ESTIMATED ERROR:
\[ \delta T/K = \pm 0.05; \ \delta x_{CO_2} = \pm 1\%. \]

REFERENCES:
1. Cukor, P.M.; Prausnitz, J.M.
COMPONENTS:

1. Carbon dioxide; CO₂; [124-38-9]
2. Tetrahydrothiophene, 1,1-dioxide, (Sulfolane); C₄H₆O₂S; [126-33-0]

VARIABLES:

\[ T/K = 303.15-373.15 \]
\[ P/kPa = 81.2-2263.4 \]

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>Henry's law constant x CO₂ (101.3 kPa)*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>( H/\text{MPa} )</td>
</tr>
<tr>
<td>303.15</td>
<td>8.61</td>
</tr>
<tr>
<td>323.15</td>
<td>13.17</td>
</tr>
<tr>
<td>373.15</td>
<td>22.39</td>
</tr>
</tbody>
</table>

* estimated by the compiler as \( P_{CO₂}/H \)

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The apparatus and method of calculation have been described in previous publications (refs. 1 and 2). The limiting values of Henry's law constant which are given above were found by fitting the experimental data to the Krichevsky-Kasarnovsky equation (3).

SOURCE AND PURITY OF MATERIALS:

1. Supplied by Infra S.A.; reported purity 99.7 mol%.
2. Purity better than 99.5 mol%.

ESTIMATED ERROR

\[ \delta T/K = \pm 0.02 \text{ to } 343 \text{ K}; \pm 0.5 \text{ at } 373 \text{ K. (authors)} \]
\[ \delta P/x_{CO₂} = \pm 3.5 \]

REFERENCES:

COMPONENTS:
1. Carbon dioxide; CO₂; [124-38-9]
2. Tetrahydrothiophene, 1,1-dioxide (Sulfolane); C₄H₈SO₂; [126-33-0]

VARIABLES:
\[ T/K = 303.15 - 333.15 \]

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>( T/K )</th>
<th>( x_{CO_2} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>303.15</td>
<td>0.0111</td>
</tr>
<tr>
<td>313.15</td>
<td>0.0089</td>
</tr>
<tr>
<td>323.15</td>
<td>0.0075</td>
</tr>
<tr>
<td>333.15</td>
<td>0.0064</td>
</tr>
</tbody>
</table>

METHOD/APPARATUS/PROCEDURE:
Falling film flow apparatus similar to that of Morrison and Billet (1). Apparatus consisted of (i) degassing section in which solvent could be degassed by freezing and thawing under vacuum and (ii) absorption section. The latter consisted of a gas buret and absorption spiral. Mole fraction solubility corrected to 1 atm partial pressure by assuming Henry’s law was valid.

SOURCE AND PURITY OF MATERIALS:
1. Purity 99.99 mole per cent.
2. Fluka AG puriss grade sample, purity better than 99 mole per cent.

ESTIMATED ERROR:
\( \delta T/K = \pm 0.1; \ \delta x/x = \pm 0.02 \) (estimated by compiler).

REFERENCES:
COMPONENTS:
1. Carbon dioxide; CO₂; [124-38-9]
2. Tetrahydrothiophene, 1,1-dioxide, (Sulfolane); C₄H₆O₂S; [126-33-0]

VARIABLES:
T/K = 313.15, 373.15
P/kPa = 105-5900

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>P/kPa*</th>
<th>Mole fraction of CO₂ in solution X₁</th>
<th>Henry's constant, H,', /MPa</th>
</tr>
</thead>
<tbody>
<tr>
<td>313.15</td>
<td>105</td>
<td>0.00971</td>
<td>10.4</td>
</tr>
<tr>
<td></td>
<td>101.3†</td>
<td>0.0094</td>
<td></td>
</tr>
<tr>
<td></td>
<td>103</td>
<td>0.00985</td>
<td></td>
</tr>
<tr>
<td></td>
<td>185</td>
<td>0.01770</td>
<td></td>
</tr>
<tr>
<td></td>
<td>278</td>
<td>0.02610</td>
<td></td>
</tr>
<tr>
<td>373.15</td>
<td>249</td>
<td>0.01040</td>
<td>25.8</td>
</tr>
<tr>
<td></td>
<td>101.3†</td>
<td>0.0040</td>
<td></td>
</tr>
</tbody>
</table>

*The partial pressure of carbon dioxide was approximately equal to the total pressure under the conditions of the measurements.

Measurements were also carried out at higher pressures to a maximum of 5900 kPa.

†Estimated by the compiler on the assumption that the variation of mole fraction solubility with partial pressure of carbon dioxide was approximately linear to a mole fraction solubility of 0.01.

‡Limiting values of Henry's constant estimated by the authors as

\[ H = \lim_{x_1 \to 0} \left[ \frac{f_1}{x_1} \right] \]

where \( f_1 \) = fugacity of CO₂
\( x_1 \) = mole fraction of CO₂ in solution.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
The apparatus was similar to that described by Jou et al.(1). The sulfolane was introduced into a windowed equilibrium cell in a constant temperature bath. Gas was added until sufficient pressure was reached. The gas was circulated by a magnetic pump and bubbled through the liquid until the pressure remained constant for several hours. The vapor phase was then analysed by gas chromatography. Samples of the liquid phase were withdrawn, added to a solution of sodium hydroxide and the amount of carbon dioxide in the samples found by titration.

SOURCE AND PURITY OF MATERIALS:
2. Sulfolane supplied by Aldrich Chemical Company; purity 99%

ESTIMATED ERROR:
\( \delta x_1 / x_1 = ±2-3\% \) (authors)

REFERENCES:
1. Jou, F.-Y.; Mather, A.E.; Otto, F.D.
COMPONENTS:

1. Carbon dioxide; CO\textsubscript{2}; [124-38-9]
2. Tetrahydrothiophene, 1,1-dioxide (Sulfolane); C\textsubscript{4}H\textsubscript{6}O\textsubscript{2}S; [126-33-0]

VARIABLES:

T/K = 303.2-359.9
P/kPa = 100

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>t/°C</th>
<th>T/K</th>
<th>Solubility /kPa m\textsuperscript{3} kmol\textsuperscript{-1}</th>
<th>x\textsubscript{CO\textsubscript{2}} at P\textsubscript{CO\textsubscript{2}} = 101.3 kPa</th>
</tr>
</thead>
<tbody>
<tr>
<td>30.0</td>
<td>303.2</td>
<td>911.9</td>
<td>0.01050</td>
</tr>
<tr>
<td>40.2</td>
<td>313.4</td>
<td>1116.1</td>
<td>0.00866</td>
</tr>
<tr>
<td>55.4</td>
<td>328.6</td>
<td>1429.3</td>
<td>0.00684</td>
</tr>
<tr>
<td>70.5</td>
<td>343.7</td>
<td>1806.9</td>
<td>0.00548</td>
</tr>
<tr>
<td>86.7</td>
<td>359.9</td>
<td>2276.7</td>
<td>0.00442</td>
</tr>
</tbody>
</table>

* estimated by the compiler.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The apparatus was similar to that described by Haimour and Sandall (1) which consisted essentially of a glass flask maintained at constant temperature connected to a gas buret. The flask was first purged with gas under test. A measured volume of solvent was then injected into the flask. The flask was mechanically shaken and the reduction of volume of gas in the gas buret recorded.

SOURCE AND PURITY OF MATERIALS:

1. Carbon dioxide supplied by Union Carbide Canada Ltd.; purity at least 99.9%
2. Sulfolane supplied by Aldrich Chemical Company; purity 99%

ESTIMATED ERROR:

δ(solubility) = ±2% (authors)

REFERENCES:

COMPONENTS:
(1) Carbon dioxide; CO$_2$; [124-38-9]
(2) Carbon disulfide; CS$_2$; [75-15-0]

ORIGINAl MEASUREMENTS:

VARIABLES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>P$_1$/kPa</th>
</tr>
</thead>
<tbody>
<tr>
<td>280.23 - 293.74</td>
<td>13.48 - 63.73</td>
</tr>
</tbody>
</table>

T/K = 280.23 - 293.74
P$_1$/kPa = 13.48 - 63.73
(101.11 - 478.25 mmHg)

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>Temperature</th>
<th>Carbon Dioxide Pressure</th>
<th>Carbon Dioxide Absorption Coefficient</th>
<th>Bunsen Coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>t/°C</td>
<td>T/K</td>
<td>P$_1$/mmHg</td>
<td>A/cm$^3$(STP) cm$^{-3}$</td>
</tr>
<tr>
<td>7.08</td>
<td>280.23</td>
<td>452.93</td>
<td>0.84818</td>
</tr>
<tr>
<td>7.1</td>
<td>280.25</td>
<td>185.5</td>
<td>0.33395</td>
</tr>
<tr>
<td>13.04</td>
<td>286.19</td>
<td>478.05</td>
<td>0.84427</td>
</tr>
<tr>
<td>13.04</td>
<td>286.19</td>
<td>195.8</td>
<td>0.33244</td>
</tr>
<tr>
<td>20.53</td>
<td>293.68</td>
<td>410.25</td>
<td>0.67281</td>
</tr>
<tr>
<td>20.59</td>
<td>293.74</td>
<td>101.11</td>
<td>0.16723</td>
</tr>
</tbody>
</table>

1 The pressure in the paper is given as 918.5 mmHg, however, other values in the paper indicate it should be 195.8 mmHg.

The Bunsen coefficient values were calculated by the compiler.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
No information.

Although the author does not describe the method, he does clearly state that the volume of gas absorbed is reduced to the standard conditions of 0 °C and 760 mmHg.

SOURCE AND PURITY OF MATERIALS:
(1) Carbon dioxide. No information.
(2) Carbon disulfide. Specified as 880°F.

ESTIMATED ERROR:

REFERENCES:
COMPONENTS:
(1) Carbon dioxide; CO₂; [124-38-9]
(2) Carbon disulfide; CS₂; [75-15-0]

ORIGINAL MEASUREMENTS:
Just, G.
Z. Phys. Chem. 1901, 37, 342 - 367.

VARIABLES:
\[ T/K = 288.15 - 298.15 \]
\[ p/f/kPa = 101.325 \text{(1 atm)} \]

PREPARED BY:
M. E. Derrick
H. L. Clever

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>Mol Fraction</th>
<th>Bunsen Coefficient ( a/(cm^3\text{ (STP)}\text{cm}^{-3}\text{atm}^{-1}) )</th>
<th>Ostwald Coefficient ( L/cm^3\text{cm}^{-3} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>288.15</td>
<td>2.39</td>
<td>0.895</td>
<td>0.9446</td>
</tr>
<tr>
<td>293.15</td>
<td>2.22</td>
<td>0.828</td>
<td>0.8888</td>
</tr>
<tr>
<td>298.15</td>
<td>2.15</td>
<td>0.797</td>
<td>0.8699</td>
</tr>
</tbody>
</table>

The author measured the Ostwald coefficient at a pressure of about 746 mmHg. The compiler assumed the Ostwald coefficient to be independent of pressure, and calculated the mole fraction and Bunsen coefficient values at 101.325 kPa (1 atm) partial pressure of the gas.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
An Ostwald apparatus as modified by Timofejev (1), and Steiner (2) is used. The apparatus consists of a gas buret, an absorption flask, and a mercury manometer. The system is thermostated with a water jacket.

The gas is introduced into the degassed liquid. The gas volume absorbed is determined by the gas buret. The solvent volume is determined at the end of the experiment by pouring the solvent into a graduated flask.

SOURCE AND PURITY OF MATERIALS:
(1) Carbon dioxide. Generated in a Kipp apparatus using marble and hydrochloric acid.
(2) Carbon disulfide. No information.

ESTIMATED ERROR:
\[ \delta L/L = 0.03 \text{ (compiler)} \]

REFERENCES:
1. Timofejev, W.
Z. Phys. Chem. 1890, 6, 141.
2. Steiner, P.
COMPONENTS:
(1) Carbon dioxide; CO₂; [124-38-9]
(2) Carbon disulfide; CS₂; [75-15-0]

ORIGINAL MEASUREMENTS:
Gjaldbaek, J. C.

VARIABLES:

\[ T/K = 298.05 - 298.45 \]
\[ P_1/kPa = 101.325 \text{ (1 atm)} \]

PREPARED BY:
J. Chr. Gjaldbaek

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>Carbon Dioxide Pressure ( p_1/mmHg )</th>
<th>Mol Fraction ( 10^3 x_1 )</th>
<th>Bunsen Coefficient ( a/cm^3\text{(STP)}cm^{-3}\text{atm}^{-1} )</th>
<th>Ostwald Coefficient ( L/cm^3cm^{-3} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>298.05</td>
<td>433.0</td>
<td>3.30</td>
<td>1.21</td>
<td>1.32</td>
</tr>
<tr>
<td>298.35</td>
<td>394.8</td>
<td>3.30</td>
<td>1.21</td>
<td>1.32</td>
</tr>
<tr>
<td>298.45</td>
<td>479.2</td>
<td>3.33</td>
<td>1.22</td>
<td>1.33</td>
</tr>
</tbody>
</table>

\( T/K \) and \( x_1 \) are the mole fraction solubility values adjusted to a gas partial pressure of 101.325 kPa by the compiler assuming that Henry's law is obeyed.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
A calibrated all-glass combined manometer and bulb was enclosed in an air thermostat and shaken until equilibrium. Mercury was used for calibration and as confining liquid. The solvent was degassed in the apparatus.

The absorbed volume of gas is calculated from the initial and final amounts, both saturated with solvent vapor. The amount of solvent is determined by the weight of displaced mercury.

The mole fraction solubility values are at 1 atm assuming Henry's law is obeyed.

Details of the apparatus and procedure are given in ref. 1 and 2.

SOURCE AND PURITY OF MATERIALS:
(1) Carbon dioxide. Prepared from potassium bicarbonate (analytical reagent) and concentrated sulfuric acid. 99.9 per cent CO₂.

ESTIMATED ERROR:
\[ \delta T/K = \pm 0.05 \]
\[ \delta x_1/x_1 = \pm 0.015 \]

REFERENCES:
1. Lannung, A.
2. Gjaldbaek, J. C.
COMPONENTS:
(1) Carbon dioxide; CO₂; [124-38-9]
(2) Carbon disulfide; CS₂; [75-15-0]

ORIGINAL MEASUREMENTS:
Kobatake, Y.; Hildebrand, J. H.

VARIABLES:
T/K: 281.65 - 306.36
P/kPa: 101.325 (1 atm)

PREPARED BY:
M. E. Derrick
H. L. Clever

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>Temperature (°C)</th>
<th>Mol Fraction</th>
<th>Bunsen Coefficient</th>
<th>Ostwald Coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>T/K</td>
<td>10³ x₁</td>
<td>a/cm³(STP) cm⁻³ atm⁻¹</td>
</tr>
<tr>
<td>8.50</td>
<td>281.65</td>
<td>3.785</td>
<td>1.431</td>
</tr>
<tr>
<td>16.55</td>
<td>289.70</td>
<td>3.538</td>
<td>1.325</td>
</tr>
<tr>
<td>25.00</td>
<td>298.15</td>
<td>3.280</td>
<td>1.22</td>
</tr>
<tr>
<td>33.21</td>
<td>306.16</td>
<td>3.020</td>
<td>1.11</td>
</tr>
</tbody>
</table>

The Bunsen and Ostwald coefficients were calculated by the compiler.

Smoothed Data: For use between 281.65 and 306.36 K.

\[ \ln x₁ = -8.3618 + 7.8588/(T/100K) \]

The standard error about the regression line is 2.64 x 10⁻⁴.

<table>
<thead>
<tr>
<th>T/K</th>
<th>Mol Fraction</th>
</tr>
</thead>
<tbody>
<tr>
<td>283.15</td>
<td>3.749</td>
</tr>
<tr>
<td>288.15</td>
<td>3.573</td>
</tr>
<tr>
<td>293.15</td>
<td>3.410</td>
</tr>
<tr>
<td>298.15</td>
<td>3.260</td>
</tr>
<tr>
<td>303.15</td>
<td>3.122</td>
</tr>
</tbody>
</table>

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE: The apparatus consists of a gas measuring buret, an absorption pipet, and a reservoir for the solvent. The buret is thermostated at 25°C, the pipet at any temperature from 5 to 30°C. The pipet contains an iron bar in glass for magnetic stirring. The pure solvent is degassed by freezing with liquid nitrogen, evacuating, then boiling with a heat lamp. The degassing process is repeated three times. The solvent is flowed into the pipet where it is again boiled for final degassing. Manipulation of the apparatus is such that the solvent never comes in contact with stopcock grease. The liquid in the pipet is sealed off by mercury. Its volume is the difference between the capacity of the pipet and the volume of mercury that confines it. Gas is admitted into the pipet. Its exact amount is determined by P-V measurements in the buret before and after introduction of the gas into the pipet. The stirrer is set in motion. Equilibrium is attained within 24 hours.

SOURCE AND PURITY OF MATERIALS:
(1) Carbon dioxide. California Dry Ice Co. Standard grade. Dried by passing through a trap at dry ice-acetone temperature, and tubes containing CaCl₂ then P₂O₅. The dried gas was distilled at liquid N₂ temperature several times.

(2) Carbon disulfide. Mallinckrodt Chemical Works. Analytical Reagent grade. Shaken successively with Hg and HgCl₂, filtered, distilled, and stored over Hg more than 5 days before use.

ESTIMATED ERROR:
\[ \delta T/K = 0.02 \]
\[ \delta x₁/x₁ = 0.003 \]
### COMPONENTS:

1. Carbon dioxide; CO₂; [124-38-9]
2. Sulfinylbismethane or dimethyl sulfoxide; C₆H₂OS (CH₃SOCH₃); [67-68-5]

### ORIGINAL MEASUREMENTS:

Dymond, J. H.

### VARIABLES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>p/kPa (1 atm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>298.15</td>
<td>101.325</td>
</tr>
</tbody>
</table>

### PREPARED BY:

M. E. Derrick
H. L. Clever

### EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>10²x₁</th>
<th>Bunsen Coefficient</th>
<th>Ostwald Coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>298.15</td>
<td>9.08</td>
<td>2.88</td>
<td>3.14</td>
</tr>
</tbody>
</table>

The Bunsen and Ostwald coefficients were calculated by the compiler.

### METHOD/APPARATUS/PROCEDURE:

The liquid is saturated with the gas at a gas partial pressure of 1 atm.

The apparatus is that described by Dymond and Hildebrand (1). The apparatus uses an all-glass pumping system to spray slugs of degassed solvent into the gas. The amount of gas dissolved is calculated from the initial and final gas pressure.

### SOURCE AND PURITY OF MATERIALS:

2. Dimethylsulfoxide. Matheson, Coleman and Bell Co. Spectro-quality. Dried and fractionally frozen. m.p. 18.37°C.

### ESTIMATED ERROR:

### REFERENCES:

COMPONENTS:

1. Carbon dioxide; CO₂; [124-38-9]
2. Sulfinylbismethane; (dimethylsulfoxide); C₂H₆SO; [67-68-5]

VARIABLES:

T/K = 298.2

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>Henry's constant H CO₂/atm</th>
<th>Mole fraction at 101.3 kPa (1 atm)*</th>
</tr>
</thead>
<tbody>
<tr>
<td>298.2</td>
<td>106</td>
<td>0.00943</td>
</tr>
</tbody>
</table>

* Calculated by compiler assuming a linear function of

\[ P_{CO_2} \text{ vs } x_{CO_2}, \text{ i.e., } x_{CO_2} (1 \text{ atm}) = 1/H_{CO_2} \]

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
A conventional gas-liquid chromatographic unit fitted with a thermal conductivity detector was used. The carrier gas was helium. The value of Henry's law constant was calculated from the retention time. The value applies to very low partial pressures of gas and there may be a substantial difference from that measured at 1 atm. pressure. There is also considerable uncertainty in the value of Henry's constant since surface adsorption was not allowed for although its possible existence was noted.

SOURCE AND PURITY OF MATERIALS:
(1) L'Air Liquide sample, minimum purity 99.9 mole per cent.
(2) Touzart and Matignon or Serlabo sample, purity 99 mole per cent.

ESTIMATED ERROR:
\[ \delta T/K = \pm 0.1; \delta H/\text{atm} = \pm 6\% \]
(estimated by compiler).

REFERENCES:

## COMPONENTS:

<table>
<thead>
<tr>
<th>Component</th>
<th>Molecular Formula</th>
<th>CAS Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Carbon dioxide; CO₂</td>
<td></td>
<td>124-38-9</td>
</tr>
<tr>
<td>2. Mixed Solvents</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

## EVALUATOR:

Peter G.T. Fogg,  
School of Applied Chemistry,  
Polytechnic of North London,  
Holloway Road, London, N7 8DB, U.K.  
July 1991

## CRITICAL EVALUATION:

**Solubility of carbon dioxide in mixed solvents**

Sichkova and co-workers (1,2) have measured the solubility of carbon dioxide in solutions of 2-aminoethanol in various organic solvents. Measurements on solutions in methanol were made at partial pressures of carbon dioxide from 6.7 kPa to 101.3 kPa, temperatures from 223.2 K to 293.2 K and concentrations of 2-aminoethanol of 5, 15 and 18 wt%. At a fixed temperature and a fixed concentration of 2-aminoethanol there is relatively little change in the mole fraction solubility of carbon dioxide with change in pressure over the pressure range studied. At 293.2 K and 15 wt% of 2-aminoethanol the mole fraction solubility at 6.7 kPa is 0.0391 and at 101.3 kPa is 0.0629. This behaviour is similar to that of aqueous solution of aminoalkanols. At a fixed partial pressure of carbon dioxide and a fixed temperature, extrapolation of mole fraction solubility of carbon dioxide to zero concentration of 2-aminoethanol gives a solubility close to that predicted from the smoothing equation recommended for solubility in methanol (see page 128). Solutions of 2-aminoethanol in other solvents were studied at one concentration of 2-aminoethanol (2.5 mol dm⁻³) and, in most cases, at one temperature, 293.2 K, only. The nature of the solvent affects the absorption of carbon dioxide to some extent. At 293 K, 99.1 kPa the solubility in benzenemethanol solution is 30.7 cm³ gas (corrected to 101.3 kPa and 273.2 K)/cm³ of solvent. The corresponding solubility in N,N-dimethylformamide solution at 98 kPa is 40.6 cm³/cm³. There is no reason to doubt the reliability of the measurements on 2-aminoethanol solutions reported by Sichkova and co-workers. The data may be accepted on a provisional basis.

Rivas and Prausnitz (3) measured solubility in solutions of 2-aminoethanol in 1-methyl-2-pyrrolidinone. This system was also studied by Sichkova et al. Data are presented in the form of small scale graphs. The graph for solutions containing 3 and 5 wt% of 2-aminoethanol shows the variation of mole fraction of carbon dioxide with partial pressure of carbon dioxide for each solution. A second graph for a solution of 15 wt% of aminoethanol shows the variation of moles of CO₂/dm³ with partial pressure of carbon dioxide. The first graph indicates that absorption of carbon dioxide per unit volume of solvent increases with concentration of 2-aminoethanol whereas the second graph indicates that the absorption in the 15 wt% solution is less than in the 5% solution for the same partial pressure of carbon dioxide. In the opinion of the evaluator the second graph should also be labelled to show the variation of mole fraction solubility of carbon dioxide with partial pressure of gas. The variation is then in accord with the variation in solubility in a solution of approximately 13 wt% reported by Sichkova et al.

Rivas and Prausnitz (4) also measured the solubility of carbon dioxide in a solution of 2-(2-aminoethoxy)-ethanol at 263.1 K and 298.3 K and pressures from 7.9 kPa to 35.0 kPa. These data are consistent with data for solutions of 2-aminoethanol.

Takahashi et al. (5) measured solubility of carbon dioxide in benzene, tetrachloromethane, 1-propanol, 1-octanol, 2-methyl-1-propanol and formamide and mixtures of pairs of these solvents. They used an indirect method in which the rate of absorption of gas was measured. The solubility data for the pure solvents are low compared with values found by other workers using conventional methods. The mole fraction solubility in ethanol at 298.2 K; 101.3 kPa from this work is 0.00624 compared with a smoothed value from other sources of 0.00727. The value for benzene is 0.00824 compared with a smoothed value of 0.00927. Viscosity of mixtures was also measured. The authors found a correlation between the variation of their solubility values and variation of viscosity as composition of a mixture was varied.
Koudelka (6) measured solubilities in pure samples of methanol, 2-propanone, trichloromethane, and benzene and in mixtures of pairs of these solvents. Measurements were carried out at 293.15 K and data given for a partial pressure of gas of 101.3 kPa. Solubility data on the pure solvents are in good accord with data obtained by other workers. It is therefore likely that data for the mixtures are reliable. In all cases the variation of mole fraction solubility of carbon dioxide with molar composition of the mixed solvent lay on smooth curves. In one case, that of mixtures of methanol and trichloromethane, the mole fraction solubility of carbon dioxide passes through a minimum.

Byrne et al. (7) measured Ostwald coefficients for dissolution of carbon dioxide in solutions of cephalin, lecithin or cholesterol in benzene. In each case the Ostwald coefficient was lower than the value for pure benzene. Similar measurements were made of the solubility of cholesterol in 2-methyl-1-propanol but, in this case, the added solid did not affect the value of the Bunsen coefficient. There is no reason to doubt the reliability of this work but no other measurements on these systems are available for comparison.

Rosenthal (8) measured the effects on the solubility of carbon dioxide of adding polymeric material to various solvents. Cellulose acetate lowered the Ostwald coefficient for dissolution in N,N-dimethylformamide and for dissolution in 2-propanone. Polystyrene and polyisobutylene both lowered the coefficient for dissolution in benzene. Polyacrylonitrile raised the coefficient for dissolution in N,N-dimethylformamide. In all cases the effects were small. The addition of 0.0987 g of polystyrene of relative molecular mass 180 000 lowered the Ostwald coefficient for dissolution in benzene from 2.66 to 2.44 at 293.15 K. No similar measurements are available to confirm these results. However the measurements of solubility in the pure liquids, in the absence of polymeric material, which was carried out as part of the same research, are in good agreement with measurements by other workers.

Rosenthal (8) measured the solubility of carbon dioxide in solutions of sodium iodide in 2-propanone. The molal concentration of sodium iodide varied from 0.55 to 2.07. Ostwald coefficients decreased with addition of sodium iodide with the Sechenov constant ranging from 0.119 to 0.129. Addition of sodium iodide to N,N-dimethylformamide also reduced the Ostwald coefficient of carbon dioxide. The Sechenov constant for a solution saturated with sodium iodide, calculated from the solubility measurements, is 0.199. These measurements appear to be reliable but need confirmation.

Rosenthal (8) also investigated the effect of adding octadecanoic acid to 2-propanone and to N,N-dimethylformamide. The Ostwald coefficient for solutions in N,N-dimethylformamide passed through a maximum with increasing concentration of octadecanoic acid. Perhaps this behaviour was due to an increasing formation of micelles as the concentration of octadecanoic acid was increased. Addition of octadecanoic acid caused a decrease in the Ostwald coefficient for dissolution in 2-propanone at the two concentrations of acid which were studied. Addition of a mole fraction of 0.00506 of acid to 2-propanone caused the Ostwald coefficient to fall from 6.88 to 5.01. Further addition to give a mole fraction of acid of 0.00805 caused a much smaller fall in the Ostwald coefficient to 4.93. These systems would bear re-investigation.

Kosakewitsch (9) measured solubility at 288.15 K and a partial pressure of 101.3 kPa in methanol containing various proportions of lithium chloride, bromide or iodide or sodium iodide. Maximum mole ratios of salt to
COMPONENTS:

1. Carbon dioxide; CO₂; [124-38-9]
2. Mixed Solvents

EVALUATOR:

Peter G.T. Fogg,
School of Applied Chemistry,
Polytechnic of North London,
Holloway Road, London, N7 8DB, U.K.

July 1991

CRITICAL EVALUATION:

methanol were LiCl:0.0917, LiBr:0.1031, LiI:0.0241, NaI:0.0835. The solubility in solutions of these salts in ethanol at 293.15 K and 101.3 kPa was also measured. Maximum mole ratios in this case were LiCl:0.1511, LiBr:0.0642, LiI:0.1040, NaI:0.0844. The evaluator has found that plots of ln(mole ratio solubility) against the mole ratio concentration of salt in methanol are close to straight lines. Under these conditions solubility in methanol approximates to a Sechenov type relationship i.e.

\[
\ln(\text{mole ratio } \text{CO}_2/\text{CH}_3\text{OH}) = A - B(\text{mole ratio } MX/\text{CH}_3\text{OH})
\]

\((MX = \text{salt}; A \& B \text{ are constants})\)

Addition of salt decreases the solubility of the gas in each case and there is negligible differences between the effects of the different salts. The value of \(A\) is -4.798. The average value of \(B\) is 7.368.

Solubility in ethanol follows similar relationships to a maximum mole ratio of salt to ethanol of about 0.06. The value of \(A\) is -4.869. The value of \(B\) is about 6.173 for LiCl, LiBr and NaI but is about 8.193 for LiI. The values of \(B\) decrease at higher concentrations of salt.

No other measurements of the solubility of carbon dioxide in solutions of salts in methanol or ethanol are available to the evaluator for a direct comparison. However there is good agreement between the author's values of solubility in pure methanol and in pure ethanol and values reported by other workers. The mole fraction solubility in methanol at 288.15 K from Kosakewitsch's work is 0.00818. The value from the smoothing equation given by the evaluator on page 128 is 0.0080 ±0.0014. The mole fraction solubility in ethanol at 293.15 K from the work is 0.00762 compared with a value of 0.00789 ±0.00002 from the equation for solubility in ethanol on page 128.

REFERENCES

COMPONENTS:

1. Carbon dioxide; CO₂; [124-38-9]
2. 2-Aminoethanol, (monoethanolamine); C₂H₇NO; [141-43-5]
3. Methanol; CH₄O; [67-56-1]

VARIABLES:

T/K = 223.2-293.2
P/kPa = 0-103 kPa
wt% MEA = 5-18

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>wt% MEA</th>
<th>T/K</th>
<th>Density of solvent /g cm⁻³</th>
<th>P_CO₂ /mmHg</th>
<th>S</th>
<th>x_CO₂ *</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>223.2</td>
<td>0.8650</td>
<td>50</td>
<td>6.7</td>
<td>16.9</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.8650</td>
<td>100</td>
<td>13.3</td>
<td>19.2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.8650</td>
<td>300</td>
<td>40.0</td>
<td>27.7</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.8650</td>
<td>600</td>
<td>80.0</td>
<td>40.4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.8650</td>
<td>760</td>
<td>101.3</td>
<td>47.2</td>
</tr>
<tr>
<td>243.2</td>
<td>0.8465</td>
<td>50</td>
<td>6.7</td>
<td>15.0</td>
<td>0.0255</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.8465</td>
<td>100</td>
<td>13.3</td>
<td>16.1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.8465</td>
<td>300</td>
<td>40.0</td>
<td>19.8</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.8465</td>
<td>600</td>
<td>80.0</td>
<td>25.8</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.8465</td>
<td>760</td>
<td>101.3</td>
<td>28.7</td>
</tr>
<tr>
<td>263.2</td>
<td>0.8264</td>
<td>50</td>
<td>6.7</td>
<td>11.8</td>
<td>0.0207</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.8264</td>
<td>100</td>
<td>13.3</td>
<td>13.6</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.8264</td>
<td>300</td>
<td>40.0</td>
<td>16.4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.8264</td>
<td>600</td>
<td>80.0</td>
<td>20.1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.8264</td>
<td>760</td>
<td>101.3</td>
<td>22.0</td>
</tr>
<tr>
<td>273.2</td>
<td>0.8181</td>
<td>50</td>
<td>6.7</td>
<td>10.7</td>
<td>0.0189</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.8181</td>
<td>100</td>
<td>13.3</td>
<td>12.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.8181</td>
<td>300</td>
<td>40.0</td>
<td>14.6</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.8181</td>
<td>600</td>
<td>80.0</td>
<td>17.8</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.8181</td>
<td>760</td>
<td>101.3</td>
<td>19.6</td>
</tr>
</tbody>
</table>

§ wt% of monoethanolamine (MEA) in the solvent before addition of CO₂
† volume of gas (reduced to 273.2 K and 101.3 kPa) absorbed by one volume of solvent; taken from graphs given in the paper.
* calculated by the compiler

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The authors used a static method described in ref. (1). Two small scale graphs (7.5 cm × 7 cm; 8 cm × 5 cm) showing experimental values of S at closely spaced pressures for the temperatures and solvent mixtures under investigation. Smooth curves were drawn through the experimental points. The compiler has measured the positions of these lines at five arbitrary pressures to obtained the values of S given above.

SOURCE AND PURITY OF MATERIALS:

1. Purity at least 99.93%
2. Vacuum distilled; no impurities detected by chromatography.
3. Fractionally distilled;
   b.p.t. (101.3 kPa) = 64.4-64.5°C
   ρ (20°C) = 0.7925 g cm⁻³
   refractive index within 0.1% of the value in the literature.

ESTIMATED ERROR:

δS = ±1.5% (authors)
δS = ±0.3 (compiler - error in measurements from the graphs)

REFERENCES:

1. Sichkova, O.P.; Shinelis; A.F.; Leites, I.L.
   Trudy GIAP, 1972, 17, 125.
### COMPONENTS:

1. Carbon dioxide; \( \text{CO}_2; \) [124-38-9]

2. 2-Aminoethanol, (monoethanolamine); \( \text{C}_2\text{H}_7\text{NO}; \) [141-43-5]

3. Methanol; \( \text{CH}_3\text{O}; \) [67-56-1]

### EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>Wt% MEA (^{\text{§}})</th>
<th>T/K</th>
<th>density of solvent ( /g \text{ cm}^{-3} )</th>
<th>( P_{\text{CO}_2} ) ( /\text{mmHg} )</th>
<th>( P_{\text{CO}_2} ) ( /\text{kPa} )</th>
<th>Solubility (^{\dagger})</th>
<th>( x_{\text{CO}_2}^{*} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>283.2</td>
<td>0.8109</td>
<td>50</td>
<td>6.7</td>
<td>9.0</td>
<td>0.0161</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.8109</td>
<td>100</td>
<td>13.3</td>
<td>10.4</td>
<td>0.0186</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.8109</td>
<td>300</td>
<td>40.0</td>
<td>13.6</td>
<td>0.0242</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.8109</td>
<td>600</td>
<td>80.0</td>
<td>16.4</td>
<td>0.0290</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.8109</td>
<td>760</td>
<td>101.3</td>
<td>17.8</td>
<td>0.0314</td>
</tr>
<tr>
<td>293.2</td>
<td></td>
<td>0.7990</td>
<td>50</td>
<td>6.7</td>
<td>7.5</td>
<td>0.0137</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.7990</td>
<td>100</td>
<td>13.3</td>
<td>9.1</td>
<td>0.0165</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.7990</td>
<td>300</td>
<td>40.0</td>
<td>12.1</td>
<td>0.0219</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.7990</td>
<td>600</td>
<td>80.0</td>
<td>14.7</td>
<td>0.0265</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.7990</td>
<td>760</td>
<td>101.3</td>
<td>16.0</td>
<td>0.0286</td>
</tr>
<tr>
<td>15</td>
<td>223.2</td>
<td>0.8872</td>
<td>50</td>
<td>6.7</td>
<td>46.3</td>
<td>0.0749</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.8872</td>
<td>100</td>
<td>13.3</td>
<td>49.9</td>
<td>0.0803</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.8872</td>
<td>300</td>
<td>40.0</td>
<td>58.1</td>
<td>0.0921</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.8872</td>
<td>600</td>
<td>80.0</td>
<td>68.0</td>
<td>0.1063</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.8872</td>
<td>760</td>
<td>101.3</td>
<td>71.2</td>
<td>0.1107</td>
</tr>
<tr>
<td>243.2</td>
<td></td>
<td>0.8700</td>
<td>50</td>
<td>6.7</td>
<td>40.2</td>
<td>0.0668</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.8700</td>
<td>100</td>
<td>13.3</td>
<td>43.4</td>
<td>0.0718</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.8700</td>
<td>300</td>
<td>40.0</td>
<td>49.5</td>
<td>0.0811</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.8700</td>
<td>600</td>
<td>80.0</td>
<td>55.2</td>
<td>0.0897</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.8700</td>
<td>760</td>
<td>101.3</td>
<td>58.1</td>
<td>0.0938</td>
</tr>
<tr>
<td>263.2</td>
<td></td>
<td>0.8528</td>
<td>50</td>
<td>6.7</td>
<td>29.6</td>
<td>0.0511</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.8528</td>
<td>100</td>
<td>13.3</td>
<td>34.0</td>
<td>0.0582</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.8528</td>
<td>300</td>
<td>40.0</td>
<td>39.5</td>
<td>0.0670</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.8528</td>
<td>600</td>
<td>80.0</td>
<td>45.3</td>
<td>0.0760</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.8528</td>
<td>760</td>
<td>101.3</td>
<td>48.2</td>
<td>0.0806</td>
</tr>
<tr>
<td>273.2</td>
<td></td>
<td>0.8443</td>
<td>50</td>
<td>6.7</td>
<td>13.0</td>
<td>0.0234</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.8443</td>
<td>100</td>
<td>13.3</td>
<td>28.5</td>
<td>0.0498</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.8443</td>
<td>300</td>
<td>40.0</td>
<td>36.7</td>
<td>0.0631</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.8443</td>
<td>600</td>
<td>80.0</td>
<td>35.8</td>
<td>0.0617</td>
</tr>
<tr>
<td>283.2</td>
<td></td>
<td>0.8357</td>
<td>50</td>
<td>6.7</td>
<td>22.5</td>
<td>0.0400</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.8357</td>
<td>100</td>
<td>13.3</td>
<td>27.7</td>
<td>0.0489</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.8357</td>
<td>300</td>
<td>40.0</td>
<td>33.6</td>
<td>0.0588</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.8357</td>
<td>600</td>
<td>80.0</td>
<td>37.9</td>
<td>0.0657</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.8357</td>
<td>760</td>
<td>101.3</td>
<td>39.7</td>
<td>0.0687</td>
</tr>
<tr>
<td>293.2</td>
<td></td>
<td>0.8273</td>
<td>50</td>
<td>6.7</td>
<td>21.7</td>
<td>0.0391</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.8273</td>
<td>100</td>
<td>13.3</td>
<td>25.7</td>
<td>0.0460</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.8273</td>
<td>300</td>
<td>40.0</td>
<td>30.5</td>
<td>0.0541</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.8273</td>
<td>600</td>
<td>80.0</td>
<td>34.2</td>
<td>0.0602</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.8273</td>
<td>760</td>
<td>101.3</td>
<td>35.8</td>
<td>0.0629</td>
</tr>
<tr>
<td>18</td>
<td>293.2</td>
<td>0.8337</td>
<td>50</td>
<td>6.7</td>
<td>27.6</td>
<td>0.0495</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.8337</td>
<td>100</td>
<td>13.3</td>
<td>31.4</td>
<td>0.0559</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.8337</td>
<td>300</td>
<td>40.0</td>
<td>36.0</td>
<td>0.0637</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.8337</td>
<td>600</td>
<td>80.0</td>
<td>39.7</td>
<td>0.0698</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.8337</td>
<td>760</td>
<td>101.3</td>
<td>41.8</td>
<td>0.0732</td>
</tr>
</tbody>
</table>

\(^{\text{§}}\) wt% of monoethanolamine (MEA) in the solvent before addition of \( \text{CO}_2 \)

\(^{\dagger}\) volume of gas (reduced to 273.2 K and 101.3 kPa) absorbed by one volume of solvent; taken from graphs given in the paper.

\(*\) calculated by the compiler

**ORIGINAL MEASUREMENTS:**

Sichkova, O.P.; Shinelis, A.F.; Voskresenskaya, N.S.; Leites, I.L.

COMPONENTS:

1. Carbon dioxide; CO$_2$; [124-38-9]
2. 2-Aminoethanol, (monoethanolamine); C$_2$H$_7$NO; [141-43-5]
3. Various organic compounds

VARIABLES:

T/K = 293.2-323.2
P/kPa = 1.2-102.7

EXPERIMENTAL VALUES:

The solvent, in each case, consisted of ethanolamine (concentration 2.5 mol dm$^{-3}$) plus component 3.

Measurements were given as points on small scale graphs (approx. 6 cm x 8 cm)

<table>
<thead>
<tr>
<th>Component 3</th>
<th>T/K</th>
<th>P/mmHg</th>
<th>P/kPa</th>
<th>Solubility*</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,2-Ethanediol, (ethylene glycol); C$_2$H$_6$O$_2$; [107-21-1]</td>
<td>293.15</td>
<td>56</td>
<td>7.5</td>
<td>30.6</td>
</tr>
<tr>
<td></td>
<td>293.15</td>
<td>130</td>
<td>17.3</td>
<td>32.7</td>
</tr>
<tr>
<td></td>
<td>293.15</td>
<td>380</td>
<td>50.7</td>
<td>36.2</td>
</tr>
<tr>
<td></td>
<td>293.15</td>
<td>390</td>
<td>52.0</td>
<td>35.8</td>
</tr>
<tr>
<td></td>
<td>293.15</td>
<td>500</td>
<td>66.7</td>
<td>36.8</td>
</tr>
<tr>
<td></td>
<td>293.15</td>
<td>672</td>
<td>89.6</td>
<td>37.9</td>
</tr>
<tr>
<td>2,2'[(1,2-Ethanediylbis-(oxy))bisethanol, (triethylene glycol)]; C$<em>6$H$</em>{14}$O$_6$; [112-27-6]</td>
<td>293.15</td>
<td>80</td>
<td>10.7</td>
<td>29.1</td>
</tr>
<tr>
<td></td>
<td>293.15</td>
<td>355</td>
<td>47.3</td>
<td>32.0</td>
</tr>
<tr>
<td></td>
<td>293.15</td>
<td>379</td>
<td>50.5</td>
<td>32.2</td>
</tr>
<tr>
<td></td>
<td>293.15</td>
<td>541</td>
<td>72.1</td>
<td>33.5</td>
</tr>
<tr>
<td></td>
<td>293.15</td>
<td>735</td>
<td>98.0</td>
<td>34.7</td>
</tr>
</tbody>
</table>

* solubilities were reported as volumes of gas (corrected to 273.15 K and 101.325 kPa) absorbed by one volume of the mixed solvent under the stated conditions.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

A sample of the mixture under test was placed in an absorption bulb fitted with a magnetic stirrer. The mixture was frozen and degassed under vacuum. The bulb was then maintained at the required temperature by thermostatic control. The vapor pressure of the solvent mixture was measured. Appropriate taps were then opened to allow carbon dioxide from one or more bulbs of known volume to come into contact with the sample. The pressure of gas before and after coming into contact with the liquid was measured with mercury manometers. Allowance was made for the volumes of various connecting tubes in the calculation of the quantity of carbon dioxide absorbed by the liquid.

SOURCE AND PURITY OF MATERIALS:

2. distilled; purity checked by measurement of the refractive index which differed by less than 0.1% from the value quoted in the literature.

3. fractionally distilled under vacuum; refractive indices differed by less than 0.1% from literature values.

ESTIMATED ERROR:

$\delta$(solubility) = ±0.3

(compiler's estimated error in reading values from the graphs supplied)

REFERENCES:
**COMPONENTS:**

1. Carbon dioxide; CO\(_2\); [124-38-9]
2. 2-Aminoethanol, (monoethanolamine); C\(_2\)H\(_5\)NO; [141-43-5]
3. Various organic compounds

**EXPERIMENTAL VALUES:**

The solvent in each case, consisted of ethanolamine (concentration 2.5 mol dm\(^{-3}\)) plus component 3.

Measurements were given as points on small scale graphs (approx. 6 cm \(\times\) 8 cm)

<table>
<thead>
<tr>
<th>Component 3</th>
<th>T/K</th>
<th>P/mmHg</th>
<th>P/kPa</th>
<th>Solubility*</th>
</tr>
</thead>
<tbody>
<tr>
<td>2,2'-[Oxylbis(2,1-ethane-diyl)oxy]bisethanol, (tetraethylene glycol); C(_4)H(_9)O(_5); [112-60-7]</td>
<td>293.15</td>
<td>131</td>
<td>17.5</td>
<td>29.9</td>
</tr>
<tr>
<td></td>
<td></td>
<td>215</td>
<td>28.7</td>
<td>31.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>335</td>
<td>44.7</td>
<td>31.9</td>
</tr>
<tr>
<td></td>
<td></td>
<td>485</td>
<td>64.7</td>
<td>32.8</td>
</tr>
<tr>
<td></td>
<td></td>
<td>755</td>
<td>100.7</td>
<td>34.2</td>
</tr>
<tr>
<td>2,2'-Oxybisethanol, (diethylene glycol); C(_4)H(_9)O(_3); [111-46-6]</td>
<td>293.15</td>
<td>81</td>
<td>10.8</td>
<td>28.1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>175</td>
<td>23.3</td>
<td>29.9</td>
</tr>
<tr>
<td></td>
<td></td>
<td>366</td>
<td>48.8</td>
<td>31.2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>543</td>
<td>72.4</td>
<td>32.7</td>
</tr>
<tr>
<td></td>
<td></td>
<td>708</td>
<td>94.4</td>
<td>33.5</td>
</tr>
<tr>
<td>Oxybispropanol, (dipropylene glycol); C(_4)H(_10)O(_3); [25265-71-8]</td>
<td>293.15</td>
<td>30</td>
<td>4.0</td>
<td>26.1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>186</td>
<td>24.8</td>
<td>29.1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>335</td>
<td>44.7</td>
<td>30.2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>525</td>
<td>70.0</td>
<td>30.9</td>
</tr>
<tr>
<td></td>
<td></td>
<td>669</td>
<td>89.2</td>
<td>31.6</td>
</tr>
<tr>
<td>1,3-Propanediol, (propylene glycol); C(_3)H(_6)O(_2); [26264-14-2]</td>
<td>293.15</td>
<td>32</td>
<td>4.3</td>
<td>28.4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>51</td>
<td>6.8</td>
<td>28.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>165</td>
<td>22.0</td>
<td>30.7</td>
</tr>
<tr>
<td></td>
<td></td>
<td>223</td>
<td>29.7</td>
<td>30.7</td>
</tr>
<tr>
<td></td>
<td></td>
<td>365</td>
<td>48.7</td>
<td>32.1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>475</td>
<td>63.3</td>
<td>32.6</td>
</tr>
<tr>
<td></td>
<td></td>
<td>566</td>
<td>75.5</td>
<td>32.9</td>
</tr>
<tr>
<td></td>
<td></td>
<td>670</td>
<td>89.3</td>
<td>33.3</td>
</tr>
<tr>
<td>2,3-Butanediol; C(_4)H(_10)O(_2); [513-85-9]</td>
<td>293.15</td>
<td>9</td>
<td>1.2</td>
<td>25.8</td>
</tr>
<tr>
<td></td>
<td></td>
<td>131</td>
<td>17.5</td>
<td>28.7</td>
</tr>
<tr>
<td></td>
<td></td>
<td>255</td>
<td>34.0</td>
<td>29.8</td>
</tr>
<tr>
<td></td>
<td></td>
<td>415</td>
<td>55.3</td>
<td>30.6</td>
</tr>
<tr>
<td></td>
<td></td>
<td>509</td>
<td>67.9</td>
<td>31.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>615</td>
<td>82.0</td>
<td>31.4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>770</td>
<td>102.7</td>
<td>32.2</td>
</tr>
<tr>
<td>1,3-Butanediol; C(_4)H(_10)O(_2); [107-88-0]</td>
<td>293.15</td>
<td>16</td>
<td>2.1</td>
<td>25.3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>45</td>
<td>6.0</td>
<td>26.7</td>
</tr>
<tr>
<td></td>
<td></td>
<td>70</td>
<td>9.9</td>
<td>26.9</td>
</tr>
<tr>
<td></td>
<td></td>
<td>81</td>
<td>10.8</td>
<td>27.3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>155</td>
<td>20.7</td>
<td>28.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>161</td>
<td>21.5</td>
<td>28.1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>300</td>
<td>40.0</td>
<td>29.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>349</td>
<td>46.5</td>
<td>29.8</td>
</tr>
<tr>
<td></td>
<td></td>
<td>500</td>
<td>66.7</td>
<td>30.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>530</td>
<td>70.7</td>
<td>30.8</td>
</tr>
<tr>
<td></td>
<td></td>
<td>650</td>
<td>86.7</td>
<td>31.3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>720</td>
<td>96.0</td>
<td>31.6</td>
</tr>
</tbody>
</table>

* Solubilities were reported as volumes of gas (corrected to 273.15 K and 101.325 kPa) absorbed by one volume of the mixed solvent under the stated conditions.
COMPONENTS:
1. Carbon dioxide; CO₂; [124-38-9]
2. 2-Aminoethanol, (monoethanolamine); C₅H₁₀N₂; [141-43-5]
3. Various organic compounds

EXPERIMENTAL VALUES:
The solvent in each case, consisted of ethanolamine (concentration 2.5 mol dm⁻³) plus component 3.

Measurements were given as points on small scale graphs (approx. 6 cm x 8 cm)

<table>
<thead>
<tr>
<th>Component 3</th>
<th>T/K</th>
<th>P/mmHg</th>
<th>P/kPa</th>
<th>Solubility*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Methanol; CH₃O; [67-56-1]</td>
<td>293.15</td>
<td>28</td>
<td>3.7</td>
<td>24.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>80</td>
<td>10.7</td>
<td>30.4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>300</td>
<td>40.0</td>
<td>36.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>496</td>
<td>66.1</td>
<td>38.8</td>
</tr>
<tr>
<td></td>
<td></td>
<td>499</td>
<td>66.5</td>
<td>39.1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>589</td>
<td>78.5</td>
<td>40.1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>293.15</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tetrahydro-2-furanmethanol, (tetrahydrofurfuryl alcohol); C₅H₁₀O₂; [97-99-4]</td>
<td>293.15</td>
<td>10</td>
<td>1.3</td>
<td>24.9</td>
</tr>
<tr>
<td></td>
<td></td>
<td>50</td>
<td>6.7</td>
<td>26.4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>135</td>
<td>18.0</td>
<td>27.6</td>
</tr>
<tr>
<td></td>
<td></td>
<td>222</td>
<td>29.6</td>
<td>29.2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>260</td>
<td>34.7</td>
<td>29.3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>373</td>
<td>49.7</td>
<td>29.7</td>
</tr>
<tr>
<td></td>
<td></td>
<td>431</td>
<td>57.5</td>
<td>30.3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>623</td>
<td>83.1</td>
<td>31.7</td>
</tr>
<tr>
<td></td>
<td></td>
<td>741</td>
<td>98.8</td>
<td>32.4</td>
</tr>
<tr>
<td></td>
<td>293.15</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Benzenemethanol, (benzyl alcohol); C₇H₈O; [100-51-6]</td>
<td>293.15</td>
<td>25</td>
<td>3.3</td>
<td>23.4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>65</td>
<td>8.7</td>
<td>25.4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>214</td>
<td>28.5</td>
<td>27.7</td>
</tr>
<tr>
<td></td>
<td></td>
<td>239</td>
<td>31.9</td>
<td>27.7</td>
</tr>
<tr>
<td></td>
<td></td>
<td>353</td>
<td>47.1</td>
<td>28.7</td>
</tr>
<tr>
<td></td>
<td></td>
<td>400</td>
<td>53.3</td>
<td>28.8</td>
</tr>
<tr>
<td></td>
<td></td>
<td>573</td>
<td>76.7</td>
<td>30.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>743</td>
<td>99.1</td>
<td>30.7</td>
</tr>
<tr>
<td></td>
<td>293.15</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2-Methoxyethanol, (ethylene glycol monomethyl ether); C₅H₈O₂; [109-86-4]</td>
<td>293.15</td>
<td>14</td>
<td>1.9</td>
<td>26.4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>25</td>
<td>3.3</td>
<td>26.3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>45</td>
<td>6.0</td>
<td>28.3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>85</td>
<td>11.3</td>
<td>29.3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>200</td>
<td>26.7</td>
<td>30.9</td>
</tr>
<tr>
<td></td>
<td></td>
<td>353</td>
<td>47.1</td>
<td>32.1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>406</td>
<td>54.1</td>
<td>32.4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>512</td>
<td>68.2</td>
<td>33.1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>631</td>
<td>84.1</td>
<td>33.7</td>
</tr>
<tr>
<td></td>
<td></td>
<td>651</td>
<td>86.8</td>
<td>34.3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>691</td>
<td>92.1</td>
<td>34.3</td>
</tr>
</tbody>
</table>

* solubilities were reported as volumes of gas (corrected to 273.15 K and 101.325 kPa) absorbed by one volume of the mixed solvent under the stated conditions.
COMPONENTS:

1. Carbon dioxide; CO₂; [124-38-9]
2. 2-Aminoethanol, (monoethanolamine); C₂H₇NO; [141-43-5]
3. Various organic compounds

EXPERIMENTAL VALUES:

The solvent in each case, consisted of ethanolamine (concentration 2.5 mol dm⁻³) plus component 3.

Measurements were given as points on small scale graphs (approx. 6 cm x 8 cm)

<table>
<thead>
<tr>
<th>Component 3</th>
<th>T/K</th>
<th>P/mmHg</th>
<th>P/kPa</th>
<th>Solubility*</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-Methyl-2-pyrrolidinone, (N-Methylpyrrolidone); C₅H₉NO; [872-50-4]</td>
<td>303.15</td>
<td>22</td>
<td>2.9</td>
<td>27.3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>55</td>
<td>7.3</td>
<td>29.3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>115</td>
<td>15.3</td>
<td>30.8</td>
</tr>
<tr>
<td></td>
<td></td>
<td>235</td>
<td>31.3</td>
<td>33.1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>344</td>
<td>45.9</td>
<td>34.1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>400</td>
<td>53.3</td>
<td>34.7</td>
</tr>
<tr>
<td></td>
<td></td>
<td>556</td>
<td>74.1</td>
<td>35.9</td>
</tr>
<tr>
<td></td>
<td></td>
<td>700</td>
<td>93.3</td>
<td>37.1</td>
</tr>
<tr>
<td></td>
<td>323.15</td>
<td>29</td>
<td>3.9</td>
<td>23.4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>63</td>
<td>8.4</td>
<td>27.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>110</td>
<td>14.7</td>
<td>26.6</td>
</tr>
<tr>
<td></td>
<td></td>
<td>200</td>
<td>26.7</td>
<td>28.7</td>
</tr>
<tr>
<td></td>
<td></td>
<td>451</td>
<td>60.1</td>
<td>31.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>612</td>
<td>81.6</td>
<td>32.8</td>
</tr>
<tr>
<td>N,N-Dimethylacetamide; C₄H₉NO; [127-19-5]</td>
<td>293.15</td>
<td>15</td>
<td>2.0</td>
<td>27.2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>32</td>
<td>4.2</td>
<td>30.4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>119</td>
<td>15.9</td>
<td>33.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>180</td>
<td>24.0</td>
<td>34.9</td>
</tr>
<tr>
<td></td>
<td></td>
<td>287</td>
<td>38.2</td>
<td>36.4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>350</td>
<td>46.7</td>
<td>37.1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>383</td>
<td>51.1</td>
<td>37.9</td>
</tr>
<tr>
<td></td>
<td></td>
<td>414</td>
<td>55.2</td>
<td>38.4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>509</td>
<td>67.9</td>
<td>38.7</td>
</tr>
<tr>
<td></td>
<td></td>
<td>528</td>
<td>70.4</td>
<td>38.9</td>
</tr>
<tr>
<td></td>
<td></td>
<td>663</td>
<td>88.4</td>
<td>40.7</td>
</tr>
<tr>
<td>N,N-Dimethylformamide; C₃H₇NO; [68-12-2]</td>
<td>293.15</td>
<td>7</td>
<td>0.9</td>
<td>26.6</td>
</tr>
<tr>
<td></td>
<td></td>
<td>119</td>
<td>15.9</td>
<td>32.4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>170</td>
<td>22.7</td>
<td>33.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>214</td>
<td>28.5</td>
<td>34.7</td>
</tr>
<tr>
<td></td>
<td></td>
<td>233</td>
<td>31.0</td>
<td>34.8</td>
</tr>
<tr>
<td></td>
<td></td>
<td>254</td>
<td>33.8</td>
<td>34.7</td>
</tr>
<tr>
<td></td>
<td></td>
<td>272</td>
<td>36.2</td>
<td>35.4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>394</td>
<td>52.5</td>
<td>36.9</td>
</tr>
<tr>
<td></td>
<td></td>
<td>413</td>
<td>55.1</td>
<td>37.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>552</td>
<td>73.6</td>
<td>39.3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>565</td>
<td>75.4</td>
<td>38.8</td>
</tr>
<tr>
<td></td>
<td></td>
<td>669</td>
<td>89.1</td>
<td>39.2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>735</td>
<td>98.0</td>
<td>40.6</td>
</tr>
</tbody>
</table>

* solubilities were reported as volumes of gas (corrected to 273.15 K and 101.325 kPa) absorbed by one volume of the mixed solvent under the stated conditions.
COMPONENTS:

1. Carbon dioxide; CO₂; [124-38-9]
2. 2-Aminoethanol, (monoethanolamine); C₂H₇NO; [141-43-5]
3. Various organic compounds

EXPERIMENTAL VALUES:

The solvent, in each case, consisted of ethanolamine (concentration 2.5 mol dm⁻³) plus component 3.

Measurements were given as points on small scale graphs (approx. 6 cm x 8 cm)

<table>
<thead>
<tr>
<th>Component 3</th>
<th>T/K</th>
<th>P/mmHg</th>
<th>P/kPa</th>
<th>Solubility*</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-(2-Methoxyethoxy)ethanol, (diethylene glycol monomethyl ether); C₅H₁₂O₃; [111-77-3]</td>
<td>293.15</td>
<td>31</td>
<td>4.1</td>
<td>27.6</td>
</tr>
<tr>
<td></td>
<td></td>
<td>65</td>
<td>8.7</td>
<td>28.2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>135</td>
<td>18.0</td>
<td>29.6</td>
</tr>
<tr>
<td></td>
<td></td>
<td>160</td>
<td>21.4</td>
<td>30.1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>244</td>
<td>32.6</td>
<td>30.9</td>
</tr>
<tr>
<td></td>
<td></td>
<td>332</td>
<td>44.3</td>
<td>31.6</td>
</tr>
<tr>
<td></td>
<td></td>
<td>451</td>
<td>60.1</td>
<td>32.2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>546</td>
<td>72.8</td>
<td>32.8</td>
</tr>
<tr>
<td></td>
<td></td>
<td>677</td>
<td>90.2</td>
<td>33.6</td>
</tr>
<tr>
<td></td>
<td></td>
<td>746</td>
<td>99.4</td>
<td>34.2</td>
</tr>
<tr>
<td>2-Phenoxyethanol, (ethylene glycol monophenyl ether); C₉H₁₀O₂; [122-99-6]</td>
<td>293.15</td>
<td>29</td>
<td>3.9</td>
<td>22.3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>40</td>
<td>5.3</td>
<td>25.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>80</td>
<td>10.7</td>
<td>26.7</td>
</tr>
<tr>
<td></td>
<td></td>
<td>159</td>
<td>21.2</td>
<td>27.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>216</td>
<td>28.8</td>
<td>28.1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>314</td>
<td>41.9</td>
<td>28.7</td>
</tr>
<tr>
<td></td>
<td></td>
<td>346</td>
<td>46.2</td>
<td>29.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>522</td>
<td>69.5</td>
<td>29.7</td>
</tr>
<tr>
<td></td>
<td></td>
<td>661</td>
<td>88.1</td>
<td>30.4</td>
</tr>
<tr>
<td>2-Pyrrolidinone; C₄H₇NO; [616-45-5]</td>
<td>293.15</td>
<td>11</td>
<td>1.5</td>
<td>29.1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>32</td>
<td>4.3</td>
<td>30.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>74</td>
<td>9.9</td>
<td>31.8</td>
</tr>
<tr>
<td></td>
<td></td>
<td>110</td>
<td>14.7</td>
<td>32.8</td>
</tr>
<tr>
<td></td>
<td></td>
<td>165</td>
<td>22.0</td>
<td>33.9</td>
</tr>
<tr>
<td></td>
<td></td>
<td>374</td>
<td>49.9</td>
<td>35.7</td>
</tr>
<tr>
<td></td>
<td></td>
<td>506</td>
<td>67.5</td>
<td>36.7</td>
</tr>
<tr>
<td></td>
<td></td>
<td>541</td>
<td>72.1</td>
<td>37.1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>660</td>
<td>88.0</td>
<td>37.9</td>
</tr>
<tr>
<td>1-Methyl-2-pyrrolidinone, (N-Methylpyrrolidone); C₅H₈NO; [872-50-4]</td>
<td>293.15</td>
<td>16</td>
<td>2.1</td>
<td>23.8</td>
</tr>
<tr>
<td></td>
<td></td>
<td>55</td>
<td>7.3</td>
<td>31.8</td>
</tr>
<tr>
<td></td>
<td></td>
<td>140</td>
<td>18.7</td>
<td>34.4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>185</td>
<td>24.7</td>
<td>35.2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>237</td>
<td>31.6</td>
<td>36.1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>315</td>
<td>42.0</td>
<td>37.1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>455</td>
<td>60.7</td>
<td>38.6</td>
</tr>
<tr>
<td></td>
<td></td>
<td>555</td>
<td>74.0</td>
<td>39.7</td>
</tr>
<tr>
<td></td>
<td></td>
<td>689</td>
<td>91.9</td>
<td>40.8</td>
</tr>
</tbody>
</table>

* solubilities were reported as volumes of gas (corrected to 273.15 K and 101.325 kPa) absorbed by one volume of the mixed solvent under the stated conditions.

ORIGINAL MEASUREMENTS:
Sichkova, O.P.; Shinelis, A.F.; Leites, I.L.
### COMPONENTS:

1. Carbon dioxide; CO$_2$; [124-38-9]
2. 1-Methyl-2-pyrrolidinone; C$_5$H$_9$NO; [872-50-4]
3. 2-Aminoethanol, (monoethanolamine); C$_2$H$_7$NO; [141-43-5]

### ORIGINAL MEASUREMENTS:

Rivas, O.R.; Prausnitz, J.M.


### VARIABLES:

\[ T/K = 298.15-373.15 \]
\[ P/kPa < 101.3 \]

### PREPARED BY:

P.G.T. Fogg

### EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>Wt% MEA</th>
<th>( P_{\text{CO}_2}/\text{kPa} )</th>
<th>Solubility of ( \text{CO}_2 )* /mol dm$^{-3}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>298.15</td>
<td>3</td>
<td>0</td>
<td>0.0200</td>
</tr>
<tr>
<td></td>
<td></td>
<td>25</td>
<td>0.0328</td>
</tr>
<tr>
<td></td>
<td></td>
<td>50</td>
<td>0.0420</td>
</tr>
<tr>
<td></td>
<td></td>
<td>75</td>
<td>0.0480</td>
</tr>
<tr>
<td></td>
<td></td>
<td>100</td>
<td>0.0530</td>
</tr>
<tr>
<td></td>
<td></td>
<td>125</td>
<td>0.0580</td>
</tr>
<tr>
<td></td>
<td></td>
<td>150</td>
<td>0.0610</td>
</tr>
<tr>
<td></td>
<td></td>
<td>175</td>
<td>0.0640</td>
</tr>
<tr>
<td></td>
<td></td>
<td>200</td>
<td>0.0680</td>
</tr>
<tr>
<td>298.15</td>
<td>5</td>
<td>0</td>
<td>0.0400</td>
</tr>
<tr>
<td></td>
<td></td>
<td>25</td>
<td>0.0532</td>
</tr>
<tr>
<td></td>
<td></td>
<td>50</td>
<td>0.0608</td>
</tr>
<tr>
<td></td>
<td></td>
<td>75</td>
<td>0.0666</td>
</tr>
<tr>
<td></td>
<td></td>
<td>100</td>
<td>0.0726</td>
</tr>
<tr>
<td></td>
<td></td>
<td>125</td>
<td>0.0770</td>
</tr>
<tr>
<td></td>
<td></td>
<td>150</td>
<td>0.0810</td>
</tr>
<tr>
<td></td>
<td></td>
<td>175</td>
<td>0.0850</td>
</tr>
<tr>
<td></td>
<td></td>
<td>200</td>
<td>0.0886</td>
</tr>
</tbody>
</table>

* data were presented in the form of smooth curves on a small scale graph (5.5 cm x 8.0 cm). The compiler has measured the co-ordinates at arbitrary points on the curves.

† MEA = 2-aminoethanol (monoethanolamine)

### AUXILIARY INFORMATION:

**METHOD/APPARATUS/PROCEDURE:**

The apparatus is described in ref. (1). The volume of gas absorbed was measured. Pressures were measured with a high precision bourdon pressure gauge. Temperatures were controlled to 0.05 K by a thermostat bath.

**SOURCE AND PURITY OF MATERIALS:**

Supplied by standard laboratory reagent suppliers; purities at least 99%

**ESTIMATED ERROR:**

\[ \delta T/K = \pm 0.05 \]

**REFERENCES:**

1. Rivas, O.R.; Prausnitz, J.M.

COMPONENTS:

1. Carbon dioxide; CO₂; [124-38-9]
2. 1-Methyl-2-pyrrolidinone; C₅H₇NO; [872-50-4]
3. 2-Aminoethanol, (monoethanolamine); C₂H₇NO; [141-43-5]

ORIGINAL MEASUREMENTS:

Rivas, O.R.; Prausnitz, J.M.

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>Wt% MEA</th>
<th>P_CO₂/kPa</th>
<th>Solubility of CO₂* /mol dm⁻³</th>
</tr>
</thead>
<tbody>
<tr>
<td>298.15</td>
<td>15</td>
<td>0</td>
<td>0.0637</td>
</tr>
<tr>
<td></td>
<td></td>
<td>25</td>
<td>0.1168</td>
</tr>
<tr>
<td></td>
<td></td>
<td>50</td>
<td>0.1430</td>
</tr>
<tr>
<td></td>
<td></td>
<td>75</td>
<td>0.1600</td>
</tr>
<tr>
<td></td>
<td></td>
<td>100</td>
<td>0.1735</td>
</tr>
<tr>
<td></td>
<td></td>
<td>125</td>
<td>0.1848</td>
</tr>
<tr>
<td></td>
<td></td>
<td>150</td>
<td>0.1956</td>
</tr>
<tr>
<td></td>
<td></td>
<td>175</td>
<td>0.2053</td>
</tr>
<tr>
<td>373.15</td>
<td>15</td>
<td>0</td>
<td>0.0000</td>
</tr>
<tr>
<td></td>
<td></td>
<td>25</td>
<td>0.0127</td>
</tr>
<tr>
<td></td>
<td></td>
<td>50</td>
<td>0.0230</td>
</tr>
<tr>
<td></td>
<td></td>
<td>75</td>
<td>0.0304</td>
</tr>
<tr>
<td></td>
<td></td>
<td>100</td>
<td>0.0368</td>
</tr>
<tr>
<td></td>
<td></td>
<td>125</td>
<td>0.0425</td>
</tr>
<tr>
<td></td>
<td></td>
<td>150</td>
<td>0.0467</td>
</tr>
<tr>
<td></td>
<td></td>
<td>175</td>
<td>0.0520</td>
</tr>
</tbody>
</table>

* data were presented in the form of smooth curves on a small scale graph (5.5 cm x 8.0 cm). The compiler has measured the co-ordinates at arbitrary points on the curves.

† MEA = 2-aminoethanol (monoethanolamine)
COMPONENTS:
1. Carbon dioxide; CO₂; [124-38-9]
2. 1-Methyl-2-pyrrolidinone; C₅H₉NO; [872-50-4]
3. 2-(2- aminoethoxy)-ethanol, (Diglycolamine); C₄H₁₁N₂O₂; [929-06-6]

ORIGINAL MEASUREMENTS:
Rivas, O.R.; Prausnitz, J.M.

VARIABLES:
Temperature, liquid composition

PREPARED BY:
C.L. Young.

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>p/mmHg</th>
<th>p/kPa</th>
<th>Component</th>
<th>x in liquid,</th>
<th>y in gas,</th>
</tr>
</thead>
<tbody>
<tr>
<td>263.08</td>
<td>6.113</td>
<td>8.150</td>
<td>1</td>
<td>0.0157</td>
<td>0.9964</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2</td>
<td>0.9550</td>
<td>0.00364</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>3</td>
<td>0.0293</td>
<td>~ 0.00001</td>
</tr>
<tr>
<td>26.28</td>
<td>35.04</td>
<td></td>
<td>1</td>
<td>0.0216</td>
<td>0.9992</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2</td>
<td>0.9493</td>
<td>0.0008</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>3</td>
<td>0.0291</td>
<td>~</td>
</tr>
<tr>
<td>298.25</td>
<td>5.913</td>
<td>7.883</td>
<td>1</td>
<td>0.00874</td>
<td>0.938</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2</td>
<td>0.9618</td>
<td>0.0618</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>3</td>
<td>0.0295</td>
<td>0.0002</td>
</tr>
<tr>
<td>13.42</td>
<td>17.89</td>
<td></td>
<td>1</td>
<td>0.0130</td>
<td>0.9728</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2</td>
<td>0.9577</td>
<td>0.0271</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>3</td>
<td>0.0294</td>
<td>0.0001</td>
</tr>
</tbody>
</table>

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
Volumetric apparatus with a fused quartz precision bourdon pressure gauge. Solubility apparatus carefully thermostatted. Solvent degassed in situ. Apparatus described in ref. (1) and modifications given in source.

SOURCE AND PURITY OF MATERIALS:
No details given.

ESTIMATED ERROR:
\[ \delta T/K = \pm 0.05; \delta x_{CO₂} = \pm 1\% . \]

REFERENCES:
1. Cukor, P.M., Prausnitz, J.M.
COMPONENTS:
(1) Carbon dioxide; CO₂; [124-38-9]
(2) Benzene; C₆H₆; [71-43-2]
(3) Tetrachloromethane or carbon tetrachloride; CCl₄; [56-23-5]

VARIABLES:
\[ T/K = 298 \]
\[ p/T/ kPa = 101.3 \]
Composition.

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>Benzene Mol Fraction ( x_2 )</th>
<th>Viscosity ( \mu_p ) ( \text{Pa s} )</th>
<th>Diffusion Coefficient ( D ) ( \text{m}^2 \text{s}^{-1} )</th>
<th>Solubility ( \sigma_2 ) ( \text{mol m}^{-3} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>298</td>
<td>0.00</td>
<td>0.88</td>
<td>3.17</td>
<td>91.2</td>
</tr>
<tr>
<td></td>
<td>0.20</td>
<td>0.82</td>
<td>3.25</td>
<td>77.0</td>
</tr>
<tr>
<td></td>
<td>0.40</td>
<td>0.76</td>
<td>3.35</td>
<td>82.2</td>
</tr>
<tr>
<td></td>
<td>0.60</td>
<td>0.70</td>
<td>3.60</td>
<td>84.1</td>
</tr>
<tr>
<td></td>
<td>0.80</td>
<td>0.64</td>
<td>3.65</td>
<td>86.7</td>
</tr>
<tr>
<td></td>
<td>1.00</td>
<td>0.60</td>
<td>3.85</td>
<td>92.9</td>
</tr>
</tbody>
</table>

\( a \) Literature values taken from Ishikawa, T. "Kongoeki Nendo no Riron" (Theories of Viscosity for Mixed Solvents); Maruzen, Tokyo, 1968.

METHOD/APPARATUS/PROCEDURE:
An indirect method (1) was used in which the absorption rate of carbon dioxide into the mixed solvent was measured as a function of time. It was assumed that the film-theory model of the gas absorption process applied. A plot of ln (absorption rate) vs. time is linear. The slope is a function of the diffusion coefficient and the intercept is a function of both the diffusion coefficient and the solubility.

A diaphragm cell with interfacial area 5.81 cm² and lower compartment volume for the liquid was 53.5 cm³. The diaphragm was Millipore Teflon of mean pore size 10.0 μm, thickness 125 ± 15 μm, and porosity 0.68. The liquid was stirred at a constant rate of 1.33 rotations s⁻¹.

The solutions were prepared and then degassed by refluxing for five hours. Their compositions were determined by density or refractive index. The CO₂ was presat. with solvent vap.

SOURCE AND PURITY OF MATERIALS:
(1) Carbon dioxide. Source not identified. From cylinder.
(2, 3) Benzene and tetrachloromethane.

It was stated that the chemicals were of special grade.

ESTIMATED ERROR:
\[ \delta T/K = \pm 0.1 \]
\[ \delta \sigma_2 = \pm 0.05 - 0.10 \text{ (compiler).} \]

REFERENCES:

AUXILIARY INFORMATION

SOURCE AND PURITY OF MATERIALS:
(1) Carbon dioxide. Source not identified. From cylinder.
(2, 3) Benzene and tetrachloromethane.

It was stated that the chemicals were of special grade.

ESTIMATED ERROR:
\[ \delta T/K = \pm 0.1 \]
\[ \delta \sigma_2 = \pm 0.05 - 0.10 \text{ (compiler).} \]

REFERENCES:
COMPONENTS:
(1) Carbon dioxide; CO$_2$; [124-38-9]
(2) 1-Octanol; C$_8$H$_{18}$O; [111-87-5]
(3) Tetrachloromethane or carbon tetrachloride; CC$_4$; [56-23-5]

ORIGINAL MEASUREMENTS:
Takahashi, M.; Kobayashi, Y.; Takeuchi, H.

VARIABLES:
$T/K = 298$
$p_{ij}/kPa = 101.3$
Composition.

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>$T/K$</th>
<th>1-Octanol Mol Fraction $x_2$</th>
<th>Viscosity $\eta_m$/Pa s</th>
<th>Diffusion Coefficient $10^8 D_a$/m$^2$ s$^{-1}$</th>
<th>Solubility $\alpha_j$/mol m$^{-3}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>298</td>
<td>0.00</td>
<td>0.88</td>
<td>3.17</td>
<td>91.2</td>
</tr>
<tr>
<td></td>
<td>0.20</td>
<td>1.40</td>
<td>2.70</td>
<td>68.8</td>
</tr>
<tr>
<td></td>
<td>0.40</td>
<td>2.25</td>
<td>2.40</td>
<td>71.7</td>
</tr>
<tr>
<td></td>
<td>0.60</td>
<td>3.55</td>
<td>1.96</td>
<td>73.7</td>
</tr>
<tr>
<td></td>
<td>0.80</td>
<td>5.25</td>
<td>1.80</td>
<td>55.4</td>
</tr>
<tr>
<td></td>
<td>1.00</td>
<td>7.35</td>
<td>1.53</td>
<td>49.6</td>
</tr>
</tbody>
</table>

a Literature values taken from Ishikawa, T. "Kongoeki Nendo no Riron" (Theories of Viscosity for Mixed Solvents); Maruzen, Tokyo, 1968.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
An indirect method (1) was used in which the absorption rate of carbon dioxide into the mixed solvent was measured as a function of time.

It was assumed that the film-theory model of the gas absorption process applied. A plot of ln (absorption rate) vs. time is linear. The slope is a function of the diffusion coefficient and the intercept is a function of both the diffusion coefficient and the solubility.

A diaphragm cell with interfacial area 5.81 cm$^2$ and lower compartment volume for the liquid was 53.5 cm$^3$. The diaphragm was Millipore Teflon of mean pore size 10.0 μm, thickness 125 ± 15 μm, and porosity 0.68. The liquid was stirred at a constant rate of 1.33 rotations s$^{-1}$.

The solutions were prepared and then degassed by refluxing for five hours. Their compositions were determined by density or refractive index. The CO$_2$ was presat. with solvent vap.

SOURCE AND PURITY OF MATERIALS:
(1) Carbon dioxide. Source not identified. From cylinder.
(2, 3) 1-Octanol and tetrachloromethane.

It was stated that the chemicals were of special grade.

ESTIMATED ERROR:
$\delta T/K = \pm 0.1$
$\delta \alpha_j/\alpha_j = \pm 0.5 - 0.10$ (compiler).

REFERENCES:
1. Takeuchi, H.; Fujine, M.; Sato, T.; Onda, K.
COMPONENTS:
(1) Carbon dioxide; $\text{CO}_2$; [124-38-9]
(2) 2-methyl-1-propanol or isobutyl alcohol; $\text{C}_4\text{H}_{10}\text{O}$; [78-83-1]
(3) Formamide; $\text{CH}_3\text{NO}$; [75-12-7]

ORIGINAL MEASUREMENTS:
Takahashi, M.; Kobayashi, Y.; Takeuchi, H.

VARIABLES:
$T/K = 298$
$p_f/kPa = 101.3$
Composition.

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>$T/K$</th>
<th>Isobutyl Alcohol Mol Fraction $x_2$</th>
<th>Viscosity $\eta_2$ in Pa s</th>
<th>Diffusion Coefficient $D_A$ in $\text{m}^2 \text{s}^{-1}$</th>
<th>Solubility $\sigma_f$ in mol $\text{m}^{-3}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>298</td>
<td>0.00</td>
<td>3.30</td>
<td>0.946</td>
<td>75.6</td>
</tr>
<tr>
<td></td>
<td>0.20</td>
<td>3.64</td>
<td>1.15</td>
<td>77.8</td>
</tr>
<tr>
<td></td>
<td>0.40</td>
<td>3.86</td>
<td>1.27</td>
<td>86.7</td>
</tr>
<tr>
<td></td>
<td>0.60</td>
<td>3.68</td>
<td>1.49</td>
<td>87.8</td>
</tr>
<tr>
<td></td>
<td>0.80</td>
<td>3.31</td>
<td>1.76</td>
<td>86.0</td>
</tr>
<tr>
<td></td>
<td>1.00</td>
<td>3.36</td>
<td>2.02</td>
<td>68.1</td>
</tr>
</tbody>
</table>

$^a$ Literature values taken from Ishikawa, T. "Kongoeki Nendo no Riron" (Theories of Viscosity for Mixed Solvents); Maruzen, Tokyo, 1968.

SOURCE AND PURITY OF MATERIALS:
(1) Carbon dioxide. Source not identified. From cylinder.
(2, 3) Isobutyl alcohol, formamide.

It was stated that the chemicals were of special grade.

ESTIMATED ERROR:
$\delta T/K = \pm 0.1$
$\delta \sigma_f/\sigma_f = \pm 0.05 - 0.10$ (compiler).

REFERENCES:
1. Takeuchi, H.; Fujine, M.; Sato, T.; Onda, K.
COMPONENTS:
(1) Carbon dioxide; CO₂; [124-38-9]
(2) Benzene; C₆H₆; [71-43-2]
(3) 1-Propanol; C₃H₈O; [71-23-8]

VARIABLES:

\[
\frac{T}{K} = 298
\]

\[
\frac{P}{\text{kPa}} = 101.3
\]

Composition

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>( \frac{T}{K} )</th>
<th>Mol Fraction</th>
<th>Viscosity( a )</th>
<th>Diffusion Coefficient</th>
<th>Solubility</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>( x_2 )</td>
<td>( 10^3 \mu_{\text{mPa s}} )</td>
<td>( 10^9 \delta \text{A}_2 \text{m}^{-2} \text{s}^{-1} )</td>
<td>( c_2 / \text{mol m}^{-3} )</td>
</tr>
<tr>
<td>298</td>
<td>0.00</td>
<td>1.97</td>
<td>3.06</td>
<td>62.9</td>
</tr>
<tr>
<td></td>
<td>0.20</td>
<td>1.49</td>
<td>3.20</td>
<td>71.0</td>
</tr>
<tr>
<td></td>
<td>0.40</td>
<td>0.67</td>
<td>4.20</td>
<td>59.0</td>
</tr>
<tr>
<td></td>
<td>0.60</td>
<td>0.62</td>
<td>4.18</td>
<td>69.1</td>
</tr>
<tr>
<td></td>
<td>0.80</td>
<td>0.61</td>
<td>3.95</td>
<td>71.4</td>
</tr>
<tr>
<td></td>
<td>1.00</td>
<td>0.60</td>
<td>3.85</td>
<td>92.9</td>
</tr>
</tbody>
</table>

\( a \) Literature values taken from Ishikawa, T. "Kongoeki Nendo no Riron" (Theories of Viscosity for Mixed Solvents); Maruzen, Tokyo, 1968.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
An indirect method (1) was used in which the absorption rate of carbon dioxide into the mixed solvent was measured as a function of time.

It was assumed that the film-theory model of the gas absorption process applied. A plot of ln (absorption rate) vs. time is linear. The slope is a function of the diffusion coefficient and the intercept is a function of both the diffusion coefficient and the solubility.

A diaphragm cell with interfacial area 5.61 cm² and lower compartment volume for the liquid was 53.5 cm³. The diaphragm was Millipore Teflon of mean pore size 10.0 μm, thickness 125 ± 15 μm, and porosity 0.68. The liquid was stirred at a constant rate of 1.33 rotations s⁻¹.

The solutions were prepared and then degassed by refluxing for five hours. Their compositions were determined by density or refractive index. The CO₂ was presat. with solvent vap.

SOURCE AND PURITY OF MATERIALS:
(1) Carbon dioxide. Source not identified. From cylinder.
(2, 3) Benzene and 1-propanol.

It was stated that the chemicals were of special grade.

ESTIMATED ERROR:

\[
\delta \frac{T}{K} = \pm 0.1
\]

\[
\delta \frac{c_2}{c_1} = \pm 0.05 - 0.10 \quad \text{(compiler)}.
\]

REFERENCES:
COMPONENTS:
1. Carbon dioxide; CO₂; [124-38-9]
2. Mixed solvents

VARIABLES:
T/K = 293.15
P/kPa = 101.3

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>Solvent mixture</th>
<th>Mole fraction of A in solvent mixture before addition of CO₂</th>
<th>Mole fraction of CO₂ in solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>(A) Methanol; CH₃OH; [67-56-1]</td>
<td>1.000</td>
<td>0.00751</td>
</tr>
<tr>
<td>(B) 2-Propanone; C₃H₆O; [67-64-1]</td>
<td>0.908</td>
<td>0.00802</td>
</tr>
<tr>
<td></td>
<td>0.670</td>
<td>0.01097</td>
</tr>
<tr>
<td></td>
<td>0.436</td>
<td>0.01433</td>
</tr>
<tr>
<td></td>
<td>0.282</td>
<td>0.01634</td>
</tr>
<tr>
<td></td>
<td>0.000</td>
<td>0.02317</td>
</tr>
<tr>
<td>(A) 2-Propanone; C₃H₆O; [67-64-1]</td>
<td>1.000</td>
<td>0.02317</td>
</tr>
<tr>
<td>(B) Trichloromethane; CHCl₃; [67-66-3]</td>
<td>0.878</td>
<td>0.02039</td>
</tr>
<tr>
<td></td>
<td>0.701</td>
<td>0.01686</td>
</tr>
<tr>
<td></td>
<td>0.578</td>
<td>0.01513</td>
</tr>
<tr>
<td></td>
<td>0.000</td>
<td>0.01375</td>
</tr>
<tr>
<td>(A) Methanol; CH₃OH; [67-56-1]</td>
<td>1.000</td>
<td>0.00751</td>
</tr>
<tr>
<td>(B) Trichloromethane; CHCl₃; [67-66-3]</td>
<td>0.975</td>
<td>0.00732</td>
</tr>
<tr>
<td></td>
<td>0.876</td>
<td>0.00687</td>
</tr>
<tr>
<td></td>
<td>0.812</td>
<td>0.00698</td>
</tr>
<tr>
<td></td>
<td>0.494</td>
<td>0.00848</td>
</tr>
<tr>
<td></td>
<td>0.000</td>
<td>0.01375</td>
</tr>
<tr>
<td>(A) Methanol; CH₃OH; [67-56-1]</td>
<td>1.000</td>
<td>0.00751</td>
</tr>
<tr>
<td>(B) Benzene; C₆H₆; [71-43-2]</td>
<td>0.905</td>
<td>0.00735</td>
</tr>
<tr>
<td></td>
<td>0.606</td>
<td>0.00755</td>
</tr>
<tr>
<td></td>
<td>0.519</td>
<td>0.00788</td>
</tr>
<tr>
<td></td>
<td>0.195</td>
<td>0.00866</td>
</tr>
<tr>
<td></td>
<td>0.000</td>
<td>0.00989</td>
</tr>
<tr>
<td>(A) 2-Propanone; C₃H₆O; [67-64-1]</td>
<td>1.000</td>
<td>0.02317</td>
</tr>
<tr>
<td>(B) Benzene; C₆H₆; [71-43-2]</td>
<td>0.939</td>
<td>0.02214</td>
</tr>
<tr>
<td></td>
<td>0.809</td>
<td>0.02014</td>
</tr>
<tr>
<td></td>
<td>0.539</td>
<td>0.01612</td>
</tr>
<tr>
<td></td>
<td>0.420</td>
<td>0.01480</td>
</tr>
<tr>
<td></td>
<td>0.134</td>
<td>0.01170</td>
</tr>
<tr>
<td></td>
<td>0.000</td>
<td>0.00989</td>
</tr>
<tr>
<td>(A) Trichloromethane; CHCl₃; [67-66-3]</td>
<td>1.000</td>
<td>0.01375</td>
</tr>
<tr>
<td>(B) Benzene; C₆H₆; [71-43-2]</td>
<td>0.831</td>
<td>0.01282</td>
</tr>
<tr>
<td></td>
<td>0.627</td>
<td>0.01196</td>
</tr>
<tr>
<td></td>
<td>0.324</td>
<td>0.01080</td>
</tr>
<tr>
<td></td>
<td>0.123</td>
<td>0.01027</td>
</tr>
<tr>
<td></td>
<td>0.000</td>
<td>0.00989</td>
</tr>
</tbody>
</table>

\[ P_{CO₂} = 760 \ \text{Torr} = 101.325 \ \text{kPa} \quad T/K = 293.15 \ \text{K} \]

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
An Ostwald type apparatus was used. The absorption vessel could be agitated by an electric motor. This vessel and the gas buret system were maintained at constant temperature by circulation of water from a constant temperature bath.

SOURCE AND PURITY OF MATERIALS:
2 Liquids were fractionally distilled before use.

ESTIMATED ERROR:
\[ \delta T/K = \pm 0.1 \text{ (authors)} \]

REFERENCES:
COMPONENTS:
(1) Carbon dioxide; CO\textsubscript{2}; [124-38-9]
(2) Cephalin
(3) Benzene; C\textsubscript{6}H\textsubscript{6}; [71-43-2]

ORIGINAL MEASUREMENTS:
Byrne, J. E.; Battino, R.; Danforth, W. F.

VARIABLES:
\begin{tabular}{|c|c|}
\hline
T/K & 310.65 \\
Total P/kPa & 101.325 (1 atm) \\
\hline
\end{tabular}

PREPARED BY:
H. L. Clever

EXPERIMENTAL VALUES:

\begin{tabular}{|c|c|c|c|}
\hline
T/K & Mass Fraction & Ostwald Coefficient & "Salting Out" Parameter \\
 & Cephalin & L/cm\textsuperscript{3}cm\textsuperscript{-3} & \(k = (1/W^2)\log(L_0/L_w)\) \\
\hline
310.64 & 0.0 & 2.284 & \\
310.69 & 0.0 & 2.283 & \\
310.53 & 0.1994 & 1.99 & \\
310.69 & 0.1994 & 2.00 & 0.29 \pm 0.05 \\
310.65 & 1.0 & 1.17* & \\
\hline
\end{tabular}

*Extrapolated carbon dioxide solubility in hypothetical liquid cephalin.

\(L_0\) and \(L_w\) are the carbon dioxide Ostwald coefficients in benzene and in the benzene + cephalin solution, respectively.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
The solubility apparatus is based on the design of Morrison and Billett (1) and the version used is described by Battino, Evans and Danforth (2). The degassing apparatus is that described by Battino, Banzhof, Bogan, and Wilhelm (3).

Degassing. Up to 500 cm\textsuperscript{3} of solvent is placed in a flask of such size that the liquid is about 4 cm deep. The liquid is rapidly stirred, and vacuum is intermittently applied through a liquid nitrogen trap until the permanent gas residual pressure drops to 5 microns.

Solubility Determination. The degassed solvent is passed in a thin film down a glass helical tube containing solute gas plus the solvent vapor at a total pressure of one atm. The volume of gas absorbed is found by difference between the initial and final volumes in the buret system. The solvent is collected in a tared flask and weighed.

SOURCE AND PURITY OF MATERIALS:
(1) Carbon dioxide. Air Products and Chemicals, Inc. Minimum purity 99.8 mole per cent.
(2) Cephalin. Nutritional Biochemicals Corp. Homostatic phosphatide obtained from bovine brain tissue, used as received.
(3) Benzene. J. T. Baker Analyzed Reagent Grade. 99.9 mole per cent, thiophene free.

ESTIMATED ERROR:
\begin{itemize}
\item \(\delta T/K = 0.01\)
\item \(\delta P/mmHg = 0.5\)
\item \(\delta L_0/L = 0.01\)
\item \(\delta L_0/L_w = 0.02\)
\end{itemize}

REFERENCES:
COMPONENTS:
(1) Carbon dioxide; CO₂; [124-38-9]
(2) Lecithin
(3) Benzene; C₆H₆; [71-43-2]

ORIGINAL MEASUREMENTS:
Byrne, J. E.; Battino, R.; Danforth, W. F.

VARIABLES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>Mass Fraction Lecithin (W₂)</th>
<th>Ostwald Coefficient (L/cm³ cm⁻²)</th>
<th>&quot;Salting Out&quot; Parameter (k = (1/W₂) log (Lₒ/Lₜ))</th>
</tr>
</thead>
<tbody>
<tr>
<td>310.64</td>
<td>0.0</td>
<td>2.284</td>
<td></td>
</tr>
<tr>
<td>310.69</td>
<td>0.0</td>
<td>2.283</td>
<td></td>
</tr>
<tr>
<td>310.62</td>
<td>0.1998</td>
<td>1.93</td>
<td>0.37 ± 0.05</td>
</tr>
<tr>
<td>310.63</td>
<td>0.1998</td>
<td>1.93</td>
<td>0.37 ± 0.05</td>
</tr>
<tr>
<td>310.65</td>
<td>1.0</td>
<td>0.97*</td>
<td></td>
</tr>
</tbody>
</table>

*Extrapolated carbon dioxide solubility in hypothetical liquid lecithin.
Lₒ and Lₜ are the carbon dioxide Ostwald coefficients in benzene and in the benzene + lecithin solution, respectively.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
The solubility apparatus is based on the design of Morrison and Billett (1) and the version used is described by Battino, Evans and Danforth (2). The degassing apparatus is that described by Battino, Banhofer, Bogan, and Wilhelm (3).

degassing. Up to 500 cm³ of solvent is placed in a flask of such size that the liquid is about 4 cm deep. The liquid is rapidly stirred, and vacuum is intermittently applied through a liquid nitrogen trap until the permanent gas residual pressure drops to 5 microns.

Solubility Determination. The degassed solvent is passed in a thin film down a glass helical tube containing solute gas plus the solvent vapor at a total pressure of one atm. The volume of gas absorbed is found by difference between the initial and final volumes in the buret system. The solvent is collected in a tared flask and weighed.

SOURCE AND PURITY OF MATERIALS:
(1) Carbon dioxide. Air Products and Chemicals, Inc. Minimum purity is 99.8 mole per cent.
(2) Lecithin. Nutritional Biochemicals Corp. Vegetable source, about 95 per cent, used as received.
(3) Benzene. J. T. Baker Analyzed Reagent Grade. 99.9 mole per cent, thiophene free.

ESTIMATED ERROR:

δT/K = 0.01
δP/mmHg = 0.5
δLₒ/Lₒ = 0.01
δLₜ/Lₜ = 0.02

REFERENCES:
COMPONENTS:
(1) Carbon dioxide; CO₂; [124-38-9]
(2) Cholest-5-en-3β-ol or Cholesterol; C₂₇H₄₆O; [57-88-5]
(3) Benzene; C₆H₆; [71-43-2]

ORIGINAL MEASUREMENTS:
Byrne, J. E.; Battino, R.; Danforth, W. F.

VARIABLES:
T/K: 310.65
P/kPa: 101.325 (1 atm)

PREPARED BY:
H. L. Clever

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>Mass Fraction Cholesterol W₃</th>
<th>Ostwald Coefficient L/cm³cm⁻³</th>
<th>&quot;Salting Out&quot; Parameter k = (1/W₃) log(Lₒ/Lʷ)</th>
</tr>
</thead>
<tbody>
<tr>
<td>310.64</td>
<td>0.0</td>
<td>2.284</td>
<td></td>
</tr>
<tr>
<td>310.69</td>
<td>0.0</td>
<td>2.283</td>
<td></td>
</tr>
<tr>
<td>310.63</td>
<td>0.0524</td>
<td>2.21</td>
<td>0.33 ± 0.17</td>
</tr>
<tr>
<td>310.63</td>
<td>0.0524</td>
<td>2.18</td>
<td></td>
</tr>
<tr>
<td>310.65</td>
<td>0.1049</td>
<td>2.12</td>
<td>0.30 ± 0.08</td>
</tr>
<tr>
<td>310.65</td>
<td>1.0</td>
<td>2.13</td>
<td>1.15*</td>
</tr>
</tbody>
</table>

*Extrapolated carbon dioxide solubility in hypothetical liquid cholesterol.
Lₒ and Lʷ are the carbon dioxide Ostwald coefficients in benzene and in the benzene + cholesterol solution, respectively.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
The solubility apparatus is based on the design of Morrison and Billett (1) and the version used is described by Battino, Evans and Danforth (2). The degassing apparatus is that described by Battino, Banzhof, Bogan, and Wilhelm (3).

Degassing. Up to 500 cm³ of solvent is placed in a flask of such size that the liquid is about 4 cm deep. The liquid is rapidly stirred, and vacuum is intermittently applied through a liquid nitrogen trap until the permanent gas residual pressure drops to 5 microns.

Solubility Determination. The degassed solvent is passed in a thin film down a glass helical tube containing solute gas plus the solvent vapor at a total pressure of one atm. The volume of gas absorbed is found by difference between the initial and final volumes in the buret system. The solvent is collected in a tared flask and weighed.

SOURCE AND PURITY OF MATERIALS:
(1) Carbon dioxide. Air Products and Chemicals, Inc. Minimum purity 99.8 mole per cent.
(2) Cholesterol. Source not given. Recrystallized from benzene.
(3) Benzene. J. T. Baker Analyzed Reagent Grade. 99.9 mole per cent, thiophene free.

ESTIMATED ERROR: 5T/K = 0.01 5P/mmHg = 0.5 5Lₒ/Lₒ = 0.01 5Lₒ/Lₒ = 0.02

REFERENCES:
COMPONENTS:
(1) Carbon dioxide; CO₂; [124-38-9]
(2) Cholest-5-en-3β-ol or cholesterol; C₂₇H₄₆O; [57-88-5]
(3) 2-Methyl-1-propanol or isobutanol; C₄H₁₀O; [78-83-1]

ORIGINAL MEASUREMENTS:
Byrne, J. E.; Battino, R.; Danforth, W. F.

VARIABLES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>Mass Fraction</th>
<th>Ostwald Coefficient</th>
<th>“Salting Out” Parameter</th>
</tr>
</thead>
<tbody>
<tr>
<td>310.65</td>
<td>0</td>
<td>1.61</td>
<td></td>
</tr>
<tr>
<td>310.63</td>
<td>0.0521</td>
<td>1.60</td>
<td></td>
</tr>
<tr>
<td>310.63</td>
<td>0.0521</td>
<td>1.62</td>
<td>0</td>
</tr>
</tbody>
</table>

1 Battino, R.; Evans, F. D.; Danforth, W. F.

L₀ and Lₜ are the carbon dioxide Ostwald coefficients in isobutanol and in the isobutanol + cholesterol solution, respectively.

METHOD/APPARATUS/PROCEDURE:
The solubility apparatus is based on the design of Morrison and Billett (1) and the version used is described by Battino, Evans and Danforth (2). The degassing apparatus is that described by Battino, Banzhof, Bogan, and Wilhelm (3).

Degassing. Up to 500 cm³ of solvent is placed in a flask of such size that the liquid is about 4 cm deep. The liquid is rapidly stirred, and vacuum is intermittently applied through a liquid nitrogen trap until the permanent gas residual pressure drops to 5 microns.

Solubility Determination. The degassed solvent is passed in a thin film down a glass helical tube containing solute gas plus the solvent vapor at a total pressure of one atm. The volume of gas absorbed is found by difference between the initial and final volumes in the buret system. The solvent is collected in a tared flask and weighed.

SOURCES AND PURITY OF MATERIALS:
(2) Cholesterol. Source not given. Recrystallized from benzene.
(3) 2-methyl-1-propanol or isobutanol. Fisher Scientific Certified. 99 mol per cent.

ESTIMATED ERROR:

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>δT/K</td>
<td>0.01</td>
<td></td>
</tr>
<tr>
<td>δP/mmHg</td>
<td>0.5</td>
<td></td>
</tr>
<tr>
<td>δL₀/L₀</td>
<td>0.01</td>
<td></td>
</tr>
<tr>
<td>δLₜ/Lₜ</td>
<td>0.02</td>
<td></td>
</tr>
</tbody>
</table>

REFERENCES:
3. Battino, R.; Banzhof, M.; Bogan, M.; Wilhelm, E.
COMPONENTS:
(1) Carbon dioxide; CO₂; [124-38-9]
(2) Cellulose, acetate; [9004-35-7]
(3) N,N-Dimethylformamide; C₃H₇NO; [68-12-2]

VARIABLES:
T/K = 293.15
ω₂/g g⁻¹ = 0, 0.0710

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>Cellulose Acetate</th>
<th>Ostwald Coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>ω₂/g g⁻¹</td>
<td>L/cm³ cm⁻³</td>
</tr>
<tr>
<td>293.15</td>
<td>0</td>
<td>5.10</td>
</tr>
<tr>
<td></td>
<td>0.0710</td>
<td>4.81</td>
</tr>
</tbody>
</table>

The author also determined that 1 g of solid cellulose acetate absorbs 4.65 cm³ CO₂ at 293.15 K and 101.325 kPa.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
The prepared solvent and solution were charged into an evacuated cell after degassing, and the mass of solvent was determined by weight. Gas was introduced into the cell from a measuring buret in which the gas was stored over mercury. The cell was agitated while the gas pressure was maintained by adjusting the gas volume. The Ostwald coefficient was determined from the mass of solvent and the volume of gas absorbed. Solubilities were measured at pressures above and below atmospheric.

SOURCE AND PURITY OF MATERIALS:
(1) Carbon dioxide. Source and purity not given. An aqueous "soda" solution absorbed 99.8% of the gas.
(2) Cellulose acetate. Rhône-Poulenc. Purity not given.

ESTIMATED ERROR:
δT/K = ± 0.2
δp/kPa = ± 0.1
δL/L = ± 0.02 (compiler)

REFERENCES:
Some data in the thesis have been published. See:

COMPONENTS:
(1) Carbon dioxide; CO\textsubscript{2}; [124-38-9]
(2) Cellulose, acetate; [9004-35-7]
(3) 2-Propanone (Acetone); C\textsubscript{3}H\textsubscript{6}O; [67-64-1]

VARIABLES:
\[ T/K = 293.15 \]
\[ \omega_{g/g} g^{-1} = 0, 0.0641 \]

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>Cellulose Acetate</th>
<th>Ostwald Coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>293.15</td>
<td>0</td>
<td>6.88</td>
</tr>
<tr>
<td></td>
<td>0.0641</td>
<td>6.58</td>
</tr>
</tbody>
</table>

The author also determined that 1 g of solid cellulose acetate absorbs 4.65 cm\textsuperscript{3} CO\textsubscript{2} at 293.15 K and 101.325 kPa.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
The prepared solvent and solution were charged into an evacuated cell after degassing, and the mass of solvent was determined by weight. Gas was introduced into the cell from a measuring buret in which the gas was stored over mercury. The cell was agitated while the gas pressure was maintained by adjusting the gas volume. The Ostwald coefficient was determined from the mass of solvent and the volume of gas absorbed. Solubilities were measured at pressures above and below atmospheric.

SOURCE AND PURITY OF MATERIALS:
(1) Carbon dioxide. Source and purity not given. An aqueous "soda" solution absorbed 99.8% of the gas.
(2) Cellulose acetate. Rhône-Poulenc. Purity not given.
(3) Acetone. Research grade. Source not given.

ESTIMATED ERROR:
\[ \delta T/K = \pm 0.2 \]
\[ \delta p/kPa = \pm 0.1 \]
\[ \delta L/L = \pm 0.02 \text{ (compiler)} \]

REFERENCES:
Some data in the thesis have been published. See:

COMPONENTS:
(1) Carbon dioxide; \( \text{CO}_2; \) [124-38-9]
(2) Ethenyl benzene, homopolymer (polystyrene); \( (\text{C}_8\text{H}_8)x; \) [9003-53-6]
(3) Benzene; \( \text{C}_6\text{H}_6; \) [71-43-2]

VARIABLES:
\( T/K = 293.15 \)
\( \omega_\ell / g \text{ g}^{-1} = 0 - 0.0884 \)

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>( T/K )</th>
<th>Polystyrene ( \omega_\ell / g \text{ g}^{-1} )</th>
<th>Viscosity(^a) ( 10^2 n/g \text{ cm}^{-1} \text{s}^{-1} )</th>
<th>Ostwald Coefficient ( L/\text{cm}^3 \text{ cm}^{-3} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>293.15</td>
<td>0</td>
<td>-</td>
<td>2.66</td>
</tr>
<tr>
<td></td>
<td>0.0489(^b)</td>
<td>-</td>
<td>2.54</td>
</tr>
<tr>
<td></td>
<td>0.0996(^b)</td>
<td>19.59</td>
<td>2.43</td>
</tr>
<tr>
<td></td>
<td>0.0987(^c)</td>
<td>55.35</td>
<td>2.44</td>
</tr>
<tr>
<td></td>
<td>0.0884(^d)</td>
<td>411.14</td>
<td>2.43</td>
</tr>
</tbody>
</table>

\(^a\) Viscosity for solution 0.099 g \text{ g}^{-1} \) and temperatures at 19.81, 19.84 and 20.06 C, respectively.

\(^b\) Molecular weight 96,000.

\(^c\) Molecular weight 180,000.

\(^d\) Molecular weight 385,000.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
The prepared solvent and solution were charged into an evacuated cell after degassing, and the mass of solvent was determined by weight. Gas was introduced into the cell from a measuring buret in which the gas was stored over mercury. The cell was agitated while the gas pressure was maintained by adjusting the gas volume. The Ostwald coefficient was determined from the mass of solvent and the volume of gas absorbed. Solubilities were measured at pressures above and below atmospheric.

SOURCE AND PURITY OF MATERIALS:
(1) Carbon dioxide. Source and purity not given. An aqueous "soda" solution absorbed 99.8\% of the gas.

ESTIMATED ERROR:
\( \delta T/K = \pm 0.2 \)
\( \delta p/\text{kPa} = \pm 0.1 \)
\( \delta L/L = \pm 0.02 \) (compiler)

REFERENCES:
Some data in the thesis have been published. See:
COMPONENTS:
(1) Carbon dioxide; \( \text{CO}_2 \); [124-38-9]
(2) 2-methyl-1-propene, homopolymer (polyisobutylene); \( (\text{C}_4\text{H}_8)_x \); [9003-27-4]
(3) Benzene; \( \text{C}_6\text{H}_6 \); [71-43-2]

VARIABLES:
\[ T / \text{K} = 293.15 \]
\[ \omega / \text{g} \text{ g}^{-1} = 0 - 0.00798 \]

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>( T / \text{K} )</th>
<th>Polyisobutylene Coefficient ( L / \text{cm}^3 \text{ cm}^{-3} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>293.15</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>0.0482a</td>
</tr>
<tr>
<td></td>
<td>0.00682b</td>
</tr>
<tr>
<td></td>
<td>0.00798b</td>
</tr>
</tbody>
</table>

\( a \) Designated low molecular weight.

\( b \) Designated high molecular weight.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
The prepared solvent and solution were charged into an evacuated cell after degassing, and the mass of solvent was determined by weight. Gas was introduced into the cell from a measuring buret in which the gas was stored over mercury. The cell was agitated while the gas pressure was maintained by adjusting the gas volume. The Ostwald coefficient was determined from the mass of solvent and the volume of gas absorbed. Solubilities were measured at pressures above and below atmospheric.

SOURCE AND PURITY OF MATERIALS:
(1) Carbon dioxide. Source and purity not given. An aqueous "soda" solution absorbed 99.8% of the gas.
(2) Polyisobutylene. BASF Ludwigshafen. Purity not given.
(3) Benzene. Source and purity not given.

ESTIMATED ERROR:
\[ \delta T / \text{K} = \pm 0.2 \]
\[ \delta p / \text{kPa} = \pm 0.1 \]
\[ \delta L / L \text{ (compiler)} = \pm 0.02 \]

REFERENCES:
Some data in the thesis have been published. See:
COMPONENTS:
(1) Carbon dioxide; CO₂; [124-38-9]
(2) 2-Propenenitrile, homopolymer (Polyacrylonitrile); (C₃H₃N)ₓ; [25014-41-9]
(3) N,N-Dimethylformamide; C₃H₇NO; [68-12-2]

VARIABLES:
T/K = 293.15
ω₂/g g⁻¹ = 0 - 0.0666

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>Polyacrylonitrile</th>
<th>Viscositya</th>
<th>Ostwald Coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>ω₂/g g⁻¹</td>
<td>10²η/g cm⁻¹ s⁻¹</td>
<td>L/cm³ cm⁻³</td>
</tr>
<tr>
<td>293.15</td>
<td>0</td>
<td>31.55</td>
<td>5.10</td>
</tr>
<tr>
<td></td>
<td>0.0535b</td>
<td>45.37</td>
<td>5.16</td>
</tr>
<tr>
<td></td>
<td>0.0516b</td>
<td>58.62</td>
<td>6.66</td>
</tr>
</tbody>
</table>

a Viscosity of 0.049 g g⁻¹ solution at 19.76, 19.84 and 20.00 °C, respectively.

b Polymer characterized by solution viscosity and K value of 80, 86 and 90, respectively. The K value is a function of intrinsic viscosity.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
The prepared solvent and solution were charged into an evacuated cell after degassing, and the mass of solvent was determined by weight. Gas was introduced into the cell from a measuring buret in which the gas was stored over mercury. The cell was agitated while the gas pressure was maintained by adjusting the gas volume. The Ostwald coefficient was determined from the mass of solvent and the volume of gas absorbed. Solubilities were measured at pressures above and below atmospheric.

SOURCE AND PURITY OF MATERIALS:
(1) Carbon dioxide. Source and purity not given. An aqueous "soda" solution absorbed 99.8% of the gas.
(2) Polyacrylonitrile. BASF of Ludwigshafen. Purity not given.

ESTIMATED ERROR:
δT/K = ± 0.2
δp/kPa = ± 0.1
δL/L = ± 0.02 (compiler)

REFERENCES:
Some data in the thesis have been published. See:
COMPONENTS:

(1) Carbon dioxide; CO₂; [124-38-9]
(2) Sodium iodide; NaI; [7681-82-5]
(3) 2-Propanone (acetone); C₃H₆O; [67-64-1]

VARIABLES:

T/K = 293.15
p/kPa = 101.325
m₂/mol kg⁻¹ = 0 - 1.582

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>Salt concentration in solvent:</th>
<th>Ostwald Coefficient</th>
<th>Sechenov Constant</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mass fraction a *</td>
<td>Molal conc. b</td>
<td></td>
</tr>
<tr>
<td></td>
<td>σ₂/g g⁻¹</td>
<td>m₂/mol kg⁻¹</td>
<td>L/cm³ cm⁻³</td>
</tr>
<tr>
<td>293.15</td>
<td>0</td>
<td>0</td>
<td>6.88</td>
</tr>
<tr>
<td></td>
<td>0.0766</td>
<td>0.553</td>
<td>5.84</td>
</tr>
<tr>
<td></td>
<td>0.1435</td>
<td>1.117</td>
<td>5.06</td>
</tr>
<tr>
<td></td>
<td>0.2371</td>
<td>2.074</td>
<td>3.83</td>
</tr>
</tbody>
</table>

a Original data. The salt concentration was expressed as mass of salt per unit mass of salt solution.

b Molal concentration and Sechenov constant calculated by compiler as follows:

\[ k_{ₑm₀} = \frac{1}{(m₂/mol \text{ kg}^{-1})} \log(L₀/L) \]

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The prepared solvent solution was charged into an evacuated cell after degassing, and the mass of solvent was determined by weight. Gas was introduced into the cell from a measuring burette in which the gas was stored over mercury. The cell was agitated while the gas pressure was maintained by adjusting the gas volume. The Ostwald coefficient was determined from the mass of solvent and volume of gas used. Solubilities were measured at pressures above and below atmospheric.

SOURCE AND PURITY OF MATERIALS:

(1) Carbon dioxide. Source and purity not given. An aqueous "soda" solution absorbed 99.8% of the gas.

(2) Sodium iodide. Source and purity not given. Recrystallized from water and dried.


ESTIMATED ERROR:

\[ \delta T/K = \pm 0.2 \]
\[ \delta p/kPa = \pm 0.1 \]
\[ \delta L/L = \pm 0.02 \text{ (compiler)} \]

REFERENCES:

Some data in the thesis have been published. See:

COMPONENTS:
(1) Carbon dioxide; CO$_2$ [124-38-9]
(2) Octadecanoic (stearic) acid; C$_{18}$H$_{36}$O$_2$ [57-11-4]
(3) 2-Propanone (acetone); C$_3$H$_6$O [67-64-1]

VARIABLES:
T/K = 293.15
p/kPa = 101.325
$\omega_2$/mass fraction = 0 - 0.0419

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>Stearic acid conc.in solvent:</th>
<th>Ostwald Coefficient$^a$</th>
<th>Bunsen Coefficient$^a$</th>
<th>Mole Fraction$^b$</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mass fraction$^a$ Mole fraction$^b$</td>
<td>L/cm$^3$cm$^{-3}$</td>
<td>a/cm$^3$(STP)cm$^{-3}$</td>
<td>$x_j$</td>
</tr>
<tr>
<td>293.15</td>
<td>0 0</td>
<td>6.88</td>
<td>6.40</td>
<td>0.0211</td>
</tr>
<tr>
<td></td>
<td>0.0243 0.00506</td>
<td>5.01</td>
<td>4.66</td>
<td>0.0154</td>
</tr>
<tr>
<td></td>
<td>0.0419 0.00885</td>
<td>4.93</td>
<td>4.58</td>
<td>0.0151</td>
</tr>
</tbody>
</table>

$^a$ Original data based on mass fraction stearic acid in gas-free solution.

$^b$ Calculated by compiler.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The prepared solvent solution was charged into an evacuated cell after degassing, and the mass of solvent was determined by weight. Gas was introduced into the cell from a measuring burette in which the gas was stored over mercury. The cell was agitated while the gas pressure was maintained by adjusting the gas volume. The Ostwald coefficient was determined from the mass of solvent and volume of gas used. Solubilities were measured at pressures above and below atmospheric.

SOURCE AND PURITY OF MATERIALS:
(1) Carbon dioxide. Source and purity not given. An aqueous "soda" solution absorbed 99.8% of the gas.
(2) Stearic acid. Merck. Melting point 69.3 °C. Used without further purification.

ESTIMATED ERROR:

$\Delta T/K = \pm 0.2$
$\Delta p/kPa = \pm 0.1$
$\Delta L/L = \pm 0.02$ (compiler)

REFERENCES:

Some data in the thesis have been published. See:

1. Maillard, A.; Rosenthal, W.
COMPONENTS:
(1) Carbon dioxide; CO₂; [124-38-9]
(2) Sodium iodide; NaI; [7681-82-5]
(3) N,N-Dimethylformamide; C₃H₇NO; [68-12-2]

VARIABLES:
\[ T/K = 293.15 \]
\[ p/kPa = 101.325 \]
\[ n_g/mol \text{ kg}^{-1} = 0, 0.360 \]

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>Salt concentration in solvent:</th>
<th>Ostwald Coefficient²</th>
<th>Sechenov Constant²</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mass fraction⁴</td>
<td>Molal conc.⁴</td>
<td>Ostwald Coefficient⁴</td>
</tr>
<tr>
<td></td>
<td>c₂/g g⁻¹</td>
<td>m₂/mol kg⁻¹</td>
<td>L/cm³ cm⁻¹</td>
</tr>
<tr>
<td>293.15</td>
<td>0</td>
<td>0</td>
<td>5.10</td>
</tr>
<tr>
<td></td>
<td>0.054⁵</td>
<td>0.3809</td>
<td>4.28</td>
</tr>
</tbody>
</table>

a Original data. The salt concentration was expressed as mass of salt per unit mass of salt solution.

b Molal concentration and Sechenov constant calculated by compiler as follows:
\[ k_{sma} = (1/(m₂/mol \text{ kg}^{-1})) \log(L₀/L) \]

c Solvent saturated with NaI.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
The prepared solvent solution was charged into an evacuated cell after degassing, and the mass of solvent was determined by weight. Gas was introduced into the cell from a measuring burette in which the gas was stored over mercury. The cell was saturated with NaI. Gas was maintained by adjusting the cell volume. The Ostwald coefficient was determined from the mass of solvent and volume of gas used. Solubilities were measured at pressures above and below atmospheric.

SOURCE AND PURITY OF MATERIALS:
(1) Carbon dioxide. Source and purity not given. An aqueous "soda" solution absorbed 99.8% of the gas.
(2) Sodium iodide. Source and purity not given.

ESTIMATED ERROR:
\[ \delta T/K = \pm 0.2 \]
\[ \delta p/kPa = \pm 0.1 \]
\[ \delta L/L = \pm 0.02 \text{ (compiler)} \]

REFERENCES:
Some data in the thesis have been published. See:

COMPONENTS:
(1) Carbon dioxide; CO₂; [124-38-9]
(2) Octadecanoic (stearic) acid; C₁₈H₃₆O₂; [57-11-4]
(3) N,N-Dimethylformamide; C₃H₇NO; [68-12-2]

ORIGINAL MEASUREMENTS:
Rosenthal, W.
Theq. fac. sci. Univ. Strasbourg (France) 1954.

VARIABLES:

T/K = 293.15
p/kPa = 101.325
ω₂/mass fraction = 0 - 0.0347

PREPARED BY:
H. L. Clever

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>Stearic acid conc. in solvent:</th>
<th>Ostwald Coefficient</th>
<th>Bunsen Coefficient</th>
<th>Mole Fraction</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mass fraction²</td>
<td>Mole fraction²</td>
<td>L/cm³ cm⁻³</td>
<td>α/cm³(STP) cm⁻³</td>
</tr>
<tr>
<td></td>
<td>ω₂</td>
<td>x₂</td>
<td>5.10</td>
<td>4.75</td>
</tr>
<tr>
<td>293.15</td>
<td>0.01515</td>
<td>0.00394</td>
<td>7.12</td>
<td>6.62</td>
</tr>
<tr>
<td></td>
<td>0.0155</td>
<td>0.00430</td>
<td>7.10</td>
<td>6.61</td>
</tr>
<tr>
<td></td>
<td>0.0347</td>
<td>0.00915</td>
<td>7.03</td>
<td>6.54</td>
</tr>
</tbody>
</table>

² Original data based on mass fraction stearic acid in gas-free solution.

REFERENCES:
Some data in the thesis have been published. See:
COMPONENTS:
1. Carbon dioxide; CO₂; [124-38-9]
2. Methanol; CH₄O; [67-56-1]
3. Lithium chloride; LiCl; [7447-41-8]
   Lithium bromide; LiBr; [7550-35-8]
   Lithium iodide; LiI; [10377-51-2]
   Sodium iodide; NaI; [7681-82-5]

VARIABLES:
T/K = 288.15
P/kPa = 101.3
Conc. of salt = 0-0.103 mole ratio

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>Salt</th>
<th>Concentration of salt†</th>
<th>Solubility†</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>100n(MX) / n(CH₃OH)</td>
<td>100n(CO₂) / n(CH₃OH)</td>
</tr>
<tr>
<td>Lithium chloride</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.00</td>
<td>0.825</td>
<td></td>
</tr>
<tr>
<td>3.37</td>
<td>0.629</td>
<td></td>
</tr>
<tr>
<td>4.92</td>
<td>0.585</td>
<td></td>
</tr>
<tr>
<td>6.43</td>
<td>0.503</td>
<td></td>
</tr>
<tr>
<td>9.17</td>
<td>0.404</td>
<td></td>
</tr>
<tr>
<td>Lithium bromide</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.00</td>
<td>0.825</td>
<td></td>
</tr>
<tr>
<td>3.06</td>
<td>0.655</td>
<td></td>
</tr>
<tr>
<td>5.74</td>
<td>0.559</td>
<td></td>
</tr>
<tr>
<td>7.41</td>
<td>0.490</td>
<td></td>
</tr>
<tr>
<td>10.31</td>
<td>0.402</td>
<td></td>
</tr>
<tr>
<td>Lithium iodide</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.00</td>
<td>0.825</td>
<td></td>
</tr>
<tr>
<td>1.17</td>
<td>0.747</td>
<td></td>
</tr>
<tr>
<td>2.41</td>
<td>0.669</td>
<td></td>
</tr>
<tr>
<td>Sodium iodide</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.00</td>
<td>0.825</td>
<td></td>
</tr>
<tr>
<td>2.64</td>
<td>0.675</td>
<td></td>
</tr>
<tr>
<td>2.86</td>
<td>0.641</td>
<td></td>
</tr>
<tr>
<td>4.78</td>
<td>0.553</td>
<td></td>
</tr>
<tr>
<td>8.35</td>
<td>0.446</td>
<td></td>
</tr>
</tbody>
</table>

† n(MX) = no. of moles of salt; n(CH₃OH) = no. of moles of methanol
n(CO₂) = no. of moles of CO₂.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
Carbon dioxide was bubbled through the alcohol or alcohol and halide for two to four days. A portion of the saturated solution of gas was then added to CO₂-free water containing a measured quantity of sodium hydroxide. The mixture of sodium hydroxide and carbonate was then titrated against hydrochloric acid using phenolphthalein as indicator.

Separate portions of the original solution of gas were analysed for halide content by the Volhard method.

Solubilities were corrected to a partial pressure of carbon dioxide of 101.3 kPa.

REFERENCE AND PURITY OF MATERIALS:
1. Carbon dioxide was prepared by the action of hydrochloric acid on calcium carbonate. The gas was purified and dried by the usual methods.
2. The alcohol was said to be free from water.
3. No information.

ESTIMATED ERROR:

REFERENCES:
COMPONENTS:
1. Carbon dioxide; CO₂; [124-38-9]
2. Ethanol; C₂H₆O; [64-17-5]
3. Lithium chloride; LiCl; [7447-41-8]
   Lithium bromide; LiBr; [7550-35-8]
   Lithium iodide; LiI; [10377-51-2]
   Sodium iodide; NaI; [7681-82-5]

VARIABLES:
T/K = 288.15  P/kPa = 101.3
Conc. of salt = 0-0.151 mole ratio

EXPERIMENTAL VALUES:
<table>
<thead>
<tr>
<th>Salt</th>
<th>Concentration of salt†</th>
<th>Solubility‡</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>100n(MX) / n(C₂H₆OH)</td>
<td>100n(CO₂) / n(C₂H₆OH)</td>
</tr>
<tr>
<td>Lithium chloride</td>
<td>0.00</td>
<td>0.768</td>
</tr>
<tr>
<td></td>
<td>2.69</td>
<td>0.648</td>
</tr>
<tr>
<td></td>
<td>5.44</td>
<td>0.585</td>
</tr>
<tr>
<td></td>
<td>8.47</td>
<td>0.498</td>
</tr>
<tr>
<td></td>
<td>15.11</td>
<td>0.388</td>
</tr>
<tr>
<td></td>
<td>0.00</td>
<td>0.768</td>
</tr>
<tr>
<td></td>
<td>1.56</td>
<td>0.680</td>
</tr>
<tr>
<td></td>
<td>2.48</td>
<td>0.662</td>
</tr>
<tr>
<td></td>
<td>3.75</td>
<td>0.612</td>
</tr>
<tr>
<td></td>
<td>6.42</td>
<td>0.543</td>
</tr>
<tr>
<td>Lithium bromide</td>
<td>0.00</td>
<td>0.768</td>
</tr>
<tr>
<td></td>
<td>2.18</td>
<td>0.640</td>
</tr>
<tr>
<td></td>
<td>5.32</td>
<td>0.498</td>
</tr>
<tr>
<td></td>
<td>10.40</td>
<td>0.383</td>
</tr>
<tr>
<td>Lithium iodide</td>
<td>0.00</td>
<td>0.768</td>
</tr>
<tr>
<td></td>
<td>1.27</td>
<td>0.705</td>
</tr>
<tr>
<td></td>
<td>2.97</td>
<td>0.629</td>
</tr>
<tr>
<td></td>
<td>3.87</td>
<td>0.612</td>
</tr>
<tr>
<td></td>
<td>4.38</td>
<td>0.579</td>
</tr>
<tr>
<td></td>
<td>8.44</td>
<td>0.512</td>
</tr>
</tbody>
</table>

† n(MX) = no. of moles of salt; n(C₂H₆OH) = no. of moles of ethanol
‡ n(CO₂) = no. of moles of CO₂.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
Carbon dioxide was bubbled through the alcohol or alcohol and halide for two to four days. A portion of the saturated solution of gas was then added to CO₂-free water containing a measured quantity of sodium hydroxide. The mixture of sodium hydroxide and carbonate was then titrated against hydrochloric acid using phenolphthalein as indicator.

Separate portions of the original solution of gas were analysed for halide content by the Volhard method.

Solubilities were corrected to a partial pressure of carbon dioxide of 101.3 kPa.

SOURCE AND PURITY OF MATERIALS:
1. Carbon dioxide was prepared by the action of hydrochloric acid on calcium carbonate. The gas was purified and dried by the usual methods.

2. The alcohol was said to be free from water.

3. No information.

ESTIMATED ERROR:

REFERENCES:

ORIGINAL MEASUREMENTS:
Kozakewitsch, P.P

PREPARED BY:
P.G.T. Fogg
Solubility of Carbon Dioxide in Mineral Oils

Various groups have measured the solubility of carbon dioxide in petroleum fractions. Precise comparison between different sets of data is not possible because of the differences in chemical nature of the materials under test. A high proportion of cyclic hydrocarbons is likely to lower the solubility of carbon dioxide. In some cases average relative molecular masses have been stated and these enable semi-quantitative comparison of solubility data. Many of the solubility values have been measured at 293.15 K. Bunsen coefficients at this temperature range from 0.76 to 1.54 and mole fraction solubilities from 0.014 to 0.028. At this temperature there is a general tendency for an increase in Bunsen coefficient to be associated with a decrease in the relative molecular mass (see Table 1). Data published by Luther and Hiemenz for a sample of kerosene are contrary to this trend. The Bunsen coefficient is low for an oil of relative molecular mass of 405. This may be due to the large proportion of cyclic hydrocarbons stated to be present. A summary of the available data for mineral oils is shown in Table 1.

REFERENCES

COMPONENTS:

1. Carbon dioxide; CO₂; [124-38-9]
2. Mineral Oils

CRITICAL EVALUATION:

Table 1 Solubilities of carbon dioxide at a partial pressure of 101.3 kPa in mineral oils and wax.

<table>
<thead>
<tr>
<th>Type of oil</th>
<th>First author and reference</th>
<th>RMM</th>
<th>T/K</th>
<th>Bunsen coeff. x CO₂</th>
<th>Density*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kerosene</td>
<td>Luther (1)</td>
<td>405</td>
<td>293.15</td>
<td>0.76</td>
<td>0.0175</td>
</tr>
<tr>
<td>Koschagyl</td>
<td>Treshchina (2)</td>
<td>293.15</td>
<td>0.81</td>
<td>0.917</td>
<td></td>
</tr>
<tr>
<td>Buguruslan</td>
<td>Treshchina</td>
<td>0.834</td>
<td>0.913</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Medicinal paraffin</td>
<td>Rubie (3)</td>
<td>297.7</td>
<td>0.841</td>
<td>0.89</td>
<td></td>
</tr>
<tr>
<td>Oil B</td>
<td>Baldwin (4)</td>
<td>630</td>
<td>293.15</td>
<td>0.85</td>
<td>0.0269</td>
</tr>
<tr>
<td>Oil A.1</td>
<td>Baldwin</td>
<td>670</td>
<td>293.15</td>
<td>0.853</td>
<td>0.0279</td>
</tr>
<tr>
<td>Oil A.2</td>
<td>Baldwin</td>
<td>610</td>
<td>293.15</td>
<td>0.861</td>
<td>0.026</td>
</tr>
<tr>
<td>Oil A.3</td>
<td>Baldwin</td>
<td>570</td>
<td>293.15</td>
<td>0.887</td>
<td>0.0251</td>
</tr>
<tr>
<td>Oil MK-8</td>
<td>Logvinyuk</td>
<td>570</td>
<td>293.15</td>
<td>0.91</td>
<td>0.855</td>
</tr>
<tr>
<td>Oil A.4</td>
<td>Baldwin (4)</td>
<td>530</td>
<td>293.15</td>
<td>0.911</td>
<td>0.0243</td>
</tr>
<tr>
<td>Ramol 350</td>
<td>Begley (6)</td>
<td>292.65</td>
<td>0.932</td>
<td>0.872</td>
<td></td>
</tr>
<tr>
<td>Oil A.5</td>
<td>Baldwin (4)</td>
<td>400</td>
<td>293.15</td>
<td>0.966</td>
<td>0.0193</td>
</tr>
<tr>
<td>Hydrogenated fuel</td>
<td>Logvinyuk</td>
<td>570</td>
<td>293.15</td>
<td>0.9</td>
<td>0.832</td>
</tr>
<tr>
<td>Mineral oil</td>
<td>Rodman (7)</td>
<td>298.15</td>
<td>0.991</td>
<td>0.840 2</td>
<td></td>
</tr>
<tr>
<td>Kulsary</td>
<td>Treshchina (2)</td>
<td>293.15</td>
<td>1.01</td>
<td>0.886</td>
<td></td>
</tr>
<tr>
<td>Kulsary</td>
<td>Treshchina</td>
<td>293.15</td>
<td>1.03</td>
<td>0.887</td>
<td></td>
</tr>
<tr>
<td>Diesel fuel</td>
<td>Messow (8)</td>
<td>234</td>
<td>293.15</td>
<td>1.06</td>
<td>0.0141</td>
</tr>
<tr>
<td>Grozny</td>
<td>Treshchina (2)</td>
<td>293.15</td>
<td>1.108</td>
<td>0.835</td>
<td></td>
</tr>
<tr>
<td>Grozny</td>
<td>Treshchina</td>
<td>293.15</td>
<td>1.135</td>
<td>0.813</td>
<td></td>
</tr>
<tr>
<td>Fuel T-1</td>
<td>Logvinyuk</td>
<td>570</td>
<td>293.15</td>
<td>1.14</td>
<td>0.816</td>
</tr>
<tr>
<td>Petroleum</td>
<td>Gniewosz (9)</td>
<td>293.15</td>
<td>1.17</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kerosene</td>
<td>Treshchina (2)</td>
<td>293.15</td>
<td>1.29</td>
<td>0.819</td>
<td></td>
</tr>
<tr>
<td>Fuel T-6</td>
<td>Logvinyuk</td>
<td>293.15</td>
<td>1.29</td>
<td>0.84</td>
<td></td>
</tr>
<tr>
<td>Fuel TS-1</td>
<td>Logvinyuk</td>
<td>293.15</td>
<td>1.31</td>
<td>0.775</td>
<td></td>
</tr>
<tr>
<td>Kerosene</td>
<td>Baldwin (4)</td>
<td>165</td>
<td>293.15</td>
<td>1.51</td>
<td>0.0144</td>
</tr>
<tr>
<td>Kerosene</td>
<td>Messow (8)</td>
<td>209</td>
<td>293.15</td>
<td>1.542</td>
<td>0.0176</td>
</tr>
<tr>
<td>Gasoline</td>
<td>Treshchina (2)</td>
<td>293.15</td>
<td>1.87</td>
<td>0.746</td>
<td></td>
</tr>
<tr>
<td>Paraffin wax</td>
<td>Ridenour (10)</td>
<td>350</td>
<td>345.4</td>
<td>0.548</td>
<td>0.0110</td>
</tr>
</tbody>
</table>

RMM = average relative molecular mass (The nature of the average is not usually stated; i.e. whether mass average or number average)

* density at 293.15 K except where indicated.

1 288.15 K
2 298.15 K
3 341.45 K
COMPONENTS:

1. Carbon dioxide; CO₂; [124-38-9]
2. Paraffin oil

VARIABLES:

T/K = 293.15-355.15
P/kPa = 0-80 kPa

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>Concentration of CO₂ /mol m⁻³</th>
<th>Ostwald coeff. L</th>
<th>Henry's law constant /atm</th>
<th>Mole fraction solubility at 101.3 bar /kPa**</th>
</tr>
</thead>
<tbody>
<tr>
<td>293.15</td>
<td>4.67</td>
<td>5.72</td>
<td>0.816</td>
<td>57.2±4.2</td>
</tr>
<tr>
<td>314.15</td>
<td>3.89</td>
<td>5.30</td>
<td>0.734</td>
<td>5800±430</td>
</tr>
<tr>
<td>334.65</td>
<td>3.39</td>
<td>5.02</td>
<td>0.675</td>
<td>5.02</td>
</tr>
<tr>
<td>355.15</td>
<td>3.05</td>
<td>4.72</td>
<td>0.646</td>
<td>5.72±4.2</td>
</tr>
</tbody>
</table>

At 293.15 K the mole fraction solubility was shown to be proportional to the partial pressure of carbon dioxide to a pressure of at least 600 Torr (80 kPa).

* concentrations correspond to a partial pressure of carbon dioxide of about 13 kPa.

** calculated by the compiler.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

A spectroscopic method was used. The gas and solution under test was circulated through cuvettes. The concentration of carbon dioxide in the gas and liquid phases were calculated from the integrated extinction coefficient due to the infra-red band at 2350 cm⁻¹.

SOURCE AND PURITY OF MATERIALS:

1. from a cylinder; purified by the usual methods.
2. contained about 30% cyclic napthenes and 70% slightly branched alkanes; d₂₀ = 0.8795; relative molecular mass = 405.

ESTIMATED ERROR:

δL ≤ ±7.5% (authors)

REFERENCES:

COMPONENTS:
1. Carbon dioxide; CO₂; [124-38-9]
2. Diesel fuel

ORIGINAL MEASUREMENTS:
Messow, U.; Pape, D.

VARIABLES:

\[
T/K = 303.15 - 363.15 \\
P/kPa = 101.3 \text{ kPa}
\]

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>(T/K)</th>
<th>(x_{CO_2}) at total pressure of 101.3 kPa</th>
</tr>
</thead>
<tbody>
<tr>
<td>303.15</td>
<td>0.01299</td>
</tr>
<tr>
<td>333.15</td>
<td>0.00968</td>
</tr>
<tr>
<td>363.15</td>
<td>0.00813</td>
</tr>
</tbody>
</table>

The authors stated that the diesel fuel had the following properties:

Average molecular weight/g mol\(^{-1}\) = 234
Average b.p./K = 553
Molar volume at 298.2 K/cm\(^3\)mol\(^{-1}\) = 300.12

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The authors stated that measurements were made in the pressure range 1 atm to 10 atm but no further experimental details or results were given.

SOURCE AND PURITY OF MATERIALS:
No details given

ESTIMATED ERROR:

REFERENCES:
COMPONENTS:
1. Carbon dioxide; CO₂; [124-38-9]
2. Petroleum

VARIABLES:
\( p_1/\text{kPa} = 101.3 \)
\( T/\text{K} = 293, 313 \)

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>Petroleum Sample</th>
<th>Location</th>
<th>Specific Gravity ( d^2_{20} )</th>
<th>( T/\text{°C} )</th>
<th>( T/\text{K} )</th>
<th>Solubility Coefficient ( \alpha )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Koschagyl,</td>
<td>0.917</td>
<td>20</td>
<td>293</td>
<td>0.810</td>
<td></td>
</tr>
<tr>
<td>Emba oilfield</td>
<td>0.917</td>
<td>40</td>
<td>313</td>
<td>0.690</td>
<td></td>
</tr>
<tr>
<td>Buguruslan,</td>
<td>0.913</td>
<td>20</td>
<td>293</td>
<td>0.834</td>
<td></td>
</tr>
<tr>
<td>Volga-Ural</td>
<td>0.913</td>
<td>40</td>
<td>313</td>
<td>0.769</td>
<td></td>
</tr>
<tr>
<td>oilfield</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kulsary,</td>
<td>0.886</td>
<td>20</td>
<td>293</td>
<td>1.01</td>
<td></td>
</tr>
<tr>
<td>Emba oilfield</td>
<td>0.886</td>
<td>40</td>
<td>313</td>
<td>0.805</td>
<td></td>
</tr>
<tr>
<td>Kulsary,</td>
<td>0.887</td>
<td>20</td>
<td>293</td>
<td>1.03</td>
<td></td>
</tr>
<tr>
<td>Emba oilfield</td>
<td>0.887</td>
<td>40</td>
<td>313</td>
<td>0.810</td>
<td></td>
</tr>
<tr>
<td>Grozny,</td>
<td>0.835</td>
<td>20</td>
<td>293</td>
<td>1.108</td>
<td></td>
</tr>
<tr>
<td>Grozny oilfield</td>
<td>0.835</td>
<td>40</td>
<td>313</td>
<td>0.92</td>
<td></td>
</tr>
<tr>
<td>Kulsary,</td>
<td>0.813</td>
<td>20</td>
<td>293</td>
<td>1.135</td>
<td></td>
</tr>
<tr>
<td>Emba oilfield</td>
<td>0.813</td>
<td>40</td>
<td>313</td>
<td>0.98</td>
<td></td>
</tr>
<tr>
<td>Kerosene</td>
<td>0.819</td>
<td>20</td>
<td>293</td>
<td>1.29</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>40</td>
<td>313</td>
<td>1.07</td>
<td></td>
</tr>
<tr>
<td>Gasoline</td>
<td>0.746</td>
<td>20</td>
<td>293</td>
<td>1.87</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>40</td>
<td>313</td>
<td>1.46</td>
<td></td>
</tr>
</tbody>
</table>

\( \alpha \) Solubility coefficient appears to be the Bunsen coefficient, \( \alpha/\text{cm}^3(\text{STP})\text{cm}^{-3}\text{atm}^{-1} \).

The petroleum viscosities are 47.8, 38.0, 11.4, 6.5, - centistoke at 323 K as one comes down the table above.

Some information on the petroleum compositions are given in the paper.

The solubility of methane (natural gas) in water and mineralized water was given.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
A detailed diagram of the apparatus is given in the paper.

SOURCE AND PURITY OF MATERIALS:
2. Petroleum, kerosene, and gasoline. Petroleum from wells in three oil fields. Specific gravity, viscosity, and some information on composition and various fractions was given.

ESTIMATED ERROR:
\( \delta a/\alpha = \pm 0.05 \) (compiler)
COMPONENTS:
(1) Carbon dioxide; CO₂; [124-38-9]
(2) Mineral oil, white

ORIGINAL MEASUREMENTS:
Kubie, L. S.
J. Biol. Chem. 1927, 72, 545 - 548.

VARIABLES:

\[
\begin{align*}
T/K & : 297.15 - 298.15 \\
p/kPa & : 101.325 \text{ (1 atm)}
\end{align*}
\]

PREPARED BY:
H. L. Clever

EXPERIMENTAL VALUES:

\[
\begin{array}{cc}
T/K & \text{Bunsen coefficient} \\
297.15 - 298.15 & \alpha/cm^3 \text{(STP) cm}^{-1} \text{ atm}^{-1} \\
& 0.841 \pm 0.011
\end{array}
\]

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
The apparatus was the constant volume Van Slyke and Neill type (1).
Saturation was attained by bubbling the gas through the oil for several hours.
A 1.990 ± 0.007 cm³ volume of saturated solution was analyzed.
The Van Slyke correction factor for unextracted and redissolved gas ranged from 1.07 to 1.09.

SOURCE AND PURITY OF MATERIALS:
(1) Oxygen. Commercial cylinder.
A medicinal white oil which meets US Pharmacopeia standards. Prepared by fractional distillation from a naphthalene base, unsaturated hydrocarbons removed. Specific gravity 0.890 - 0.895 at 15 °C, viscosity 285 at 100 °F.

ESTIMATED ERROR:
\[
\delta T/K = 1
\]

REFERENCES:
J. Biol. Chem. 1924, 56, 523.
COMPONENTS:
1. Carbon dioxide; CO₂; [124-38-9]
2. Petroleum fractions

VARIABLES:
T/K = 273.15-373.15; P/kPa = 101.3

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>Solvent</th>
<th>Viscosity at 310.93 K /centipoises</th>
<th>Number average</th>
<th>Mole fraction x_CO₂</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>T/K</td>
<td>R.M.M.</td>
<td>Bunsen coeff. a</td>
</tr>
<tr>
<td>Oil A.1</td>
<td>293.15 0.853 0.915 0.0279</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oil A.2</td>
<td>293.15 0.861 0.924 0.0260</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oil A.3</td>
<td>293.15 0.887 0.952 0.0251</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oil A.4</td>
<td>293.15 0.911 0.978 0.0243</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oil A.5</td>
<td>293.15 0.966 1.037 0.0193</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oil B</td>
<td>293.15 0.850 0.912 0.0269</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kerosene</td>
<td>293.15 1.51 1.62</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* calculated by the compiler from the density at 15°C given by the authors, assuming that the density at 20°C is approximately that at 15°C.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
Most of the dissolved air was removed from a sample of oil by letting it stream into a continuously evacuated vessel. Any traces of air which remained were removed by saturating the oil with carbon dioxide or other gas under test and then subjecting the sample to vacuum treatment again. The oil was then transferred to an evacuated gas buret. The buret was then held in a thermostat bath and gas under test bubbled for 2-5 h until saturation was complete. Sufficient time was allowed for bubbles of gas to disappear and the gas above the oil was then displaced by running mercury into the gas buret. Dissolved gas was then pumped out of solution by a Topler pump, collected and measured.

SOURCE AND PURITY OF MATERIALS:
1. No information.
2. Samples A were fractions of the same sample of crude oil. Sample B was from another source. The following properties were given in the paper:

<table>
<thead>
<tr>
<th>Oil</th>
<th>Density 15°/4°C</th>
<th>Flash point (closed)</th>
<th>Kinematic viscosity/centipoises 100°F</th>
<th>V.I.</th>
<th>Pour point 210°F</th>
</tr>
</thead>
<tbody>
<tr>
<td>A.1 (residual)</td>
<td>0.894 510</td>
<td>615 34.4</td>
<td>95 0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A.2 (residual)†</td>
<td>0.885 460</td>
<td>268 20.3</td>
<td>96 0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A.3 (residual)</td>
<td>0.884 440</td>
<td>181 15.7</td>
<td>97 5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A.4 (distillate)</td>
<td>0.873 445</td>
<td>80.3 9.1</td>
<td>96 0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A.5 (distillate)</td>
<td>0.869 350</td>
<td>34.9 5.4</td>
<td>96 0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B†</td>
<td>0.890 460</td>
<td>260 20.0</td>
<td>96 10</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

† conformed to DTD 472B specification
COMPONENTS:
(1) Carbon dioxide; CO₂; [124-38-9]
(2) Hydrocarbon fuels and oil

ORIGINAL MEASUREMENTS:
Logvinyuk, V. P.; Makarenkov, V. V.; Malyshov, V. V.; Panchenkov, G. M.

VARIABLES:
\[ T/K: \text{253.15 - 365.15} \]
\[ P_{\text{CO}_2}/\text{kPa: 101.325 (1 atm)} \]

PREPARED BY:
S. A. Johnson
H. L. Clever

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>Bunsen Coefficient</th>
<th>Ostwald Coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>( a )</td>
<td>( L )</td>
</tr>
<tr>
<td>Hydrocarbon fuel, T-1, density ( \rho_{\text{a}} = 0.816 )</td>
<td></td>
<td></td>
</tr>
<tr>
<td>253.15</td>
<td>2.89</td>
<td>2.68</td>
</tr>
<tr>
<td>293.15</td>
<td>1.14</td>
<td>1.22</td>
</tr>
<tr>
<td>323.15</td>
<td>0.76</td>
<td>0.90</td>
</tr>
<tr>
<td>Hydrocarbon fuel, TS-1, density ( \rho_{\text{a}} = 0.775 )</td>
<td></td>
<td></td>
</tr>
<tr>
<td>293.15</td>
<td>1.22</td>
<td>1.31</td>
</tr>
<tr>
<td>Hydrocarbon fuel, T-6, density ( \rho_{\text{a}} = 0.84 )</td>
<td></td>
<td></td>
</tr>
<tr>
<td>253.15</td>
<td>2.43</td>
<td>2.25</td>
</tr>
<tr>
<td>273.15</td>
<td>1.52</td>
<td>1.52</td>
</tr>
<tr>
<td>293.15</td>
<td>1.29</td>
<td>1.38</td>
</tr>
<tr>
<td>323.15</td>
<td>0.84</td>
<td>0.99</td>
</tr>
<tr>
<td>365.15</td>
<td>0.50</td>
<td>0.67</td>
</tr>
<tr>
<td>Hydrogenated fuel, density ( \rho_{\text{a}} = 0.832 )</td>
<td></td>
<td></td>
</tr>
<tr>
<td>293.15</td>
<td>0.91</td>
<td>0.98</td>
</tr>
<tr>
<td>Oil, MK-8, density ( \rho_{\text{a}} = 0.855 )</td>
<td></td>
<td></td>
</tr>
<tr>
<td>293.15</td>
<td>0.91</td>
<td>0.98</td>
</tr>
</tbody>
</table>

The compiler calculated the Ostwald coefficients.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
The apparatus and procedure are described in reference (1) which was not available to the compiler.

SOURCE AND PURITY OF MATERIALS:
No information given.

ESTIMATED ERROR:
\[ \delta a/a \leq 0.06 \text{ (authors)} \]

REFERENCES:
1. Gogitidize, L.D.; Logvinyuk, V.P.; Makarenkov, V.V.; Panchenkov, G.M.; Malyshov, V.V.; Yakovlevskii, V.V. *Method of Evaluating the Operating Properties of Jet Fuels and Lubricating Materials (Russ.), Mashinostroenie 1966.*
COMPONENTS:
1. Carbon dioxide; CO₂; [124-38-9]
2. Ramol 350 (a hydrocarbon oil)

ORIGINAL MEASUREMENTS:
Begley, J.W.; Maget, J.R.; Williams, B.

VARIABLES:
P/kPa = 101.3
T/K = 292.65-317.75

PREPARED BY:
P.G.T. Fogg

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>Ostwald coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>292.65</td>
<td>0.998</td>
</tr>
<tr>
<td>296.25</td>
<td>0.903</td>
</tr>
<tr>
<td>300.85</td>
<td>0.800</td>
</tr>
<tr>
<td>307.15</td>
<td>0.764</td>
</tr>
<tr>
<td>311.25</td>
<td>0.747</td>
</tr>
<tr>
<td>315.25</td>
<td>0.717</td>
</tr>
<tr>
<td>317.75</td>
<td>0.660</td>
</tr>
</tbody>
</table>

Ramol 350 was reported to have the following physical properties

<table>
<thead>
<tr>
<th>T/°C</th>
<th>Density/g cm⁻³</th>
<th>T/°C</th>
<th>Viscosity/cp</th>
<th>T/°C</th>
<th>Viscosity/cp</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>0.872</td>
<td>19.4</td>
<td>219.5</td>
<td>37.8</td>
<td>67.9</td>
</tr>
<tr>
<td>38.6</td>
<td>0.861</td>
<td>35.8</td>
<td>77.8</td>
<td>40.5</td>
<td>58.9</td>
</tr>
<tr>
<td>45</td>
<td>0.858</td>
<td>36.6</td>
<td>71.9</td>
<td>44.4</td>
<td>47.9</td>
</tr>
</tbody>
</table>

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
The solvent was boiled to remove any gases in solution and was then introduced into the absorption vessel without coming into contact with the air. The volume of carbon dioxide absorbed by the liquid from gas buret was then measured. The composition of the solution after equilibrium was attained was measured by chemical analysis. This enabled a check to be made of solubility as calculated from the volume of gas absorbed. The absorption vessel and the gas buret were kept at constant temperature by circulation of water from a thermostat bath.

SOURCE AND PURITY OF MATERIALS:
2. Ramol 350 supplied by Sherwood Refining Company, Detroit, Mich. USA.

ESTIMATED ERROR:
δT/K = ±0.1 Solubility measurements reproducible to about ±0.5% (authors).

REFERENCES:
COMPONENTS:
(1) Carbon dioxide; CO₂; [124-38-9]
(2) Mineral oil

ORIGINAL MEASUREMENTS:
Rodman, C. J.; Maude, A. H.

VARIABLES:
\[ T/K = 298.15 - 353.15 \]
\[ p_1/kPa = 101.3 (760 \text{ mmHg}) \]

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>Temperature t/°C</th>
<th>Bunsen Coefficient a/cm³( STP) cm⁻³ atm⁻¹</th>
<th>Ostwald Coefficient L/cm³ cm⁻³</th>
<th>Solubility g kg⁻¹</th>
</tr>
</thead>
<tbody>
<tr>
<td>25</td>
<td>0.991</td>
<td>1.083</td>
<td>2.333</td>
</tr>
<tr>
<td>50</td>
<td>0.774</td>
<td>0.916</td>
<td>1.87</td>
</tr>
<tr>
<td>80</td>
<td>0.566</td>
<td>0.732</td>
<td>1.396</td>
</tr>
</tbody>
</table>


AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
The apparatus consists of an 180 cm³ absorption bottle connected to a 100 cm³ gas buret. The absorption bottle sets in a thermostat, which is attached to a shaking machine.

A weighed sample of oil is introduced into the absorption vessel. The sample is degassed by vacuum taking care to avoid excessive foaming. The gas is brought into the system. An initial buret reading taken, and the shaker is started and reading taken every 5 minutes until 2 or 3 constant readings are obtained.

SOURCE AND PURITY OF MATERIALS:
(1) Carbon dioxide. No information.
(2) Mineral oil. A Pennsylvania base oil, 96 per cent saturated hydrocarbons, and distilling between 300 and 400°C. Density at 25°C = 0.840 and at 80°C = 0.800 g cm⁻³. As a commercial product the oil is known as "Wemco A".

ESTIMATED ERROR:

REFERENCES:
**COMPONENTS:**

1. Carbon dioxide; CO₂; [124-38-9]
2. Kerosene

**ORIGINAL MEASUREMENTS:**

Messow, U.; Pape, D.

**VARIABLES:**

\[ T/K = 303.15-363.15 \]
\[ P/kPa = 101.3 \text{ kPa} \]

**EXPERIMENTAL VALUES:**

<table>
<thead>
<tr>
<th>T/K</th>
<th>( x_{CO_2} ) at total pressure of 101.3 kPa</th>
</tr>
</thead>
<tbody>
<tr>
<td>303.15</td>
<td>0.01560</td>
</tr>
<tr>
<td>333.15</td>
<td>0.01182</td>
</tr>
<tr>
<td>363.15</td>
<td>0.00901</td>
</tr>
</tbody>
</table>

The authors stated that the kerosene had the following properties:

- Average molecular weight/g mol\(^{-1}\) = 209
- Average b.p./K = 462
- Molar volume at 298.2 K/cm\(^3\)mol\(^{-1}\) = 257.75

**AUXILIARY INFORMATION**

**METHOD/APPARATUS/PROCEDURE:**

The authors stated that measurements were made in the pressure range 1 atm to 10 atm but no further experimental details or results were given.

**SOURCE AND PURITY OF MATERIALS:**

No details given

**ESTIMATED ERROR:**

**REFERENCES:**
COMPONENTS:
(1) Carbon dioxide; CO₂; [124-38-9]
(2) Petroleum

ORIGINAL MEASUREMENTS:
Gniewosz, S.; Walfisz, A.
Z. Phys. Chem. 1887, 1, 70 – 72.

VARIABLES:
T/K = 283.15, 293.15
p/kPa = 101 "atmospheric"

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>Temperature</th>
<th>Bunsen Coefficient α/(cm³(STP)cm⁻³ atm⁻¹)</th>
<th>Ostwald Coefficient L/cm³ cm⁻¹</th>
</tr>
</thead>
<tbody>
<tr>
<td>t/°C</td>
<td>T/K</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>283.15</td>
<td>1.32</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.30</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.32</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.31 Av.</td>
</tr>
<tr>
<td>20</td>
<td>293.15</td>
<td>1.18</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.15</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.19</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.17 Av.</td>
</tr>
</tbody>
</table>

The Ostwald coefficients were calculated by the compiler.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
The apparatus consisted of an absorption flask connected to a gas buret by a flexible lead capillary. The system was thermostated in a large water bath.

The volume of gas absorbed in a known volume of degassed petroleum was measured directly using the gas buret.

SOURCE AND PURITY OF MATERIALS:
(1) Carbon dioxide. No information
(2) Petroleum. Russian petroleum. Cleaned by boiling in a large copper flask.

ESTIMATED ERROR:

δα/α = ± 0.05 (Compiler)

REFERENCES:
COMPONENTS:

1. Carbon dioxide; CO₂; [124-38-9]
2. Paraffin wax

ORIGINAL MEASUREMENTS:

Ridenour, W.P.; Weatherford, W.D.; Capell, R.G.

VARIABLES:

T/K = 345.4
P/kPa = 34.33 - 100.33

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>P/mmHg</th>
<th>P/kPa</th>
<th>Soly./cm³g⁻¹</th>
<th>Bunsen coeff. x CO₂</th>
</tr>
</thead>
<tbody>
<tr>
<td>345.4</td>
<td>257.5</td>
<td>34.33</td>
<td>0.208</td>
<td>0.471</td>
</tr>
<tr>
<td>379.5</td>
<td>50.60</td>
<td>0.329</td>
<td>0.504</td>
<td>0.00514</td>
</tr>
<tr>
<td>505.5</td>
<td>67.39</td>
<td>0.457</td>
<td>0.528</td>
<td>0.00714</td>
</tr>
<tr>
<td>613.1</td>
<td>81.74</td>
<td>0.571</td>
<td>0.548</td>
<td>0.00892</td>
</tr>
<tr>
<td>752.5</td>
<td>100.33</td>
<td>0.704</td>
<td>0.548</td>
<td>0.0110</td>
</tr>
<tr>
<td>760</td>
<td>101.3</td>
<td>0.710</td>
<td></td>
<td>0.01104†</td>
</tr>
</tbody>
</table>

§ volumes of gas were corrected to 273.15 K and 101.3 kPa
* extrapolated value given by the authors
† calculated by the compiler

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The apparatus was based upon the equilibrium adsorption apparatus described by Brunauer, Emmett and Teller. Gas was circulated through the vessel containing wax. Pressures were measured with a mercury manometer. Measured quantities of carbon dioxide were delivered to the system from two calibrated burets. A period of 20-60 minutes was allowed for the system to reach equilibrium after each addition of gas.

SOURCE AND PURITY OF MATERIALS:

1. Obtained by heating NaHCO₃; contained 0.1% N₂, 0.1% O₂, 3.4% CO.
2. M.pt 50.7°C (ASTM D 87-22);
   Density/g cm⁻³ 0.7716 (68.3°C) 0.7662 (76.8°C)
   Relative molecular mass 350

ESTIMATED ERROR:

δT/K = ±2  δP/mmHg = ±0.2
δσ = ±0.004; high pressure
      = ±0.012; low pressure (authors)

REFERENCES:

   J. Amer. Chem. Soc. 1938, 60, 309.
COMPONENTS:
1. Carbon dioxide; CO₂; [124-38-9]
2. Animal and Vegetable Oils and Fats

CRITICAL EVALUATION:

Solubility of carbon dioxide in animal and vegetable oils and fats.

There have been several measurements (1-6) of the solubility of carbon dioxide in olive oil at a partial pressure of 101.3 kPa. The most reliable are probably those carried out by Yeh and Petersen (1) from 298.2 K to 318.2 K and by Battino et al. (2) from 298.0 K to 327.9 K. In both cases the oil was carefully degassed before absorption of carbon dioxide. Values of mole fraction solubility from the two sources agree to within 2%. The recommended smoothing equation, based on these two sets of data, is given below.

\[
\ln x_{CO_2} = -88.009 + \frac{4996.8}{(T/K)} + 11.9998 \ln(T/K)
\]

temperature range = 298.0-327.9 K
standard deviation in \(x_{CO_2}\) = 0.00023

The average thermodynamic values for the transfer of one mole of carbon dioxide at a partial pressure of 101.3 kPa to a hypothetical solution of unit mole fraction concentration are

\[
\Delta H^\circ/J\,mol^{-1} = -10479
\]
\[
\Delta S^\circ/J\,mol^{-1}\,K^{-1} = -59.1
\]

The equation for the Bunsen coefficient, \(a\), based on data from the two sources is

\[
\ln a = -3.0329 + \frac{1328.0}{(T/K)} - 0.20002 \ln(T/K)
\]

temperature range = 298.0-327.9 K
standard deviation in \(a\) = 0.029

Yeh and Petersen (1) measured the solubilities of carbon dioxide in dog fat, rat-pooled fat, and two samples of human fat over the temperature range 298.2-318.2 K. In all cases Bunsen coefficients were within 1.6% of the values which they found for olive oil at the same temperatures. Nichols (7) also measured solubility in dog fat, rat-pooled fat and human fat. Values of Bunsen coefficients from these measurements were close to each other but about 10% lower than Yeh and Peterson's values.

Tomoto and Kusano (5) measured solubility in olive oil, linseed oil and soybean oil. The data which they published are close to those in an earlier paper by Tomoto (4). They found that Bunsen coefficients at 293.2 K and 323.2 K for solution in linseed oil were greater than the coefficients for olive oil. Bunsen coefficients for soybean oil were less than for olive oil. Schmidt-Nielsen's data (3) also indicate that the Bunsen coefficient for carbon dioxide in linseed oil at 293.2 K is greater than that for olive oil at this temperature. However Tomoto's and Schmidt-Nielsen's values of Bunsen coefficients for both linseed oil and olive oil are lower than Bunsen coefficients for olive oil from data published by Yeh and Petersen and by Battino et al. which are recommended above.

Schmidt-Nielsen (3) also found that the solubility of carbon dioxide (\(\text{cm}^3\,\text{g}^{-1}\)) in cod-liver oil and in herring oil was greater than in olive oil. Further work is needed to establish the relative solubilities in these solvents.

Vibrans (8) measured solubility in cottonseed oil at about 298 and 318 K. Temperature control was poor but averaged values of Bunsen coefficients are close to those for olive oil. The average value for 296-299 K was found to be 1.34 ± 0.04 compared with a value for olive oil at 298.2 K of 1.3565 (Yeh and Petersen). The average value for 318 K was 1.012 ± 0.029 compared with 1.0150 for olive oil (Yeh and Petersen). Vibrans also found
that the Bunsen coefficient for dissolution in steam rendered lard at
318 K was 1.014 ±0.012, close to the value of 1.012 for cottonseed oil.

Schaffer and Haller (9) measured solubility in cottonseed oil at 313.2 K.
Their value for the Bunsen coefficient was 0.876 which is not in accord
with values reported by Vibrans. Schaffer and Haller also reported
Bunsen coefficients for solubility in lard at 313.2 K and in butter oil at
313.2 K and 333.15 K. The value for lard is, in this case, slightly lower
than the value given by Vibrans (Schaffer at 313.2 K: 1.003; Vibrans at
about 318 K: 1.014). The Bunsen coefficients for dissolution in butter
oil were greater than values for olive oil reported by Yeh and Petersen
(1) and by Battino et al. (2).

REFERENCES
2. Battino, R.; Evans, F.D.; Danforth, W.F. J. Am. Oil Chem. Soc. 1968,
   45, 830-833.
   7pp.
4. Tomoto, N. Miyazaki Daigaku Kagokubu Kenkyu Hokoku 1958, No. 4,
   39-46. (Bull. Fac. Eng., Miyazaki Univ.)
   Chemistry)
COMPONENTS:
(1) Carbon dioxide; CO$_2$; [124-38-9]
(2) Fats

VARIABLES:

\[
\begin{align*}
T/K & = 293 \\
p_1/kPa & = 101 \quad (1 \text{ atm})
\end{align*}
\]

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>Solubility/ cm$^3$(STP) per 100 g</th>
</tr>
</thead>
<tbody>
<tr>
<td>293</td>
<td>Cod-liver oil 135</td>
</tr>
<tr>
<td>293</td>
<td>Herring oil 134</td>
</tr>
<tr>
<td>293</td>
<td>Linseed oil 160</td>
</tr>
<tr>
<td>293</td>
<td>Olive oil 117</td>
</tr>
</tbody>
</table>

The author classes the solubilities as approximate values.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The oil is degassed for two hours in a vacuum.

The oil stands for 24 hours with the dry gas.

The dissolved gas is removed from the oil by a Barcroft gas pump, and the gas volume is measured.

SOURCE AND PURITY OF MATERIALS:

No information.

ESTIMATED ERROR:

REFERENCES:
**COMPONENTS:**
(1) Carbon dioxide; CO₂;
[124-38-9]
(2) Olive oil

**ORiGInAL MEASUREMENTS:**
Tomoto, N.
*Miyazaki Daigaku Kogakubu Kenkyu Hokoku* 1958, No. 4, 39 - 46.

**VARIABLES:**

<table>
<thead>
<tr>
<th>Temperature t/°C</th>
<th>T/K = 303, 323</th>
<th>Partial Pressure P₂/mmHg</th>
<th>Carbon Dioxide Solubility (mg g⁻¹ cm³(STP)g⁻¹)</th>
<th>Bunsen Coefficient a₁</th>
</tr>
</thead>
<tbody>
<tr>
<td>30</td>
<td>303</td>
<td>214.8</td>
<td>0.676</td>
<td>1.097</td>
</tr>
<tr>
<td></td>
<td></td>
<td>278.7</td>
<td>0.897</td>
<td>1.123</td>
</tr>
<tr>
<td></td>
<td></td>
<td>366.7</td>
<td>1.133</td>
<td>1.115</td>
</tr>
<tr>
<td></td>
<td></td>
<td>549.5</td>
<td>1.696</td>
<td>1.076</td>
</tr>
<tr>
<td></td>
<td></td>
<td>664.2</td>
<td>1.957</td>
<td>1.028</td>
</tr>
<tr>
<td></td>
<td></td>
<td>765.0</td>
<td>2.307</td>
<td>1.052</td>
</tr>
<tr>
<td></td>
<td></td>
<td>837.6</td>
<td>2.491</td>
<td>1.037</td>
</tr>
<tr>
<td>50</td>
<td>323</td>
<td>321.5</td>
<td>0.775</td>
<td>0.828</td>
</tr>
<tr>
<td></td>
<td></td>
<td>426.4</td>
<td>1.036</td>
<td>0.834</td>
</tr>
<tr>
<td></td>
<td></td>
<td>528.3</td>
<td>1.293</td>
<td>0.841</td>
</tr>
<tr>
<td></td>
<td></td>
<td>635.8</td>
<td>1.554</td>
<td>0.840</td>
</tr>
<tr>
<td></td>
<td></td>
<td>797.8</td>
<td>1.864</td>
<td>0.845</td>
</tr>
</tbody>
</table>

1 Bunsen coefficient a/cm³(STP)cm⁻³ atm⁻¹.
2 The author's values, probably from their Henry's law diagrams.

**METHOD/APPARATUS/PROCEDURE:**
The apparatus consists of a thermostated absorption flask, a gas reservoir, and a manometer and leveling bulb system.

The oil is placed in the absorption flask and both are weighed, the system is heated to 80°C and evacuated for six hours to degass the solvent. The gas is admitted to the system. The oil is stirred by a magnetic stirrer until equilibrium is attained.

The flask and contents are disconnected from the system and weighed. The amount of gas absorbed is calculated from the gain in weight. The loss of oil due to evaporation during the degassing is considered negligible.

**SOURCE AND PURITY OF MATERIALS:**

(2) Olive oil. Iodine value 83, acid value 0.20, density p/g cm⁻³ = 0.9076, 0.9007, and 0.8940 at 30, 40, and 50°C, respectively.

**ESTIMATED ERROR:**
\[
\delta T/K = \pm 0.5 \\
\delta P/mmHg = \pm 0.5 \\
\delta \omega/mg = \pm 0.5 \\
\delta a/a = \pm 0.03 \text{ (compiler)}
\]

**REFERENCES:**
COMPONENTS:
(1) Carbon dioxide; CO₂; [124-38-9]
(2) Olive Oil

ORIGINAL MEASUREMENTS:
Yeh, S. Y.; Peterson, R. E.

VARIABLES:
\[ T/K = 298.15 - 318.15 \]
\[ P/kPa = 101.325 \text{ (1 atm)} \]

PREPARED BY:
H. L. Clever

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>Mol Fraction</th>
<th>Bunsen Coefficient (a/cm^3\text{ (STP)}cm^{-3}\text{atm}^{-1}) ± Std. Dev.</th>
<th>Ostwald Coefficient (L/cm^3cm^{-3})</th>
</tr>
</thead>
<tbody>
<tr>
<td>298.15</td>
<td>55.96</td>
<td>1.3565 ± 0.0013</td>
<td>1.4806</td>
</tr>
<tr>
<td>303.15</td>
<td>52.00</td>
<td>1.2519 ± 0.0016</td>
<td>1.3893</td>
</tr>
<tr>
<td>310.15</td>
<td>47.40</td>
<td>1.1306 ± 0.0016</td>
<td>1.2849</td>
</tr>
<tr>
<td>318.15</td>
<td>42.90</td>
<td>1.0150 ± 0.0015</td>
<td>1.1821</td>
</tr>
</tbody>
</table>

The Bunsen coefficients are the average of three measurements. The Ostwald coefficients were fitted by the method of least squares to the equation
\[ \log L = A/T + B \]
by the authors. The same line fitted olive oil and the fats. From the slope and intercept they obtained
\[ \Delta H^\circ/\text{cal mol}^{-1} = -1217 ± 30 \text{ and } \Delta S^\circ/\text{cal K}^{-1}\text{mol}^{-1} = -8.5 ± 0.1. \]

The thermodynamic values are for the standard state transfer of one mole of carbon dioxide from the gas phase at a concentration of one mole dm\(^{-3}\) to the solution at a concentration of one mole dm\(^{-3}\). See the evaluation of the carbon dioxide + olive oil system for the thermodynamic values of the standard state transfer on one mole of carbon dioxide from the gas phase at a partial pressure of one atm to the hypothetical unit mole fraction solution.

Smoothed Data: For use between 298.15 and 318.15 K.
\[ \ln x_I = -7.1013 + 12.5711/(T/100 \text{ K}) \]

The standard error about the regression line is 1.15 \times 10^{-4}.
For more information see the evaluation.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
Oil was dried and degassed by stirring under vacuum at 80°C for about 12 hr. A 50 ml. sample was placed in an absorption flask attached to a Geffken gas buret (1). The oil was constantly stirred and equilibrated with increments of gas until no change was observed in a differential oil manometer for \(\frac{1}{2}\) hr. Difference between initial and final buret readings indicated amount of gas absorbed. Absorption at successively lower temperatures was determined. The authors also measured the viscosity and surface tension of the liquid.

SOURCE AND PURITY OF MATERIALS:
(1) Carbon dioxide. Matheson Co., Inc. Research grade, maximum impurity 0.3 mol per cent N\(_2\) or CO.
(2) Olive Oil. Magnus, Mabee and Raynard Co., U.S.P.

ESTIMATED ERROR:
\[ \delta T/K = 0.05 \]
\[ \delta P/mmHg = 0.5 \]
\[ \delta a/a = 0.005 \]

REFERENCES:
1. Geffken, G.
   Z. Physik Chem. 1904, 48, 257.
COMPONENTS:
(1) Carbon dioxide; CO₂; [124-38-9]
(2) Olive oil

ORIGINAL MEASUREMENTS:

VARIABLES:
\[ T/K = 303, 323 \]
\[ p_1/kPa = 20.3 - 101 \]
\[ (0.2 - \text{about 1 atm}) \]

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>Temperature (t/°C)</th>
<th>(T/K)</th>
<th>Bunsen Coefficient (\alpha/\text{cm}^3) (STP) (\text{cm}^{-3} \text{ atm}^{-1})</th>
</tr>
</thead>
<tbody>
<tr>
<td>30</td>
<td>303</td>
<td>1.076</td>
</tr>
<tr>
<td>50</td>
<td>323</td>
<td>0.8376</td>
</tr>
</tbody>
</table>

Five to seven measurements were made at each temperature over the pressure interval of 0.2 to about 1.0 atm. A diagram of solubility (cm³ per g) vs. pressure was linear. Only the values of the Bunsen coefficient above were tabulated in the paper.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

SOURCE AND PURITY OF MATERIALS:
(1) Carbon dioxide.
(2) Olive oil. The oil had a saponification value of 190.2, an acid value of 0.20, and an iodine value of 83.2. Density \(\rho^o/g \text{ cm}^{-3} = 0.9076\), mean mol wt = 885, mean molar volume, \(\gamma^o/\text{cm}^3 \text{ mol}^{-1} = 975.1\).

ESTIMATED ERROR:

REFERENCES:
COMPONENTS:
(1) Carbon dioxide; CO₂; [124-38-9]
(2) Olive oil

ORIGINAL MEASUREMENTS:
Battino, R.; Evans, F. D.; Danforth, W. F.
J. Am. Oil Chem. Soc. 1968, 45, 830 - 833.

VARIABLES:
T/K: 298.00 - 327.94
P/kPa: 101.325 (1 atm)

PREPARED BY:
H. L. Clever

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>Mol Fraction</th>
<th>Bunsen Coefficient (a/cm³(STP) cm⁻³ atm⁻¹)</th>
<th>Ostwald Coefficient (L/cm³ cm⁻³)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>10³ x_j</td>
<td></td>
<td></td>
</tr>
<tr>
<td>298.00</td>
<td>56.5</td>
<td>1.295</td>
<td>1.412</td>
</tr>
<tr>
<td>307.91</td>
<td>48.5</td>
<td>1.105</td>
<td>1.246</td>
</tr>
<tr>
<td>318.50</td>
<td>42.1</td>
<td>0.9605</td>
<td>1.120</td>
</tr>
<tr>
<td>327.94</td>
<td>38.5</td>
<td>0.8688</td>
<td>1.043</td>
</tr>
</tbody>
</table>

The solubility values were adjusted to a partial pressure of carbon dioxide of 101.325 kPa (1 atm) by Henry's law.

The Bunsen coefficients were calculated by the compiler.

Smoothed Data: For 298.15 - 328.15 K.

\[
\ln x_j = -7.1169 + \frac{12.6193}{(T/100K)}
\]

The standard error about the regression line is 2.34 x 10⁻⁴.

See the evaluation of the carbon dioxide + olive oil system for the recommended Gibbs energy equation and smoothed solubility values.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
The apparatus is based on the design by Morrison and Billett (1) and the version used is a modification of the apparatus of Clever, Battino, Saylor and Gross (2).

The solvent is sprayed into an evacuated chamber of an all glass apparatus; it is stirred and heated until the pressure drops to the vapor pressure of the liquid.

Solubility Determination. The degassed liquid passes in a thin film down a glass spiral tube at a total pressure of one atm of solute gas plus solvent vapor. The gas absorbed is measured in the attached buret system, and the solvent is collected in a tared flask and weighed.

SOURCE AND PURITY OF MATERIALS:

(2) Olive oil. A. U.S.P. Fisher Scientific Co., 0.58% free fatty acid. B. Nutritional Biochemicals Corp. 0.30% free fatty acid.

The density was measured and fitted to the equation

\[
p/g cm⁻³ = 0.9152 - 0.000468 t°C
\]

The average mol wt is 884 ± 45.

ESTIMATED ERROR:

δT/K = ±0.03  
δP/mmHg = ±0.5  
δx_j/x_j = ±0.03

REFERENCES:
**COMPONENTS:**

1. Carbon dioxide; CO₂; \([124-38-9]\)
2. Olive oil.

**ORIGINAL MEASUREMENTS:**

Power, G.G.; Stegall, H.


**VARIABLES:**

\[ T/K = 310.15 \]

**PREPARED BY:**

C.L. Young

**EXPERIMENTAL VALUES:**

<table>
<thead>
<tr>
<th>( T/K )</th>
<th>Bunsen coefficient, ( a )</th>
<th>S.D.*</th>
<th>No. of measurements</th>
</tr>
</thead>
<tbody>
<tr>
<td>310.15</td>
<td>1.23</td>
<td>0.02</td>
<td>4</td>
</tr>
</tbody>
</table>

* Standard deviation.

**AUXILIARY INFORMATION**

**METHOD/APPARATUS/PROCEDURE:**

Liquid saturated with gas in a stirred cell. 5.0 cm³ samples of liquid removed in a calibrated syringe and amount of gas extracted by two extraction in a van Slyke apparatus determined. Details in source and ref. (1).

**SOURCE AND PURITY OF MATERIALS:**

1. Matheson Co. sample, purity better than 99.7 mole per cent.
2. No details given.

**ESTIMATED ERROR:**

\( \delta T/K = \pm 0.1 \)

**REFERENCES:**

1. Power, G.G.

*J. Appl. Physiology, 1968, 24, 468.*
COMPONENTS:
1. Carbon dioxide; CO₂; [124-38-9]

VARIABLES:
\[ T/K = 311.2 \]
\[ P/kPa = 101.3 \]

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>Solvent</th>
<th>Number of samples</th>
<th>Density /g cm(^{-3})</th>
<th>M.pt /°C</th>
<th>Solubility of CO₂ * (cm(^2) g(^{-1}) α /mmol kg(^{-1}) mmHg(^{-1}))</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dog fat</td>
<td>9</td>
<td>0.9155</td>
<td>30</td>
<td>0.9405 ±0.0140 0.8609 ±0.0129 0.0556</td>
</tr>
<tr>
<td>Rat fat (A)</td>
<td>9</td>
<td>0.9154</td>
<td>19</td>
<td>0.9738 ±0.0092 0.8917 ±0.0077 0.0576</td>
</tr>
<tr>
<td>Rat fat (B)</td>
<td>10</td>
<td>0.9154</td>
<td>19</td>
<td>0.9813 ±0.0089 0.8985 ±0.0082 0.0578</td>
</tr>
<tr>
<td>Human fat</td>
<td>8</td>
<td>0.9110</td>
<td>18</td>
<td>0.9306 ±0.0483 0.8476 ±0.0447 0.0550</td>
</tr>
</tbody>
</table>

\( T/K = 311.2; P_{CO₂} = 101.3 \) kPa

* volume of gas corrected to 273.15 K, 101.3 kPa; α is the Bunsen coefficient; H is Henry's constant defined as millimoles of CO₂ dissolved per kilogram of fat per mmHg partial pressure of CO₂.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
Fatty tissue homogenized with sand at 30-35 °C in a buffer solution at pH 4.0 or, in the case of one rat sample, at pH 7.40. Fat removed by centrifuging. Dry air mixed with 23.5-24.9% CO₂ passed for 2.5 to 5 h through samples of volume 3-5 cm\(^3\). Solutions then analysed by use of a van Slyke apparatus. Concentrations of CO₂ corrected to a partial pressure of 101.3 kPa.

SOURCE AND PURITY OF MATERIALS:
1. No information
2. Depot fat from the following sources:
   Dog - perirenal and subcutaneous fat from an adult mongrel dog 2 h after death by exsanguination under anesthesia.
   Rat - perirenal, subcutaneous and retroperitoneal fat from six 200-day old Wistar rats killed by a blow on the head followed by exsanguination. Samples pooled and divided in two parts, A and B.
   Human - omental fat from an 86-year old woman 5 h after death.
Negligible water content - no loss of weight from any sample during 48 h in a dessicator

ESTIMATED ERROR:
See above

REFERENCES:
COMPONENTS:
(1) Carbon dioxide; CO₂; [124-38-9]
(2) Dog Fat

ORIGINAL MEASUREMENTS:
Yeh, S. Y.; Peterson, R. E.

VARIABLES:
T/K = 298.15 - 318.15
P/kPa = 101.325 (1 atm)

PREPARED BY:
H. L. Clever

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>Bunsen Coefficient (STP) cm⁻³ atm⁻¹ ± Std. Dev.</th>
<th>Ostwald Coefficient L/cm³ cm⁻³</th>
</tr>
</thead>
<tbody>
<tr>
<td>298.15</td>
<td>1.3411 ± 0.0022</td>
<td>1.4638</td>
</tr>
<tr>
<td>303.15</td>
<td>1.2491 ± 0.0015</td>
<td>1.3862</td>
</tr>
<tr>
<td>310.15</td>
<td>1.1283 ± 0.0014</td>
<td>1.2822</td>
</tr>
<tr>
<td>318.15</td>
<td>1.0122 ± 0.0011</td>
<td>1.1790</td>
</tr>
</tbody>
</table>

The Bunsen coefficients are the average of three measurements. The Ostwald coefficients were fitted by the method of least squares to the equation \( \log L = \Delta H/\Delta S - 8 \) by the authors. The same line fitted olive oil and the fats. From the slope and intercept they obtained

\[ \Delta H/\text{cal mol}^{-1} = -1273 \pm 30 \text{ and } \Delta S/\text{cal K}^{-1} \text{ mol}^{-1} = -8.5 \pm 0.1. \]

The thermodynamic values are for the transfer of one mole of carbon dioxide from the gas phase at a concentration of one mole dm⁻³ to the solution phase at a concentration of one mole dm⁻³.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
Fat was dried and degassed by stirring under vacuum at 80°C for about 12 hr. A 50 ml. sample was placed in an absorption flask attached to a Geffken gas buret (1). The fat was constantly stirred and equilibrated with increments of gas until no change was observed in a differential oil manometer for ½ hr. Difference between initial and final buret readings indicated amount of gas absorbed. Absorption at successively lower temperatures was determined. The authors also measured the viscosity and surface tension of the liquid.

SOURCE AND PURITY OF MATERIALS:
(1) Carbon dioxide. Matheson Co. Research grade, maximum impurity 0.3 mole per cent N₂ or CO.
(2) Dog perineal, mesenteric, omental, and other adipose fats were extracted with petroleum ether (b.p. 309-338 K). The ether was evaporated at 353 K under vacuum for several hours. Stored under refrigeration until use.

ESTIMATED ERROR:
\[ \delta T/K = 0.05 \]
\[ \delta P/mmHg = 0.5 \]
\[ \delta a/a = 0.005 \]

REFERENCES:
1. Geffken, G.
Z. Physik Chem. 1904, 49, 257.
COMPONENTS:
(1) Carbon dioxide; \( \text{CO}_2 \); [124-38-9]
(2) Rat-pooled Fat

ORIGINAL MEASUREMENTS:
Yeh, S. Y.; Peterson, R. E.

VARIABLES:
\[ T/K = 298.15 - 318.15 \]
\[ P/kPa = 101.325 \text{ (1 atm)} \]

PREPARED BY:
H. L. Clever

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>Bunsen Coefficient ( a/cm^3 \text{(STP)} cm^-3 \text{ atm}^-1 ) ± Std. Dev.</th>
<th>Ostwald Coefficient ( L/cm^3 \text{ cm}^-3 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>298.15</td>
<td>1.3363 ± 0.0073</td>
<td>1.4586</td>
</tr>
<tr>
<td>303.15</td>
<td>1.2344 ± 0.0061</td>
<td>1.3700</td>
</tr>
<tr>
<td>310.15</td>
<td>1.1125 ± 0.0035</td>
<td>1.2643</td>
</tr>
<tr>
<td>318.15</td>
<td>0.9989 ± 0.0041</td>
<td>1.1635</td>
</tr>
</tbody>
</table>

The Bunsen coefficients are the average of three measurements. The Ostwald coefficients were fitted by the method of least squares to the equation \( \log L = A/T + B \) by the authors. The same line fitted olive oil and the fats. From the slope and intercept they obtained

\[ \Delta H^o/\text{cal mol}^-1 = -2713 ± 30 \text{ and } \Delta S^o/\text{cal K}^-1 \text{ mol}^-1 = -8.5 ± 0.1. \]

The thermodynamic values are for the transfer of one mole of carbon dioxide from the gas phase at a concentration of one mole \( \text{dm}^-3 \) to the solution at a concentration of one mole \( \text{dm}^-3 \).

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
Fat was dried and degassed by stirring under vacuum at 80°C for about 12 hr. A 50 mL sample was placed in an absorption flask attached to a Geffken gas buret (1). The fat was constantly stirred and equilibrated with increments of gas until no change was observed in a differential oil manometer for ½ hr. Difference between initial and final buret readings indicated amount of gas absorbed. Absorption at successively lower temperatures was determined. The authors also measured the viscosity and surface tension of the liquid.

SOURCE AND PURITY OF MATERIALS:
(1) Carbon dioxide. Matheson Co. Research grade, maximum impurity 0.3 mole per cent N\(_2\) or CO.
(2) Rat retroperitoneal, mesenteric, omental, and hair clipped skin was cut into about 2.5 cm squares, dried at 353 K under vacuum, coarsely crushed and then extracted with petroleum ether (b.p. 308-338 K) in a Soxhlet extractor. The ether was evaporated at 353 K for several hours under vacuum. Stored under refrigeration until use.

ESTIMATED ERROR: \[ \delta T/K = 0.05 \]
\[ \delta P/mmHg = 0.5 \]
\[ \delta a/a = 0.005 \]

REFERENCES:
1. Geffken, G.
Z. Physik Chem. 1904, 49, 257.
COMPONENTS:
(1) Carbon dioxide; CO₂; [124-38-9]
(2) Human Fat

VARIABLES:
\[ T/K = 298.15 - 318.15 \]
\[ P/kPa = 101.325 \text{ (1 atm)} \]

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>Bunsen Coefficient ± Std. Dev.</th>
<th>Ostwald Coefficient L/cm³ cm⁻³</th>
</tr>
</thead>
<tbody>
<tr>
<td>298.15</td>
<td>1.3589 ± 0.0015</td>
<td>1.4833</td>
</tr>
<tr>
<td>303.15</td>
<td>1.2471 ± 0.0015</td>
<td>1.3840</td>
</tr>
<tr>
<td>310.15</td>
<td>1.1359 ± 0.0018</td>
<td>1.2897</td>
</tr>
<tr>
<td>318.15</td>
<td>1.0153 ± 0.0020</td>
<td>1.1820</td>
</tr>
</tbody>
</table>

The Bunsen coefficients are the average of three measurements. The Ostwald coefficients were fitted by the method of least squares to the equation
\[ \log L = \frac{A}{T} + B \]
by the authors. The same line fitted olive oil and the fats. From the slope and intercept they obtained
\[ \Delta n^0/\text{cal mol}^{-1} = -2713 ± 30 \text{ and } \Delta S^0/\text{cal K}^{-1} \text{ mol}^{-1} = -8.5 ± 0.1. \]

The thermodynamic values are for the transfer of one mole of carbon dioxide from the gas phase at a concentration of one mole dm⁻³ to the solution at a concentration of one mole dm⁻³.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
Fat was dried and degassed by stirring under vacuum at 80°C for about 12 hr. A 50 ml sample was placed in an absorption flask attached to a Geffken gas buret (1). The fat was constantly stirred and equilibrated with increments of gas until no change was observed in a differential oil manometer for ½ hr. Difference between initial and final buret readings indicated amount of gas absorbed. Absorption at successively lower temperatures was determined. The authors also measured the viscosity and surface tension of the liquid.

SOURCE AND PURITY OF MATERIALS:
(1) Carbon dioxide. Matheson Co. Research grade, maximum impurity 0.3 mole per cent N₂ or CO.
(2) Human omental fats obtained from two deceased patients (1 and 2). Extracted with petroleum ether (b.p. 309-338 K). The ether was evaporated at 353 K under vacuum for several hours. Stored under refrigeration until use. Fat 2 appeared to have more stearine precipitate than fat 1 at 296 K.

ESTIMATED ERROR:
\[ \delta T/K = 0.05 \]
\[ \delta P/mmHg = 0.5 \]
\[ \delta \alpha/\alpha = 0.005 \]

REFERENCES:
COMPONENTS:
(1) Carbon dioxide; CO$_2$; [124-38-9]
(2) Linseed oil

ORIGINAL MEASUREMENTS:
Tomoto, N.
*Miyazaki Daigaku Kagakubu Kenkyu Hokoku* 1958, No. 4, 39 - 46.

VARIABLES:
$T/K = 303, 323$
$p_j/kPa = 27.45 - 98.405$
$(205.9 - 738.1 \text{ mmHg})$

PREPARED BY:
H. L. Clever

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>Temperature</th>
<th>Carbon Dioxide Partial Pressure $p_j/$kPa</th>
<th>Solubility $\text{mg g}^{-1}$</th>
<th>Bunsen Coefficient $a^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>t/$^\circ\text{C}$</td>
<td>T/K</td>
<td>$p_j$/kPa</td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>303</td>
<td>205.9</td>
<td>0.678</td>
</tr>
<tr>
<td>235.4</td>
<td>0.777</td>
<td>0.393</td>
<td>1.172</td>
</tr>
<tr>
<td>300.8</td>
<td>0.951</td>
<td>0.481</td>
<td>1.122</td>
</tr>
<tr>
<td>328.8</td>
<td>1.077</td>
<td>0.545</td>
<td>1.163</td>
</tr>
<tr>
<td>406.7</td>
<td>1.346</td>
<td>0.681</td>
<td>1.176</td>
</tr>
<tr>
<td>510.0</td>
<td>1.635</td>
<td>0.827</td>
<td>1.137</td>
</tr>
<tr>
<td>608.8</td>
<td>1.919</td>
<td>0.971</td>
<td>1.115</td>
</tr>
<tr>
<td>728.8</td>
<td>2.228</td>
<td>1.127</td>
<td>1.085</td>
</tr>
</tbody>
</table>

1 Bunsen coefficient $a/cm^3\text{(STP)}cm^{-2}\text{atm}^{-1}$.

2 The author's values, probably from their Henry's law diagrams.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
The apparatus consists of a thermostated absorption flask, a gas reservoir, and a manometer and leveling bulb system.

The oil is placed in the absorption flask and both are weighed, the system is heated to 80$^\circ\text{C}$ and evacuated for six hours to degass the solvent. The gas is admitted to the system. The oil is stirred by a magnetic stirrer until equilibrium is attained.

The flask and contents are disconnected from the system and weighed. The amount of gas absorbed is calculated from the gain in weight. The loss of oil due to evaporation during the degassing is considered negligible.

SOURCE AND PURITY OF MATERIALS:
(2) Linseed oil. Iodine value 175, acid value 0.32, density $\rho/g \text{ cm}^{-3} = 0.9232$, 0.9163, and 0.9096 at 30, 40, and 50$^\circ\text{C}$, respectively.

ESTIMATED ERROR:

$\delta T/K = \pm 0.5$

$\delta p_j$/mmHg $= \pm 0.5$

$\delta \rho$/mg $= \pm 0.5$

$\delta a/a = \pm 0.03$ (compiler)

REFERENCES:
COMPONENTS:
(1) Carbon dioxide; CO₂; [124-38-9]
(2) Linseed oil

ORIGINAL MEASUREMENTS:
Tomoto, N.; Kusano, K.
[Oil Chemistry]

VARIABLES:
\( T/K = 303, 323 \)
\( P_1/kPa = 20.3 - \sim 101 \)
(0.2 - about 1 atm)

PREPARED BY:
H. L. Clever

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>Temperature ( t/°C )</th>
<th>Bunsen Coefficient ( a/cm^3 ) (STP) cm(^{-3}) atm(^{-1})</th>
</tr>
</thead>
<tbody>
<tr>
<td>30</td>
<td>303</td>
</tr>
<tr>
<td>50</td>
<td>323</td>
</tr>
</tbody>
</table>

Five to seven measurements were made at each temperature over the pressure interval of 0.2 to about 1.0 atm. A diagram of solubility (cm\(^3\) per g) vs. pressure was linear. Only the values of the Bunsen coefficient above were tabulated in the paper.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

SOURCE AND PURITY OF MATERIALS:
(1) Carbon dioxide.
(2) Linseed oil. The oil had a saponification value of 191.2, an acid value of 0.23, an iodine value of 175.7. Density \( \rho_{30}/g \) cm\(^{-3}\) = 0.9232, mean mol wt = 880, mean molar volume \( V^o/cm^3 \) mol\(^{-1}\) = 953.2.

ESTIMATED ERROR:

REFERENCES:
COMPONENTS:
(1) Carbon dioxide; CO₂; [124-38-9]
(2) Soybean oil

ORIGINAL MEASUREMENTS:
Tomoto, N.; Kusano, K.
[Oil Chemistry]

VARIABLES:
\[ T/K = 303.15 \text{ - } 343.15 \]
\[ p_1/kPa = 20.3 \text{ - } 101 \]
\( (0.2 \text{ - about 1 atm}) \)

PREPARED BY:
H. L. Clever

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>Temperature ( t/°C )</th>
<th>Bunsen Coefficient ( a/cm^3 ) (STP) cm(^3) atm(^{-1})</th>
</tr>
</thead>
<tbody>
<tr>
<td>30</td>
<td>1.018</td>
</tr>
<tr>
<td>40</td>
<td>0.901</td>
</tr>
<tr>
<td>50</td>
<td>0.800 (_2)</td>
</tr>
<tr>
<td>70</td>
<td>0.634 (_8)</td>
</tr>
</tbody>
</table>

Five to seven measurements were made at each temperature over the pressure interval of 0.2 to about 1.0 atm. A diagram of solubility (cm\(^3\) per g) \( vs \) pressure was linear. Only the values of the Bunsen coefficient above were tabulated in the paper.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

SOURCE AND PURITY OF MATERIALS:
(1) Carbon dioxide.
(2) Soybean oil. The oil had a saponification value of 192.0, an acid value of 0.17, an iodine value of 128.5. Density \( \rho^3/g \text{ cm}^3 = 0.9132 \), Mean mol wt = 877, mean molar volume \( \nu^*/cm^3 \text{ mol}^{-1} = 960.4 \).

ESTIMATED ERROR:

REFERENCES:
COMPONENTS:

(1) Carbon dioxide; CO\(_2\); [124-38-9]

(2) Soybean oil

ORIGINAL MEASUREMENTS:

Tomoto, N.
Miyazaki Daigaku Kagakubu Kenkyu Hokoku 1958, No. 4, 39 - 46.

VARIABLES:

\[
T/K = 303 - 323 \\
p_1/kPa = 26.28 - 110.66 \\
(197.1 - 830.0 \text{ mmHg})
\]

PREPARED BY:
H. L. Clever

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>Temperature</th>
<th>Carbon Dioxide Partial Pressure</th>
<th>Solubility</th>
<th>Bunsen Coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>t/°C</td>
<td>T/K</td>
<td>(p_1/\text{mmHg})</td>
<td>mg g(^{-1})</td>
</tr>
<tr>
<td>30</td>
<td>303</td>
<td>272.5</td>
<td>0.795</td>
</tr>
<tr>
<td></td>
<td></td>
<td>347.5</td>
<td>1.026</td>
</tr>
<tr>
<td></td>
<td></td>
<td>444.1</td>
<td>1.307</td>
</tr>
<tr>
<td></td>
<td></td>
<td>588.8</td>
<td>1.726</td>
</tr>
<tr>
<td></td>
<td></td>
<td>765.2</td>
<td>2.153</td>
</tr>
<tr>
<td>40</td>
<td>313</td>
<td>197.1</td>
<td>0.493</td>
</tr>
<tr>
<td></td>
<td></td>
<td>254.1</td>
<td>0.646</td>
</tr>
<tr>
<td></td>
<td></td>
<td>346.9</td>
<td>0.915</td>
</tr>
<tr>
<td></td>
<td></td>
<td>350.2</td>
<td>0.916</td>
</tr>
<tr>
<td></td>
<td></td>
<td>467.8</td>
<td>1.274</td>
</tr>
<tr>
<td></td>
<td></td>
<td>500.0</td>
<td>1.533</td>
</tr>
<tr>
<td></td>
<td></td>
<td>723.4</td>
<td>1.853</td>
</tr>
<tr>
<td>50</td>
<td>323</td>
<td>306.5</td>
<td>0.660</td>
</tr>
<tr>
<td></td>
<td></td>
<td>380.5</td>
<td>0.850</td>
</tr>
<tr>
<td></td>
<td></td>
<td>491.0</td>
<td>1.117</td>
</tr>
<tr>
<td></td>
<td></td>
<td>582.0</td>
<td>1.352</td>
</tr>
<tr>
<td></td>
<td></td>
<td>693.1</td>
<td>1.617</td>
</tr>
<tr>
<td></td>
<td></td>
<td>830.0</td>
<td>1.915</td>
</tr>
</tbody>
</table>

1 Bunsen coefficient \(\alpha/\text{cm}^2\) (STP) cm\(^{-3}\) atm\(^{-1}\)
2 The author's values, probably from his Henry's law diagrams.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
The apparatus consists of a thermostated absorption flask, a gas reservoir, and a manometer and leveling bulb system.

The oil is placed in the absorption flask, heated to 80°C and the system evacuated for six hours to degass the solvent. The gas is admitted to the system. The oil is stirred by a magnetic stirrer until equilibrium is attained.

The flask and contents are disconnected from the system and weighed. The amount of gas absorbed is calculated from the gain in weight. The loss of oil due to evaporation during the degassing is considered negligible.

SOURCE AND PURITY OF MATERIALS:

(1) Carbon dioxide. Commercial cylinder. Passsed through the purification train: stannous chloride, NaHCO\(_3\), CuSO\(_4\), conc. H\(_2\)SO\(_4\), hot copper, and P\(_2\)O\(_5\).

(2) Soybean oil. Iodine value 128, acid value 0.33, density \(\rho/\text{g cm}^{-3}\) = 0.9132, 0.9066, and 0.9001 at 30, 40, and 50°C, respectively.

ESTIMATED ERROR:

\[
\delta T/K = \pm 0.5 \\
\delta p_1/\text{mmHg} = \pm 0.5 \\
\delta \omega/\text{mg} = \pm 0.5 \\
\delta \alpha/\alpha = \pm 0.03 \text{ (compiler)}
\]

REFERENCES:
**COMPONENTS:**

(1) Carbon dioxide; CO₂; [124-38-9]
(2) Cottonseed oil
    Steam rendered lard

**ORIGINAL MEASUREMENTS:**

Vibrans, F. C.

_Oil and Soap_ 1935, 12, 14 - 15.

**VARIABLES:**

<table>
<thead>
<tr>
<th>T/K</th>
<th>Bunsen Coefficient(^1) (10^2a/cm^3 \text{(STP)} \cdot cm^{-3} \cdot atm^{-1})</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>296-299</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>318</td>
<td></td>
</tr>
</tbody>
</table>

**PREPARED BY:**

P. L. Long
H. L. Clever

**EXPERIMENTAL VALUES:**

<table>
<thead>
<tr>
<th>T/K</th>
<th>Cottonseed oil</th>
<th>Steam rendered lard</th>
</tr>
</thead>
<tbody>
<tr>
<td>296-299</td>
<td>140.0</td>
<td>100.4</td>
</tr>
<tr>
<td></td>
<td>130.5</td>
<td>101.0</td>
</tr>
<tr>
<td></td>
<td>133.0</td>
<td>102.8</td>
</tr>
<tr>
<td></td>
<td>130.8</td>
<td>100.4</td>
</tr>
<tr>
<td></td>
<td>135.9</td>
<td>102.6</td>
</tr>
<tr>
<td></td>
<td>134.0 Av. (\sigma = 4.0)</td>
<td>101.4 Av. (\sigma = 1.2)</td>
</tr>
<tr>
<td>318</td>
<td>105.8</td>
<td>101.1</td>
</tr>
<tr>
<td></td>
<td>101.7</td>
<td>102.2</td>
</tr>
<tr>
<td></td>
<td>98.9</td>
<td>101.2 Av. (\sigma = 2.9)</td>
</tr>
<tr>
<td></td>
<td>97.5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>101.1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>102.2</td>
<td></td>
</tr>
</tbody>
</table>

\(^1\) The author labeled his results as \(cm^3 \text{(STP)}\) per 100 \(cm^3\) of oil.

**AUXILIARY INFORMATION**

**METHOD/APPARATUS/PROCEDURE:**

Van Slyke manometric method (1).

**SOURCE AND PURITY OF MATERIALS:**


(2) Cottonseed oil. Commercial sample bought on market. Representative of its class.

Lard. From a mixture of killing and cutting fats. Steam rendered.

**ESTIMATED ERROR:**

\(\delta T/K = \pm 3\) at room temperature,

\(\pm 2\) at 318 K.

\(\delta a/a = \pm 0.04\) (author)

**REFERENCES:**

1. Van Slyke, D. D.; _et al._

_J. Biol. Chem._ 1924, 61, 523 and 575.
COMPONENTS: ORIGINAL MEASUREMENTS:
(1) Carbon dioxide; CO₂; [124-38-9] Schaffer, P. S.; Haller, H. S.
(2) Cottonseed oil
Butter oil
Lard

VARIABLES:
\[ T/K = 313.15, 333.15 \]
\[ p/kPa = 101.3 \text{ (1 atm)} \]

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>Temperature ( K )</th>
<th>Bunsen Coefficient ( 10^2 \text{a/cm}^3 \text{(STP)} \text{cm}^{-3} \text{atm}^{-1} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cottonseed oil</td>
<td>[ 313.15 \quad 87.6 ] [ 333.15 \quad 91.0 ]</td>
</tr>
<tr>
<td>Butter oil</td>
<td>[ 313.15 \quad 109.5 ] [ 333.15 \quad 100.3 ]</td>
</tr>
<tr>
<td>Lard</td>
<td>[ 313.15 \quad 87.6 ]</td>
</tr>
</tbody>
</table>

\[ \text{1 The author labeled his solubility values as cm}^2 \text{gas (STP) per 100 cm}^3 \text{ of fat. The unit is the same as 100 x Bunsen coefficient.} \]

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
The apparatus consists of a reaction flask connected to a water jacketed gas buret, a mercury leveling bulb, and a differential manometer. The reaction vessel is attached to a shaking mechanism in an air bath.

A 50 cm³ sample of oil is placed in the flask. Heat and vacuum are applied to remove dissolved gases. The sample is cooled to the temperature of the measurement. The gas is admitted, a zero reading is taken. The system is shaken until the sample takes up no more gas at a pressure of one atm. Three determinations are made on each sample.

SOURCE AND PURITY OF MATERIALS:
(2) Cottonseed oil. Good grade commercial product.
Butter oil. Obtained from butter prepared in the lab from fresh cream.
Lard. Good grade commercial product.

ESTIMATED ERROR:
\[ \delta T/K = \pm 0.5 \]
\[ \delta a / a = \pm 0.003 \text{ (authors, error among three determinations).} \]

REFERENCES:
COMPONENTS:
1. Carbon dioxide; CO₂; [124-38-9]
2. Polymeric Materials

EVALUATOR:
Peter G.T. Fogg,
School of Applied Chemistry,
Polytechnic of North London,
Holloway Road, London, N7 8DB, U.K.
July 1991

CRITICAL EVALUATION:
Solubility of carbon dioxide in polymeric materials

The solubility constant for dissolution of gas in a polymer has been defined (1) as

\[
\text{volume of gas absorbed (reduced to 1 atm, 273.15 K)}
\] \[
\text{volume of polymer x pressure of gas/atm}
\]

Solubility in different samples of polyethylene has been measured by Michaels and Bixler (1) at 273.2 K; 101.3 kPa. Values of the solubility constant were unaffected by the magnitude of the number average relative molecular mass. Ash et al. (2) measured solubility in a single sample of polyethylene at 313.2-333.2 K. Values of the solubility constant are consistent with a value given by Michaels and Bixler for polyethylene tested at 273.2 K, if error limits are taken into account.

Solubility in orientated polyethylene terephthalate having an amorphous volume fraction of 0.49 has been measured by Vieth et al. (3) from 5.5 kPa to 130.5 kPa at 298.2 K and 313.2 K. The authors showed that the measurements were consistent with earlier measurements of solubility in samples of unorientated material having amorphous volume fractions of 0.58 and 1, reported by Michaels et al. (4).

Michaels and Bixler (1) measured the dissolution of carbon dioxide in unvulcanised smoked sheet rubber. The solubility constant for this material at 273.2 K was found to be 0.95 atm⁻¹. This value may be compared with a solubility constant for unvulcanised smoked sheet rubber of 1.02 atm⁻¹ at 293 K which was reported by Venable and Fuwa (5). Venable and Fuwa also reported the solubility in other samples of rubber.

Solubility in polyvinyl acetate has been measured by Liu and Prausnitz (6) and in Nylon 11 by Ash et al. (2). Solubility in hydrogenated polybutadiene was measured by Michaels and Bixler. There is no reason to doubt the reliability of these sets of measurements but no other work on these systems is available to the evaluator for comparison.

REFERENCES
COMPONENTS:
1. Carbon dioxide; CO₂; [124-38-9]
2. Ethene, homopolymer, (polyethylene); (C₂H₄)x; [9002-88-4]
Hydrogenated polybutadiene
Natural rubber

ORIGINAL MEASUREMENTS:
Michaels, A.S.; Bixler, H.J.

VARIABLES:
P/kPa = 101.3  T/K = 273.15

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>Polymer</th>
<th>Solubility constant, k'</th>
<th>Volume fraction of amorphous polymer, α</th>
</tr>
</thead>
<tbody>
<tr>
<td>Polyethylene</td>
<td>0.451 ±0.023</td>
<td>0.22-0.65</td>
</tr>
<tr>
<td>Hydrogenated polybutadiene</td>
<td>0.577</td>
<td>0.71</td>
</tr>
<tr>
<td>Natural rubber</td>
<td>0.95</td>
<td>1</td>
</tr>
</tbody>
</table>

The solubility constant, k, is defined as the ratio of volume of gas absorbed at a partial pressure of gas of 1 atm to volume of polymer, corrected to 273.15 K and 1 atm. The authors state that the value of k depends upon the volume fraction of amorphous polymer in the sample. Constants k' given above refer to hypothetical amorphous polymers and are related to k by the equation

k' = ak

where a is the volume fraction of amorphous polymer.

The authors measured the solubility of thirteen different gases in three different polyethylenes having different number average relative molecular mass. These polyethylenes were Grex, Alathon 14 and Epolene C. These three polymers gave no significant differences between values of k' for a particular gas. The hydrogenated polybutadiene was a sample of Hydropol.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Two methods of measuring solubility are mentioned. One method, used for samples of polyethylene, involved equilibrating the gas under test at a pressure of about 1 atm with pellets of the polymer. Gas in the voids was then quickly pumped off during a period of about 10 secs. Gas which subsequently diffused from the polymer was taken to be dissolved gas. It was estimated that about 5% of the dissolved gas was lost during the rapid evacuation period.

A second method was the time lag method based upon work by Barrer (1). Gas at pressures from 5 mmHg to 800 mmHg was brought into contact with a film of polymer in an evacuated section of the apparatus. The build up of gas at the other side of the film was monitored. This method was used for all the polymers under test with the exception of Epolene C.

SOURCE AND PURITY OF MATERIALS:

1. From a cylinder, dried over calcium sulfate before use.
2. Grex. Manufactured by W.R. Grace & Co. ̂Mn = 40 000. α = 0.22-0.31.
   α = 0.57-0.59.
   Epolene C. Manufactured by Tennessee Eastman Co. ̂Mn = 6 600. α = 0.65
   Hydropol. Manufactured by Phillips Petroleum Co. by hydrogenation of
   (41°F) emulsion polybutadiene. ̂Mn = 100 000. α = 0.71
   Natural rubber Unvulcanised smoked sheet (Revea) ̂Mn = 400 000
   α = 1.
(̂Mn = number average relative molecular mass)

REFERENCES:
COMPONENTS:
1. Carbon dioxide; CO₂; [124-38-9]
2. Ethene, homopolymer, (polyethylene); (C₂H₄); [9002-86-4]

VARIABLES:
\[ \frac{T}{K} = 293.2-333.2 \]
\[ P/kPa = 0-33 \]

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>( \frac{T}{K} )</th>
<th>Henry's law solubility constant/atm</th>
</tr>
</thead>
<tbody>
<tr>
<td>293.2</td>
<td>0.321</td>
</tr>
<tr>
<td>303.2</td>
<td>0.301</td>
</tr>
<tr>
<td>313.2</td>
<td>0.289</td>
</tr>
<tr>
<td>323.2</td>
<td>0.283</td>
</tr>
<tr>
<td>333.2</td>
<td>0.273</td>
</tr>
</tbody>
</table>

Henry's law solubility constant was defined as:

\[
\frac{\text{volume of gas absorbed, reduced to 273.2 K and 1 atm}}{\text{volume of polymer} \times \text{pressure of gas/atm}}
\]

Values of the solubility constant were found from the slopes of graphs of solubility against pressure.

1 atm = 101.325 kPa

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>( \delta T/K )</th>
<th>( \delta (\text{solubility constant}) )</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 0.1</td>
<td>= ±2% (authors)</td>
</tr>
</tbody>
</table>

REFERENCES:

2. From laminated tubing made by Messrs. Griflex Ltd.
COMPONENTS:

1. Carbon dioxide; CO₂; [124-38-9]

2. Poly(oxy-1,2-ethanediyoxy-carbonyl-1,4-phenylene carbonyl), (poly(ethylene terephthalate)); (C₁₂H₈O₄)ₓ; [25038-59-9]

VARIABLES:

\[ \frac{T}{K} = 298.2, 313.2 \]

\[ \frac{P}{kPa} = 5.5-130.5 \]

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>( \frac{T}{K} )</th>
<th>( \frac{P}{mmHg} )</th>
<th>( \frac{P}{kPa} )</th>
<th>Solubility*</th>
</tr>
</thead>
<tbody>
<tr>
<td>298.2</td>
<td>41</td>
<td>5.5</td>
<td>0.118</td>
</tr>
<tr>
<td>91</td>
<td>12.1</td>
<td>0.272</td>
<td></td>
</tr>
<tr>
<td>129</td>
<td>17.2</td>
<td>0.378</td>
<td></td>
</tr>
<tr>
<td>272</td>
<td>36.3</td>
<td>0.763</td>
<td></td>
</tr>
<tr>
<td>395</td>
<td>52.6</td>
<td>1.002</td>
<td></td>
</tr>
<tr>
<td>591</td>
<td>78.8</td>
<td>1.356</td>
<td></td>
</tr>
<tr>
<td>787</td>
<td>105.0</td>
<td>1.687</td>
<td></td>
</tr>
<tr>
<td>903</td>
<td>120.4</td>
<td>1.843</td>
<td></td>
</tr>
<tr>
<td>313.2</td>
<td>72</td>
<td>9.6</td>
<td>0.146</td>
</tr>
<tr>
<td>147</td>
<td>19.7</td>
<td>0.275</td>
<td></td>
</tr>
<tr>
<td>256</td>
<td>34.1</td>
<td>0.439</td>
<td></td>
</tr>
<tr>
<td>419</td>
<td>55.9</td>
<td>0.650</td>
<td></td>
</tr>
<tr>
<td>568</td>
<td>75.8</td>
<td>0.830</td>
<td></td>
</tr>
<tr>
<td>700</td>
<td>93.3</td>
<td>0.996</td>
<td></td>
</tr>
<tr>
<td>870</td>
<td>116.0</td>
<td>1.180</td>
<td></td>
</tr>
<tr>
<td>979</td>
<td>130.5</td>
<td>1.283</td>
<td></td>
</tr>
</tbody>
</table>

* Solubility is defined as the volume of gas, reduced to 101.3 kPa and 273.15 K, dissolved by one volume of polymer.

Data were presented as points on two graphs. The compiler took measurements from these graphs to compile the co-ordinates of the experimental points.

AUXILIARY INFORMATION

METHOD APPARATUS/PROCEDURE:

A static method was used. The apparatus is described in ref. (1). The polymer was in the form of film of thickness 1 mil (0.00254 cm).

SOURCE AND PURITY OF MATERIALS:

1. Minimum purity 99.5%.

2. Crystalline biaxially oriented Mylar supplied by the Mylar Laboratory of E.I. du Pont de Nemours & Co.;
   \[ \rho = 1.394 \text{ g cm}^{-3}; \]
   amorphous volume fraction = 0.49;
   number average relative molecular mass = 15000-20000.

ESTIMATED ERROR:

\( \delta(\text{Solubility}) = \pm 8\% \) (authors)

Errors on transferring data from graphs: \( \delta(\text{Solubility}) = \pm 0.002; \)
\( \delta\frac{P}{mmHg} = \pm 2 \) (compiler)

REFERENCES:

1. Michaels, A.S.; Vieth, W.R.; Barrie, J.A.
Components:
1. Carbon dioxide; CO₂;
   [124-38-9]
2. Poly(oxy-1,2-ethenediroyloxy-
carbonyl-1,4-phenylenecarbonyl),
   (poly(ethylene terephthalate));
   (C₈H₆O₄)ₓ [25038-59-9]

Original Measurements:
Michaels, A.S.; Vieth, W.R.; Barrie, J.A.
J. Appl. Phys. 1963, 34, 1-12

Variables:

<table>
<thead>
<tr>
<th>P/kPa</th>
<th>5-1240</th>
</tr>
</thead>
<tbody>
<tr>
<td>T/K</td>
<td>298-379</td>
</tr>
</tbody>
</table>

Experimental Values:
Absorption of carbon dioxide in various samples of polyethylene
terephthalate of different degrees of crystallinity and thicknesses were
measured by time-lag solubility measurements and by static measurements.
Absorption isotherms for glassy amorphous polymer were explained by
postulating that absorption took place by two concurrent mechanisms. One
mechanism involved the filling of voids and the other an ordinary
dissolution process. The shape of the isotherms was explained by
assuming that the filling of the voids was consistent with a Langmuir
mechanism and the dissolution was consistent with Henry's law.

- \( C^* \) = volume of gas, reduced to 273.15 K and 101.3 kPa, taken up
  by one cm³ of amorphous polymer.
- \( C^*_D \) = reduced volume of gas absorbed by a dissolution process
- \( C^*_H \) = reduced volume of gas absorbed by a void-filling process
- \( C^*_v \) = reduced volume of gas absorbed by saturation of voids
- \( b \) = a constant
- \( k_D^* \) = solubility constant for dissolution defined as
  reduced volume of gas dissolved
  pressure × (volume of amorphous polymer)
- \( k^* \) = solubility constant for adsorption of gas defined as the
  value at low pressures of
  reduced volume of gas adsorbed in voids and by dissolution
  pressure × (volume of amorphous polymer)

At a pressure of \( P \) it follows that

\[
C^* = C_H^* + C_D^* \quad (1)
\]
\[
= C_H^*bP/(1+bP) + k_D^*P \quad (2)
\]

At low pressures this equation may be written

\[
C^* = (C_H^*b + k_D^*)P \quad (3)
\]

At high pressures when the microvoids are all filled equation (2) may be
written

\[
C^* = C_H^* + k_D^*P \quad (4)
\]

The variation in absorption of gas at high pressure from by time-lag
solubility measurements gave a value for the constant \( k_D^* \) of 0.38 atm⁻¹
at 298.15 K. Absorption of gas at low pressures at 298.15K measured by a
static method fitted the equation

\[
C^* = \frac{2.33P}{1 + 0.44P/atm} + 0.38P/atm
\]

\[
k^* = 2.33 + 0.38 = 2.71 \text{ atm}^{-1}
\]

Samples of partially crystalline polymer with an amorphous volume
fraction less than 1 absorbed less gas. The authors interpreted this by
assuming that the crystalline fraction could only take up gas in the
microvoids and not by a dissolution process.
Values of the solubility constant for the amorphous polymer, $k^*$, at other temperatures were displayed on a small scale graph. Approximate values for the amorphous polymer from the graph are as follows:

<table>
<thead>
<tr>
<th>$T/K$</th>
<th>$k^*/\text{atm}^{-1}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>298</td>
<td>2.71</td>
</tr>
<tr>
<td>320</td>
<td>1.42</td>
</tr>
<tr>
<td>337</td>
<td>0.89</td>
</tr>
<tr>
<td>342</td>
<td>0.63</td>
</tr>
<tr>
<td>341</td>
<td>0.57</td>
</tr>
</tbody>
</table>

† from the text

The solubility constant for samples of crystalline polymer, $k$, were defined as the value at low pressure of reduced volume of gas absorbed in voids and by dissolution

$$\text{pressure} \times (\text{total volume of polymer})$$

Solubility constants, $k$, for samples of partially crystalline polymer with an amorphous volume fraction of 0.58, taken from a small scale graph, are as follows:

<table>
<thead>
<tr>
<th>$T/K$</th>
<th>$k/\text{atm}^{-1}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>297</td>
<td>2.02 s</td>
</tr>
<tr>
<td>312</td>
<td>1.81 t</td>
</tr>
<tr>
<td>312</td>
<td>1.70 t</td>
</tr>
<tr>
<td>312</td>
<td>1.25 s</td>
</tr>
<tr>
<td>327</td>
<td>0.65 s</td>
</tr>
<tr>
<td>338</td>
<td>0.48 s</td>
</tr>
<tr>
<td>343</td>
<td>0.45 t</td>
</tr>
<tr>
<td>349</td>
<td>0.34 s</td>
</tr>
<tr>
<td>357</td>
<td>0.34 t</td>
</tr>
<tr>
<td>373</td>
<td>0.37 t</td>
</tr>
<tr>
<td>373</td>
<td>0.30 t</td>
</tr>
<tr>
<td>387</td>
<td>0.30 t</td>
</tr>
<tr>
<td>403</td>
<td>0.21 t</td>
</tr>
<tr>
<td>402</td>
<td>0.20 t</td>
</tr>
</tbody>
</table>

Glass transition zone approximately 355-368 K
s - static measurements; t - time-lag measurements

**AUXILIARY INFORMATION**

**METHOD/APPARATUS/PROCEDURE:**
Low pressure static absorption measurements were carried at pressures up to about 170 kPa in glass apparatus using sheets of polymer film. The system was evacuated and a measured quantity of gas admitted. The amount of gas absorbed was calculated from the initial and final pressures.

Time-lag solubility measurements were carried out to pressures of about 1240 kPa using apparatus similar to that described earlier. (1,2).

**SOURCE AND PURITY OF MATERIALS:**
1. Dried with CaSO$_4$; minimum purity 99.5%
2. Amorphous polyethylene terephthalate supplied by the Mylar laboratory of E.I. du Pont de Nemours & Co. Number average relative molecular mass 15-20 000. Crystalline samples prepared by annealing the amorphous polymer at 120°C to 150°C. Densities of samples were measured with density gradient columns and the amorphous volume fraction determined assuming that the fully crystalline polymer has a density of 1.455 g cm$^{-3}$. (3)

**ESTIMATED ERROR:**
Static measurements - precision limits ±3.5% at the 95% confidence level.
Time-lag measurements - precision limits of ±10% (authors)

**REFERENCES:**
COMPONENTS:
1. Carbon dioxide; CO₂; [124-38-9]
2. Rubber

VARIABLES:
T/K = 289-373

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>Grade of rubber</th>
<th>T/K</th>
<th>Solubility /cm³ of gas per 100cm³ of rubber</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>294</td>
<td>90</td>
</tr>
<tr>
<td></td>
<td>293</td>
<td>92a</td>
</tr>
<tr>
<td>II</td>
<td>289</td>
<td>108</td>
</tr>
<tr>
<td></td>
<td>293</td>
<td>102a</td>
</tr>
<tr>
<td>III</td>
<td>297</td>
<td>92</td>
</tr>
<tr>
<td></td>
<td>293</td>
<td>99a</td>
</tr>
<tr>
<td>IV</td>
<td>292</td>
<td>103.5</td>
</tr>
<tr>
<td></td>
<td>293</td>
<td>101a</td>
</tr>
<tr>
<td></td>
<td>331</td>
<td>58b</td>
</tr>
<tr>
<td></td>
<td>373</td>
<td>28b</td>
</tr>
<tr>
<td></td>
<td>373</td>
<td>34.0c</td>
</tr>
</tbody>
</table>

a estimated by the authors;   b values from a graph given by the authors
                                      c value given in a table by the authors

I - pale crepe (raw); II - smoked sheet (raw);
III - smoked sheet (vulc. coeff. = 2.56);
IV - smoked sheet (vulc. coeff. 3.2)

Solubility in IV was shown to be proportional to pressure to at least 128 kPa at 373 K, within experimental error.

The solubility was measured as the volume of gas reduced to 273.15 K and 101.3 bar which was dissolved by 100 cm³ of rubber. In the case of compounded samples (III & IV) the solubility was calculated on the basis of the actual rubber present in the sheet.

AUXILIARY INFORMATION

Weighed samples of rubber were kept under high vacuum for 48 hrs to remove dissolved gases. They were then put into contact with carbon dioxide or other gas under test for 2 to 24 hrs until equilibrium was reached. The dissolved gas was then pumped off and measured.

1. From a cylinder; 97.55 pure.
2. I - 3 to 4 years old;
   II - from Akron;
   III - composition by weight:
      smoked sheet 100
      zinc oxide 10
      thiocarbanilide 3
      combined sulfur 3.2% of smoked sheet present.
   IV - composition by weight:
      smoked sheet 100
      zinc oxide 10
      free sulfur 10
      thiocarbanilide 0
      combined sulfur 2.56% of smoked sheet present.

ESTIMATED ERROR:

δ(solubility) = ±5% (authors)
(note the discrepancies in the data reported for 373 K)

REFERENCES:
COMPONENTS:
1. Carbon dioxide; CO₂; [124-38-9]
2. Acetic acid ethenyl ester homopolymer, (polyvinyl acetate); (C₄H₆O₂)ₓ; [9003-20-7]

ORIGINAL MEASUREMENTS:
Liu, D.D.; Prausnitz, J.M.

VARIABLES:
T/K = 398-473

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/°C</th>
<th>T/K</th>
<th>Henry's law constant H/atm</th>
<th>H/kPa*</th>
</tr>
</thead>
<tbody>
<tr>
<td>125</td>
<td>398.15</td>
<td>990</td>
<td>100300</td>
</tr>
<tr>
<td>150</td>
<td>423.15</td>
<td>1200</td>
<td>121600</td>
</tr>
<tr>
<td>175</td>
<td>448.15</td>
<td>1500</td>
<td>152000</td>
</tr>
<tr>
<td>200</td>
<td>473.15</td>
<td>1700</td>
<td>172300</td>
</tr>
</tbody>
</table>

* calculated by the compiler.

Henry's law constant, H, is defined as:

\[ H = \lim_{w \to 0} \left( \frac{f}{w} \right) \]

where \( f \) is the fugacity of the carbon dioxide and \( w \) the weight fraction of carbon dioxide in the polymer.

The polymer had a number average relative molecular mass of \( 8.34 \times 10^4 \).

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
Solubilities were measured by gas-liquid chromatography using helium as carrier gas and Chromosorb as support material. A weighed quantity of poly(vinyl acetate) was dissolved in a mixture of methanol and 1,2-dichloroethane at 80°C. This was then mixed with a weighed and preheated quantity of the support. The mixture was then heated in an oven until methanol and 1,2-dichloroethane had evaporated, and subsequently used in a steel chromatography column. The dead time of a chromatogram was found by injecting nitrogen. Retention volumes for carbon dioxide were found for various ratios of polymer to support material. This enabled correction to be made for surface adsorption of carbon dioxide. Henry's constants were calculated from the corrected retention volumes. Additional correction was made for the solubility of nitrogen.

SOURCE AND PURITY OF MATERIALS:
1. Supplied by Matheson Gas Products; purity > 99%
2. Supplied by Cellomer Associates.

ESTIMATED ERROR:
\( \delta H = \pm 9\% \) at 125°C; \( \pm 16\% \) at 200°C.
\( \delta T/K = \pm 0.1. \)

REFERENCES:
## COMPONENTS:

1. Carbon dioxide; CO$_2$; [124-38-9]
2. Poly[(imino(1-oxo-1,11-undecanediyl)], (Nylon 11); (C$_{11}$H$_{21}$NO)$_x$; [25035-04-5]

## VARIABLES:

$T/K = 313.2 - 333.2$

## EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>$T/K$</th>
<th>Henry's law solubility constant/atm</th>
</tr>
</thead>
<tbody>
<tr>
<td>313.2</td>
<td>0.368</td>
</tr>
<tr>
<td>323.2</td>
<td>0.314</td>
</tr>
<tr>
<td>333.2</td>
<td>0.280</td>
</tr>
</tbody>
</table>

Henry's law solubility constant was defined as:

$$\frac{\text{volume of gas absorbed, reduced to 273.2 K and 1 atm}}{\text{volume of polymer} \times \text{pressure of gas/atm}}$$

Values of the solubility constant were found from the slopes of graphs of solubility against pressure.

1 atm = 101.325 kPa

## AUXILIARY INFORMATION

**METHOD/APPARATUS/PROCEDURE:**

The gas at a known temperature and pressure was allowed to reach equilibrium with a sample of the polymer. The gas phase was then flushed out by mercury and the dissolved gas allowed to desorb into a previously evacuated vessel of known volume. The pressure of the desorbed gas was measured with a McLeod gauge. The temperature of the desorbed gas was also measured and the quantity of gas calculated from its volume, pressure and temperature. Correction was made for the absorbed gas lost during the flushing process. Measurements were made at various initial pressures of gas. The maximum pressure was not stated but measurements on the solubility of gases in polyethylene which are reported in the same paper were made to a maximum pressure of about 25 cmHg (33 kPa).

**SOURCE AND PURITY OF MATERIALS:**

2. From laminated tubing made by Messrs. Griflex Ltd.

**ESTIMATED ERROR:**

$\delta T/K < \pm 0.1$

$\delta(\text{solubility constant}) = \pm 2\%$ (authors)

**REFERENCES:**

COMPONENTS:

1. Carbon dioxide; CO₂;
   [124-38-9]
2. Liquid Gases

EVALUATOR:

Peter G.T. Fogg,
School of Applied Chemistry,
Polytechnic of North London,
Holloway Road, London, N7 8DB, U.K.

July 1991

CRITICAL EVALUATION:

Solubility of solid carbon dioxide in liquid gases.

The solubility of solid carbon dioxide in liquid oxygen was measured by Amamchyan et al. (1) from 77 K to 95 K and by Rest et al. (2) from 89.5 K to 118.5 K. Equations for mole fraction solubility over the temperature ranges of measurement were given by each group of authors. Error limits in \( x_{\text{CO}_2} \) were quoted as ±15-20% by Amamchyan and as ±21% by Rest. The two equations give the same value of \( x_{\text{CO}_2} \) at 87.7 K. Values for \( x_{\text{CO}_2} \) at 95 K from the two equations are as follows:

- Amamchyan et al.: 10.75 ±1.61 to 2.15 \times 10^{-6}
- Rest et al.: 8.00 ±1.68 \times 10^{-6}

The limits of error for the two values overlap. The two equations are therefore consistent with each other, within the limits of error given by the authors.

Rest et al. (2) measured the solubility of solid carbon dioxide in liquid argon from 87.9 K to 120.5 K and published an equation for the variation of mole fraction solubility with temperature. Preston et al. (3) also measured the solubility in argon at 109.0 K and 115.9 K. Mole fraction solubility at these two temperatures from the two sources are as follows:

<table>
<thead>
<tr>
<th>Temperature</th>
<th>Amamchyan et al.</th>
<th>Rest et al.</th>
<th>Preston et al.</th>
</tr>
</thead>
<tbody>
<tr>
<td>109.0 K</td>
<td>2.25 ±0.47 \times 10^{-5}</td>
<td>4.27 ±0.90 \times 10^{-5}</td>
<td>7.97 ±3.67 \times 10^{-5}</td>
</tr>
<tr>
<td>115.9 K</td>
<td>7.97 ±3.67 \times 10^{-5}</td>
<td>20.59 ±2.26 \times 10^{-5}</td>
<td></td>
</tr>
</tbody>
</table>

The two sets of measurements are not compatible.

Rest et al. (2) also measured the solubility of solid carbon dioxide in liquid nitrogen from 77.7 K to 117 K. No other measurements on this system are available for comparison.

Chang et al. (4) measured the solubility in liquid nitrogen oxide at partial pressures of carbon dioxide from 17.2 kPa to 67.8 kPa at 262.2 K to 293.2 K. Values of mole fraction solubility are close to 'ideal' or reference values from Raoult's law. Solubility of carbon dioxide gas in liquid chlorine was measured by Krieve and Mason (5) at partial pressures of carbon dioxide to 66.3 kPa at 273.2 K and 298.2 K. In this case experimental values of mole fraction solubility fall much lower than the reference values from Raoult's law. A selection of mole fraction solubilities in the two gases is given below:

<table>
<thead>
<tr>
<th>Solvent</th>
<th>T/K</th>
<th>( P_{\text{CO}_2} )/kPa</th>
<th>( x_{\text{CO}_2} )</th>
<th>R.L.</th>
</tr>
</thead>
<tbody>
<tr>
<td>liquid nitrogen oxide</td>
<td>262.15</td>
<td>58.49</td>
<td>0.02103</td>
<td>0.0228</td>
</tr>
<tr>
<td></td>
<td>273.15</td>
<td>34.11</td>
<td>0.01018</td>
<td>0.0098</td>
</tr>
<tr>
<td></td>
<td>293.15</td>
<td>63.07</td>
<td>0.01265</td>
<td>0.0110</td>
</tr>
<tr>
<td>liquid chlorine</td>
<td>273.15</td>
<td>78.2</td>
<td>0.0106</td>
<td>0.0225</td>
</tr>
<tr>
<td></td>
<td>298.15</td>
<td>111</td>
<td>0.01593</td>
<td>0.0319</td>
</tr>
</tbody>
</table>

(R.L. = reference value from Raoult's law)

The measurements on both systems are self-consistent but no other data on either system are available to the evaluator for comparison.

The solubilities of solid carbon dioxide in liquid methane, ethane, propane, butane, 2-methylpropane, ethene and propene have been measured. The data which are available have been discussed earlier (pages 1, 8, 10).
## COMPONENTS:

1. Carbon dioxide; CO₂; [124-38-9]
2. Liquid Gases

## EVALUATOR:

Peter G.T. Fogg, School of Applied Chemistry, Polytechnic of North London, Holloway Road, London, N7 8DB, U.K.

July 1991

## CRITICAL EVALUATION:

## REFERENCES

### COMPONENTS:

1. Carbon dioxide; CO₂; [124-38-9]
2. Oxygen; O₂; [7782-44-7]

### ORIGINAL MEASUREMENTS:

Amamchyan, R.G.; Bertsev, V.V.; Bulanin, M.O.


### VARIABLES:

\[ T/K = 77-95 \]

### EXPERIMENTAL VALUES:

The solubility of solid carbon dioxide in liquid oxygen was measured at six temperatures in the range 77 K to about 95 K. The following equation was given for the mole fraction solubility in this temperature range:

\[
\log_{10} x_{CO_2} = 2.40 - \frac{700}{(T/K)}
\]

The mole fraction solubility at 90 K was given as \(4.3 \pm 0.5 \times 10^{-6}\)

### AUXILIARY INFORMATION

#### METHOD/APPARATUS/PROCEDURE:

Liquid oxygen and solid carbon dioxide were contained in an optical cryostat described previously (1,2). The solubility was calculated from optical density as measured by IKS-16 and IKS-21 spectrometers. The liquid was stirred vigorously before each measurement and then allowed to stand until the absorption band due to suspended solid carbon dioxide had disappeared. Measurements with step-wise increase in the temperature differed by less than 10% from measurements when the temperature was decreasing.

#### SOURCE AND PURITY OF MATERIALS:

No information

#### ESTIMATED ERROR:

\[ \delta x_{CO_2} = \pm 15-20\% \] (authors)

#### REFERENCES:

COMPONENTS:
1. Carbon dioxide; CO₂; [124-38-9]
2. Oxygen; O₂; [7782-44-7]
   Nitrogen; N₂; [7727-37-9]
   Argon; Ar; [7440-37-1]

VARIABLES:
T/K = 77.7-120.5

EXPERIMENTAL VALUES:

Mole fraction solubilities of solid carbon dioxide in liquid gases were measured and, over the specified temperature ranges, fitted equations of the form

\[
\log_{10} x_{CO_2} = a - b/(T/K)
\]

<table>
<thead>
<tr>
<th>Solvent</th>
<th>Temperature range /K</th>
<th>a</th>
<th>b</th>
</tr>
</thead>
<tbody>
<tr>
<td>Liquid oxygen</td>
<td>89.5-118.5</td>
<td>0.724</td>
<td>553</td>
</tr>
<tr>
<td>Liquid nitrogen</td>
<td>77.7-117</td>
<td>0.552</td>
<td>512</td>
</tr>
<tr>
<td>Liquid argon</td>
<td>87.9-120.5</td>
<td>0.022</td>
<td>509</td>
</tr>
</tbody>
</table>

At a particular temperature the pressure was equal to the vapor pressure of liquid oxygen, nitrogen or argon.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
Solid carbon dioxide was added to liquid oxygen, nitrogen or argon. Large particles of carbon dioxide were filtered off. The liquid containing carbon dioxide in solution and in suspension was introduced into a variable pressure infra-red absorption cell surrounded by a thermal shield chamber also containing liquid oxygen, nitrogen or argon. Temperature was varied by applying pressure to the solution from a gas cylinder or by supplying heat from a heating element at the bottom of the cell. Infra-red spectra were recorded at intervals until equilibrium was reached at a particular temperature. Concentrations of carbon dioxide were calculated from the intensities of bands due to carbon dioxide in solution but not due to carbon dioxide in suspension.

SOURCE AND PURITY OF MATERIALS:
1. commercial sample of specified purity 99.999%
2. O₂; specified purity 99.9997%
   N₂; specified purity 99.999%
   Ar; specified purity 99.999%

ESTIMATED ERROR:
\[
\delta x_{CO_2} = \pm 21\% (O_2 \& Ar); \pm 23\% (N_2)
\]
(authors)

REFERENCES:
## COMPONENTS:

1. Carbon dioxide; CO₂; [124-38-9]
2. Methane; CH₄; [74-82-8]
   
   Argon; Ar; [7440-37-1]

## VARIABLES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>P_{CO₂}/kPa</th>
<th>x_{CO₂}</th>
</tr>
</thead>
<tbody>
<tr>
<td>109.0-137.5</td>
<td>0.000027-0.126</td>
<td></td>
</tr>
</tbody>
</table>

## EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>Solvent</th>
<th>T/K</th>
<th>P_{CO₂}/kPa *</th>
<th>x_{CO₂}</th>
</tr>
</thead>
<tbody>
<tr>
<td>Methane</td>
<td>126.4</td>
<td>0.016</td>
<td>0.000732</td>
</tr>
<tr>
<td></td>
<td>137.5</td>
<td>0.126</td>
<td>0.002366</td>
</tr>
<tr>
<td>Argon</td>
<td>109.0</td>
<td>0.00027</td>
<td>0.000797</td>
</tr>
<tr>
<td></td>
<td>115.9</td>
<td>0.0016</td>
<td>0.002059</td>
</tr>
</tbody>
</table>

The above solubilities correspond to equilibria between solid carbon dioxide and solutions of carbon dioxide in liquid methane or argon.

* vapor pressure of solid CO₂ from equation given in ref.(1).

## AUXILIARY INFORMATION

**METHOD/APPARATUS/PROCEDURE:**

Solubilities were measured in a vacuum cryostat held in a bath of liquid nitrogen. The temperature of the cryostat could be controlled by electric heating. Temperatures were measured by a calibrated copper-constantin thermocouple. Vapor from the cell was pumped from the top of the cell, cooled, passed into the base of the cell and bubbled through the liquid. This speeded up the attainment of equilibrium. Samples of liquid from the cell were vaporized and analyzed by gas chromatography. Full details of the apparatus have been given by Preston (2) and Funk (3).

**SOURCE AND PURITY OF MATERIALS:**

1. Supplied by Matheson Co.; purity 99.8%
2. Supplied by Matheson Co.; purity 99.97% (methane), 99.995% (argon).

**ESTIMATED ERROR:**

δT/K = ±0.5 (authors)

**REFERENCES:**

COMPONENTS:
1. Carbon dioxide; CO₂; [124-38-9]
2. Nitrogen oxide; N₂O₄; [10544-72-6]

ORIGINAL MEASUREMENTS:
Chang, E.T.; Gocken, N.A.; Poston, T.M.

VARIABLES:

\[
\begin{align*}
T/\text{K} & = 262.15-293.15 \\
p/\text{kPa} & = 17.23-67.79
\end{align*}
\]

PREPARED BY:
C.L. Young

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>(T/\text{K})</th>
<th>(p^+/\text{atm})</th>
<th>(p^+/\text{kPa})</th>
<th>Mole fraction of carbon dioxide in liquid, (x_{\text{CO}_2})</th>
</tr>
</thead>
<tbody>
<tr>
<td>262.15</td>
<td>0.5773</td>
<td>58.49</td>
<td>0.02103</td>
</tr>
<tr>
<td>273.15</td>
<td>0.1700</td>
<td>17.23</td>
<td>0.005276</td>
</tr>
<tr>
<td>283.20</td>
<td>0.3495</td>
<td>34.11</td>
<td>0.01018</td>
</tr>
<tr>
<td>293.15</td>
<td>0.1763</td>
<td>17.86</td>
<td>0.008712</td>
</tr>
<tr>
<td></td>
<td>0.3175</td>
<td>32.17</td>
<td>0.01642</td>
</tr>
<tr>
<td></td>
<td>0.6225</td>
<td>63.07</td>
<td>0.006524</td>
</tr>
</tbody>
</table>

+ partial pressure of carbon dioxide

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
Volumetric apparatus consisting of solvent vessel and buret with three calibrated bulbs. Pressure measured with mercury manometer and cathetometer. Solvent stirred with magnet enclosed in glass. Mole fraction absorbed calculated from knowledge of amount of gas before and after absorption. Solvent carefully degassed.

SOURCE AND PURITY OF MATERIALS:
1. Research grade gas, purity 99.995 mole per cent minimum.
2. Research grade gas, purity 99.5 mole per cent minimum, further purified by bubbling oxygen through, degassed and distilled.

ESTIMATED ERROR:
\[
\delta T/\text{K} = \pm 0.1; \delta p/\text{kPa} = \pm 0.01; \delta x_{\text{CO}_2} < \pm 2\%
\]

REFERENCES:
COMPONENTS:
1. Carbon dioxide; CO₂; [124-38-9]
2. Chlorine; Cl₂; [7782-50-5]

ORIGINAL MEASUREMENTS:
Krieve, W. F.; Mason, D. M.

VARIABLES:
T/K = 273.15, 298.15
P_CO₂ = 78.2-663

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>P^+/10^5Pa</th>
<th>x_CO₂</th>
</tr>
</thead>
<tbody>
<tr>
<td>273.15</td>
<td>0.792</td>
<td>0.0106</td>
</tr>
<tr>
<td></td>
<td>1.11</td>
<td>0.01593</td>
</tr>
<tr>
<td></td>
<td>1.69</td>
<td>0.02135</td>
</tr>
<tr>
<td></td>
<td>2.32</td>
<td>0.02983</td>
</tr>
<tr>
<td></td>
<td>2.94</td>
<td>0.03945</td>
</tr>
<tr>
<td></td>
<td>3.64</td>
<td>0.04950</td>
</tr>
<tr>
<td></td>
<td>4.15</td>
<td>0.05640</td>
</tr>
<tr>
<td></td>
<td>4.84</td>
<td>0.06582</td>
</tr>
<tr>
<td>298.15</td>
<td>1.11</td>
<td>0.00976</td>
</tr>
<tr>
<td></td>
<td>1.52</td>
<td>0.0142</td>
</tr>
<tr>
<td></td>
<td>2.24</td>
<td>0.0204</td>
</tr>
<tr>
<td></td>
<td>3.07</td>
<td>0.0298</td>
</tr>
<tr>
<td></td>
<td>3.90</td>
<td>0.0380</td>
</tr>
<tr>
<td></td>
<td>4.86</td>
<td>0.0474</td>
</tr>
<tr>
<td></td>
<td>5.62</td>
<td>0.0546</td>
</tr>
<tr>
<td></td>
<td>6.63</td>
<td>0.0643</td>
</tr>
</tbody>
</table>

^ partial pressure of carbon dioxide.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
Measured amount of gas added to cell of known volume. Composition of liquid determined from knowledge of total amounts of chlorine and carbon dioxide and assuming Raoult's law followed by chlorine in vapor.

SOURCE AND PURITY OF MATERIALS:
1. Matheson Co. sample, pure grade.
2. Commercial sample, fractionally distilled.

ESTIMATED ERROR:
δT/K = ±0.1; δP/10^5Pa = ±0.5%;
δx_CO₂ = ±0.001 (estimated by compiler).

REFERENCES:
SYSTEM INDEX

Page numbers preceded by E refer to evaluation texts whereas page numbers not preceded by E refer to compiled tables. Compounds are named as in Chemical Abstracts indexes (toluene appears under Benzene, methyl-).

<table>
<thead>
<tr>
<th>Compound</th>
<th>Page Numbers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acetaldehyde</td>
<td>E178, E179, 204</td>
</tr>
<tr>
<td>Acetamide, N,N-dimethyl- (ternary)</td>
<td>E384, 392</td>
</tr>
<tr>
<td>Acetic acid</td>
<td>E179, E180, E187, E188, 218, 219</td>
</tr>
<tr>
<td>Acetic acid anhydride</td>
<td>E180, E187, 223</td>
</tr>
<tr>
<td>Acetic acid, 2-[2-(2-butoxyethoxy)ethoxy]ethanol ester</td>
<td>E182, E183, 234</td>
</tr>
<tr>
<td>Acetic acid, butyl ester</td>
<td>198</td>
</tr>
<tr>
<td>Acetic acid, ethenyl ester homopolymer</td>
<td>E448, 455</td>
</tr>
<tr>
<td>Acetic acid, ethyl ester</td>
<td>109, E180, E187, E188, 198, 227, 228</td>
</tr>
<tr>
<td>Acetic acid, 2-[2-(2-methoxyethoxy)ethoxy]ethanol ester</td>
<td>E182, E183, 234</td>
</tr>
<tr>
<td>Acetic acid, methyl ester</td>
<td>E180, E187, 225, 226</td>
</tr>
<tr>
<td>Acetic acid, 2-methylpropyl ester</td>
<td>E180, E187, 230</td>
</tr>
<tr>
<td>Acetic acid, penty l ester</td>
<td>E180, E187, 219, 231</td>
</tr>
<tr>
<td>Acetic acid, propyl ester</td>
<td>E180, E187, 229</td>
</tr>
<tr>
<td>Adiponitrile</td>
<td>see hexanenitrile</td>
</tr>
<tr>
<td>Amylacetate</td>
<td>see acetic acid, penty l ester</td>
</tr>
<tr>
<td>Amyl alcohol</td>
<td>see 1-pentanol</td>
</tr>
<tr>
<td>Amyl bromide</td>
<td>see pentane, 1-bromo-</td>
</tr>
<tr>
<td>Aniline</td>
<td>see benzenemethanol E457, 460, 461</td>
</tr>
<tr>
<td>Argon</td>
<td>2H-Azepin-2-one, hexahydro-1-methyl- E304, E306, 357</td>
</tr>
<tr>
<td>2p-Azoxyphenetole</td>
<td>see diazene, bis(4-ethoxyphenyl)-1-oxide</td>
</tr>
<tr>
<td>Benzaldehyde</td>
<td>E179, E187, E188, 190, 205</td>
</tr>
<tr>
<td>Benzenamine</td>
<td>E302, E306, E307, 308-312</td>
</tr>
<tr>
<td>Benzenemethanol</td>
<td>E302, E306, 314</td>
</tr>
<tr>
<td>Benzenemethanol (ternary)</td>
<td>E302, E306, 313</td>
</tr>
<tr>
<td>Benzene</td>
<td>E90, E94, E95, 96-98, 100-105, 114, E257, 397, 401, 408</td>
</tr>
<tr>
<td>Benzene (ternary)</td>
<td>E384, E385, 397, 400-404, 408, 409</td>
</tr>
<tr>
<td>Benzenemethacetonitrile</td>
<td>E306, 355</td>
</tr>
<tr>
<td>Benzene, bromo-</td>
<td>E257, E259, E260, 295</td>
</tr>
<tr>
<td>Benzene, (chloromethyl)-</td>
<td>E258, E259, 300</td>
</tr>
<tr>
<td>Benzene, chloro-</td>
<td>E257, E259, E260, 295-297</td>
</tr>
<tr>
<td>Benzene, dimethyl-</td>
<td>E91, 86, 120</td>
</tr>
<tr>
<td>Benzene, 1,2-dimethyl-</td>
<td>E90, E91, E94, E95, 98, 114, 115</td>
</tr>
<tr>
<td>Benzene, 1,3-dimethyl-</td>
<td>E90, E91, E95, 105, 114, 116-118</td>
</tr>
<tr>
<td>Benzene, 1,4-dimethyl-</td>
<td>E90, E91, E94, E95, 99, 114, 119</td>
</tr>
<tr>
<td>Benzene, ethylene- homopolymer (ternary)</td>
<td>E385, 408</td>
</tr>
<tr>
<td>Benzene, ethyl-</td>
<td>E91, E95, 99, 105</td>
</tr>
<tr>
<td>Benzene, hexafluoro-</td>
<td>E257, E259, E260, 299</td>
</tr>
<tr>
<td>Benzene, iodo-</td>
<td>E257, E259, 298</td>
</tr>
<tr>
<td>Benzenemethanol</td>
<td>E132, 172, 173</td>
</tr>
<tr>
<td>Benzenemethanol (ternary)</td>
<td>E384, 391</td>
</tr>
<tr>
<td>Benzene, methyl-</td>
<td>E90, E91, E94, E95, 98, 105-113, E258</td>
</tr>
<tr>
<td>Benzene, 1,1'-methylenebis-</td>
<td>E91, E94, E95, 122, 123</td>
</tr>
<tr>
<td>Benzene, 1,1'-methylenebis(methyl-</td>
<td>E91, E95, 124</td>
</tr>
<tr>
<td>Benzene, (1-methylethyl)-</td>
<td>E91, E95, 121</td>
</tr>
<tr>
<td>Compound</td>
<td>Reference Numbers</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>--------------------</td>
</tr>
<tr>
<td>Benzene, nitro-</td>
<td>E304, E306, E307, 312, 349-351</td>
</tr>
<tr>
<td>Benzene, trichloromethyl-</td>
<td>E258, E259, 301</td>
</tr>
<tr>
<td>Benzene, 1,2,4-trimethyl-</td>
<td>E91, E95, 105</td>
</tr>
<tr>
<td>Benzotrichloride</td>
<td></td>
</tr>
<tr>
<td>Benzyl alcohol</td>
<td>see benzene, trichloromethyl-</td>
</tr>
<tr>
<td>Benzyl cyanide</td>
<td>see benzenemethanol</td>
</tr>
<tr>
<td>Benzyl chloride</td>
<td>see benzene, (chloromethyl)-</td>
</tr>
<tr>
<td>1,1-Bicyclohexyl</td>
<td>E8, E13, 79, 80</td>
</tr>
<tr>
<td>1,1'-Biphenyl, (1-methylethyl)-</td>
<td>E92, 125</td>
</tr>
<tr>
<td>1-Butanamine, 1,1,2,3,3,4,4,4-nonafluoro-N,N-bis-(nonafluorobutyl)</td>
<td>E302, E306, E307, 319, 320</td>
</tr>
<tr>
<td>Butane</td>
<td>E11, E13, 14-16</td>
</tr>
<tr>
<td>Butane, 1,1,2,2,3,3,4,4-octafluoro-1,4-bis(1,2,2,2-tetrafluoro-1-(trifluoromethyl)ethoxy)</td>
<td>E259, 291</td>
</tr>
<tr>
<td>1,4-Butanediol</td>
<td>E133, 176</td>
</tr>
<tr>
<td>1,3-Butanediol (ternary)</td>
<td>E384, 390</td>
</tr>
<tr>
<td>2,3-Butanediol (ternary)</td>
<td>E384, 390</td>
</tr>
<tr>
<td>Butanoic acid</td>
<td>E179, 180, 187, 220</td>
</tr>
<tr>
<td>1-Butanol</td>
<td>E130, E135, 146, 149, 157</td>
</tr>
<tr>
<td>2-Butanol</td>
<td>E131, 149</td>
</tr>
<tr>
<td>1-Butanol, 3-methyl-</td>
<td>E131, E135, 137</td>
</tr>
<tr>
<td>2-Butanone</td>
<td>E178, 109, 196</td>
</tr>
<tr>
<td>1-Butene</td>
<td>E10, 83</td>
</tr>
<tr>
<td>Butoxytriethyleneglycol acetate</td>
<td>see Acetic acid, 2-[2-[2-butoxyethoxy]ethoxy]ethanol ester</td>
</tr>
<tr>
<td>Butter oil</td>
<td>E431, 447</td>
</tr>
<tr>
<td>Butyl oleate</td>
<td>see 9-octadecenoic acid, butyl ester</td>
</tr>
<tr>
<td>γ-Butyrolactone</td>
<td>see furenone, dihydro-2(3H)-</td>
</tr>
<tr>
<td>Carbon disulfide</td>
<td>E359, E361, E362, 378-381</td>
</tr>
<tr>
<td>C8roxin-D</td>
<td>see butane, 1,1,2,2,3,3,4,4,-octafluoro-1,4-bis(1,2,2,2-tetrafluoro-1-(trifluoromethyl)ethoxy)</td>
</tr>
<tr>
<td>C8roxin-F</td>
<td>see hexane, 1,1,1,2,2,3,3,4,4,5,5,6,6-tridecafluoro-6-[1,2,2,2-tetrafluoro-1-(trifluoromethyl)ethoxy]</td>
</tr>
<tr>
<td>Carvene</td>
<td>see cyclohexene, 1-methyl-4-(1-methylethenyl)-</td>
</tr>
<tr>
<td>Carvol</td>
<td>see 2-cyclohexen-1-one, 2-methyl-5-(1-methylethenyl)-</td>
</tr>
<tr>
<td>Cephalin (ternary)</td>
<td>E385, 402</td>
</tr>
<tr>
<td>Cellulose acetate (ternary)</td>
<td>E385, 406, 407</td>
</tr>
<tr>
<td>Chlorine</td>
<td>E457, 463</td>
</tr>
<tr>
<td>Chloroform</td>
<td>see methane, trichloro-</td>
</tr>
<tr>
<td>Cholest-5-en-3β-ol (ternary)</td>
<td>E385, 404, 405</td>
</tr>
<tr>
<td>Cholesterol</td>
<td>see cholest-5-en-3β-ol</td>
</tr>
<tr>
<td>Cod liver oil</td>
<td>E430, 432</td>
</tr>
<tr>
<td>Cottonseed oil</td>
<td>E430, E431, 446, 447</td>
</tr>
<tr>
<td>m-Cresol</td>
<td>see phenol, 3-methyl-</td>
</tr>
<tr>
<td>Cumene</td>
<td>see benzene, (1-methylethyl)-</td>
</tr>
<tr>
<td>Cyclohexane</td>
<td>E7, E9, E13, 64-72, E132, E257</td>
</tr>
<tr>
<td>Cyclohexane, bromo-</td>
<td>E257, E259, 293</td>
</tr>
<tr>
<td>Cyclohexane, chloro-</td>
<td>E257, E259, E260, 292</td>
</tr>
<tr>
<td>Cyclohexane, 1,2-dimethyl-, cis-</td>
<td>E8, E13, 76</td>
</tr>
<tr>
<td>Cyclohexane, 1,2-dimethyl-, trans-</td>
<td>E8, E13, 75</td>
</tr>
<tr>
<td>Cyclohexane, 1,3-dimethyl-, cis-</td>
<td>E8, 78</td>
</tr>
<tr>
<td>Cyclohexane, 1,3-dimethyl-, trans-</td>
<td>E8, 78</td>
</tr>
<tr>
<td>Cyclohexane, 1,4-dimethyl-, cis-</td>
<td>E8, 77</td>
</tr>
</tbody>
</table>
Cyclohexane, 1,4-dimethyl-, trans- E8, 77
Cyclohexane, methyl- E7, E9, E13, 72, 73
Cyclohexanol E132, E135, 170, 171
Cyclohexanone E178, E187, 201
Cyclohexanone, 2,6-dimethyl- E178, E187, 202
Cyclohexene, 1-methyl-4-(1-methylthienyl) E10, E13, 89
2-Cyclohexene-1-one, 2-methyl-5-(1-methylthienyl)- E178, 203
Cyclooctane E8, E13, 74
Cyclopentane E7, 63
Cyclopentanone E178, E187, 200
Cyclopropane E7, 62
Cycloetrasiloxane, octamethyl- E358, E361, E362, 371
Decalin see naphthalene, decahydro-
Decane E5, E9, E13, 27, 40-43
1-Decanol E132, E135, 166, 167, 169
2-Decanone 197
3-Decanone 197
Diaxene, bis(4-ethoxyphenyl)-1-oxide E303, 328
α-Dichlorohydrin see 2-propanol, 1,3-dichloro-
Diesel fuel E418, 420
Diethylene glycol monomethyl ether see ethanol, 2-(2-methoxyethoxy)-
Diethylene glycol dimethyl ether see ethane, 1,1'-oxybis(2-methoxy)-
Diglycolamine see ethanol, 2-(2-aminoethoxy)-
N,N-Dimethylformamide see formamide, N,N-dimethyl-
1,3-Dimethyl-1H-pyrazole see 1H-pyrazole, 1,3-dimethyl-
Dimethylsulfoxide see methane, sulfinylbis-
1,4-Dioxane E181, E187, 198, 239, 240
1,3-Dioxolan-2-one E179, 206
1,3-Dioxolan-2-one, 4-methyl- E179, E187, E188, 86, 207-217, 330, 331
Diphenylmethane see benzene, 1,1'-methylenebis-
Dipropylene glycol see propanol, oxybis-
Ditolyl methane see benzene, 1,1-methylenebis(methyl-
Dodecane E5, E13, 30, 45, 46
1-Dodecanol E128, E132, 168, 169
Eicosane E6, E13, 58, 60, 61
Ethane E1, E8, 14-16
Ethane (ternary) E8, 85
Ethane, 1,2-dibromo- E255, E259, E260, 268, 273-275
Ethane, 1,2-dichloro- E255, E256, E259, E260, 264, 276
1,2-Ethanediol E132, E135, 172, 174, 175, E182, E183
1,2-Ethanediol (ternary) 174, E384, 389
Ethane, 1,1-oxybis- E181-E183, E187, 236
Ethane, 1,1'-oxybis(2-methoxy- E182, E183, 249
Ethane, 1,2-dichloro-1,1,2,2-tetrafluoro- E256, E259, 271, 272
Ethane, 1,1,2-trichloro-1,2,2-trifluoro- E255, E256, E259, 281
Ethanol (ternary) E384, E386, 153, 416
Ethanol, 2-amino- (ternary) E384, 387-395
Ethanol, 2-(2-aminoethoxy)- (ternary) E384, 396
Ethanol, 2,2'-[1-(2-ethanediylbis(oxy))bis- 175, E181, E183, E187, 242, 243
<table>
<thead>
<tr>
<th>Chemical Name</th>
<th>E Numbers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ethanol, 2,2'-[1,2-ethanediylbis(oxy)]bis-(ternary)</td>
<td>E384, 389</td>
</tr>
<tr>
<td>Ethanol, 2-methoxy-</td>
<td>E182, E183, E187, 246, 247</td>
</tr>
<tr>
<td>Ethanol, 2-methoxy- (ternary)</td>
<td>E384, 391</td>
</tr>
<tr>
<td>Ethanol, 2-(2-methoxyethoxy)-</td>
<td>E182, E183, 249</td>
</tr>
<tr>
<td>Ethanol, 2-(2-methoxyethoxy)- (ternary)</td>
<td>E384, 393</td>
</tr>
<tr>
<td>Ethanol, 1,1'-oxybis- (ternary)</td>
<td>E384, 390</td>
</tr>
<tr>
<td>Ethanol, 2,2'-oxylvbis(2,1-ethanediyl)oxy)bis- (ternary)</td>
<td>E384, 390</td>
</tr>
<tr>
<td>Ethanol, 2-phenoxy- (ternary)</td>
<td>E384, 393</td>
</tr>
<tr>
<td>Ethene</td>
<td>E8, E10, 83</td>
</tr>
<tr>
<td>Ethene (ternary)</td>
<td>E8, 85</td>
</tr>
<tr>
<td>Ethene homopolymer</td>
<td>E448, 449, 450</td>
</tr>
<tr>
<td>Ethylene chloride</td>
<td>see ethane, 1,2-dichloro-</td>
</tr>
<tr>
<td>Ethylene glycol</td>
<td>see 1,2-ethanediol</td>
</tr>
<tr>
<td>Ethylene glycol monomethyl ether</td>
<td>see ethanol, 2-methoxy-</td>
</tr>
<tr>
<td>Ethylene glycol monophenyl ether</td>
<td>see ethanol, 2-phenoxy-</td>
</tr>
<tr>
<td>1-Ethyl-3-methyl-1H-pyrazole</td>
<td>see 1H-pyrazole, 1-ethyl-3-methyl-</td>
</tr>
<tr>
<td>Ethyl oleate</td>
<td>see 9-octadecenoic acid, ethyl ester</td>
</tr>
<tr>
<td>Ethyl stearate</td>
<td>see 9-octadecanoic acid, ethyl ester</td>
</tr>
<tr>
<td>Eugenol (ternary)</td>
<td>E178, 199, E303, E304, 348</td>
</tr>
<tr>
<td>Ether</td>
<td>see phenol, 2-methoxy-4-(2-propenyl)-</td>
</tr>
<tr>
<td>Fat, dog</td>
<td>E430, 438, 439</td>
</tr>
<tr>
<td>Fat, human</td>
<td>E430, 438, 441</td>
</tr>
<tr>
<td>Fat, rat</td>
<td>E430, 438, 440</td>
</tr>
<tr>
<td>FC-47</td>
<td>320</td>
</tr>
<tr>
<td>FC-80</td>
<td>(see also 1-butanimine, 1,1,2,2,3,3,4,4,4-nonafluoro-N,N-bis-(nonafluorobutyl)-</td>
</tr>
<tr>
<td>Formamide</td>
<td>E304, 399</td>
</tr>
<tr>
<td>Formamide (ternary)</td>
<td>E384, 399</td>
</tr>
<tr>
<td>Formamide, N,N-dimethyl-</td>
<td>E303, E304, E306, E307, 342-347</td>
</tr>
<tr>
<td>Formamide, N,N-dimethyl- (ternary)</td>
<td>348, E384, E385, 392, 406, 410, 413, 414</td>
</tr>
<tr>
<td>Formic acid, pentyl ester</td>
<td>E180, E187, 224</td>
</tr>
<tr>
<td>N-Formyl morpholine</td>
<td>see 4-morpholinecarboxaldehyde</td>
</tr>
<tr>
<td>Furan, heptafluorotetrahydro(nonafluorobutyl)-</td>
<td>E256, E259, 266-288</td>
</tr>
<tr>
<td>2-Furanmethanol, tetrahydro-</td>
<td>E384, 391</td>
</tr>
<tr>
<td>Furan, tetrahydro-</td>
<td>E181, E187, 237, 238</td>
</tr>
<tr>
<td>Furenone, dihydro-2(3H)-</td>
<td>E184, 254</td>
</tr>
<tr>
<td>Glycerol</td>
<td>see 1,2,3-propanetriol</td>
</tr>
<tr>
<td>Heptadecane</td>
<td>E6, 51</td>
</tr>
<tr>
<td>Heptane</td>
<td>E2, E13, 20, 27-32</td>
</tr>
<tr>
<td>Heptane, hexadecafluoro-</td>
<td>E256, E259, E260, 283, 284</td>
</tr>
<tr>
<td>1-Heptanol</td>
<td>E132, 163, 164</td>
</tr>
<tr>
<td>3-Heptanone</td>
<td>E178, 197</td>
</tr>
<tr>
<td>4-Heptanone</td>
<td>E178, 196</td>
</tr>
<tr>
<td>Herring oil</td>
<td>E430, 432</td>
</tr>
<tr>
<td>Hexadecane</td>
<td>E1, E6, E13, 30, 51-56</td>
</tr>
<tr>
<td>Hexametapol</td>
<td>see phosphoric triamide, hexamethyl-</td>
</tr>
<tr>
<td>Hexamethyl phosphoric triamide</td>
<td>see phosphoric triamide, hexamethyl-</td>
</tr>
<tr>
<td>Hexane</td>
<td>E2, E4, E7, E9, E13, 20-27</td>
</tr>
</tbody>
</table>
Hexanedinitrile E306, 354
Hexane, 1,1,1,2,2,3,3,4,4,5,5,6,6-tridecafluoro-6-[1,2,2,2-tetrafluoro-1-(trifluoromethyl)ethoxy]- E257,
E259, E260, 289, 290
1-Hexanol E132, 161
2-Hexanone E178, 196
3-Hexanone E178, 197
Hexatriacontane E6, E7, E9, E13, 56, 60
Hydrocarbon fuel E417, E418, 424
Hydrocyanic acid E304, 352

Isobutyl acetate see acetic acid, 2-methylpropyl ester
Isopropylbenzene see benzene, (1-methylene)-

Kerosene E407, E408, 419, 421, 423, 427
L-1822 E256, 285
Lard E431, 447
Lard, steam rendered E431, 446
Lecithin (ternary) E385, 403
d-Limonene see cyclohexene, 1-methyl-4-(1-methylene)-

Lithium bromide (ternary) E385, 415, 416
Lithium chloride (ternary) E385, 415, 416
Lithium iodide (ternary) E385, 415, 416
Linseed oil E430, 432, 442, 443

Medicinal Oil E418, 422
Methane E1, E5, 14, 15, 461
Methane (ternary) E4, 36, 37
Methane, dichloro- E255, E259, 269, 270
Methane, dichlorodifluoro- E255, E259, 271
Methane, sulfinylbis- E359, E361, E362, 383
Methane, tetrachloro- E255, E259, E260, 261-264, 397
Methane, tetrachloro- (ternary) E384, 397, 398
Methane, trichloro- E255, E259, E260, 265-268, 401
Methane, trichloro- (ternary) E385, 401
Methane, trichlorofluoro- E255, E259, 271, 272
Methanol 86, 109, E128, E131, E135, 136-146, 401
Methanol (ternary) E384-E386, 387, 388, 391, 401, 415

Methoxytriethylene glycol acetate see acetic acid, 2-[2-(2-methoxyethoxy)ethoxy]ethanol ester

N-Methyl-£-caprolactam see 2H-azepin-2-one, hexahydro-1-methyl-
1,1'-Methylbis(methylbenzene) see benzene, 1,1-methylenebis(methyl-
Methyl oleate see 9-octadecenoic acid, methyl ester
3-Methyl-1H-pyrazole see 1H-pyrazole, 3-methyl-

Mineral oil E418, 422, 426
4-Morpholinecarboxaldehyde E302, E306, 321, 322

Naphthalene, decahydro- E8, E10, 71, 81
Naphthalene, decahydro-, cis- E8, 82
Naphthalene, decahydro-, trans- E8, 82
Naphthalene, 1-methyl- E92, E94, E95, 126, 127
Naphthalene, 1,2,3,4-tetrahydro- E10, E13, 71, 86-88
Nitrogen E457, 460
Nitrogen oxide E457, 462
Nonane E5, 27, 39
1-Nonanol E132, 166
2-Nonanol E178, 197
3-Nonanol E178, 197
5-Nonanol 196

Nylon 11 see poly[1-oxo-1,11-undecanediyl]}
Octacosane E6, E9, E13, 56, 59, 60
Octadecanoic acid (ternary) E385, 412, 414
Octadecanoic acid, ethyl ester E181, E187, 232
9-Octadecenoic acid (Z) E180, E187, 222
9-Octadecenoic acid, butyl ester E181, E187, 233
9-Octadecenoic acid, ethyl ester E181, E187, 233
9-Octadecenoic acid, methyl ester E181, E187, 233
Octamethylcyclotetrasiloxane
  see cyclotetrasiloxane, octamethyl-
Octane (ternary) E2, E5, E8, E13, 20, 27, 33-35
Octane (ternary) E4, 36, 37
1-Octanol E132, E135, 163-165, 398
1-Octanol (ternary) E384, 398
2-Octanone E178, 197
3-Octanone E178, 197
Oil E417, E418, 423-425
  see also kerosene, mineral oil, olive oil, cod liver oil,
  herring oil, linseed oil, soybean oil and cotton seed oil
Oleic acid E430, 432-437
Olive oil E457, 459, 460
Paraffin wax E418, 429
Paraffinic oil E417, E418, 419
Pentadecane E5, 50
Pentane E1, E5, E7, E13, 17, 18
Pentane, 1-bromo- E256, E259, 277
Pentane, 1-chloro- E256, E259, E260, 278
Pentane, 2,2,4-trimethyl- E5, E13, 38
1-Pentanol E131, E135, 160-162
2-Pentanone E178, 196
3-Pentanone E178, 196
2,5,8,11,14-Pentaoxapentadecane E182, E183, 216, 248, 249
Perfluorobutylperfluorotetrahydrofuran
  see furan, heptafluorotetrahydro(nonafluorobutyl)-
Perfluoro-1,4-diisopropoxybutane
  see butane, 1,1,2,2,3,3,4,4,-octafluoro-1,4-
    bis(1,2,2,2-tetrafluoro-1-(trifluoromethyl)ethoxy)-
Perfluoro-1-isoproxyhexane
  see hexane, 1,1,2,2,3,3,4,4,5,5,6,6-tri
    decafluoro-6-[1,2,2,2-tetrafluoro-1-(trifluoromethyl)ethoxy]-
    Perfluoroheptane
  see heptane, hexadecafluoro-
Perfluorotributylamine
  see 1-butanimine, 1,1,2,2,3,3,4,4,4-nafluoro-
    N,N-bis(nonafluorobutyl)-
Petroleum E417, E418, 421, 423, 424, 428
Phenol E182, E184, E187, 251
Phenol, 3-methyl- E182, E184, E187, 252
Phenol, 3-methoxy-4-(2-propenyl)- E184, 253
Phosphoric acid, tributyl ester 216, E358, E361, E362,
  366-370
Phosphoric acid, triethyl ester E358, E362, 363, 370
Phosphoric acid, trimethyl ester E358, 370
Phosphoric acid, tripropyl ester E358, 370
Phosphoric acid, tris(2-methylpropyl) ester E358, 370
Phosphoric triamide, hexamethyl-
  86, E358, E361, E362, 363-365
Polyacrylonitrile
  see 2-propenenitrile homopolymer
Polybutadiene, hydrogenated E448, 452
Polyethylene
  see ethene homopolymer
Poly(ethylene glycol)
  see poly(oxy-1,2-ethanediyl), a-hydro-ω-hydroxy-
Poly(ethylene glycol) diacetate
  see poly(oxy-1,2-ethanediyl), a-acetyl-ω-(acetoxy)-
Poly(ethylene glycol) diethyl ether
  see poly(oxy-1,2-ethanediyl),
    \(a\)-ethyl-\(\omega\)-ethoxy-

Poly(ethylene glycol) dipropyl ether
  see poly(oxy-1,2-ethanediyl),
    \(a\)-propyl-\(\omega\)-propoxy-

Poly(ethylene glycol) methyl isopropyl ether
  see poly(oxy-1,2-ethanediyl),
    \(a\)-methyl-\(\omega\)-(1-methylethoxy-)

Poly(ethylene glycol) methyl propyl ether
  see poly(oxy-1,2-ethanediyl),
    \(a\)-methyl-\(\omega\)-propoxy-

Poly(ethylene terephthalate)
  see poly(oxy-1,2-ethanediyl)oxycarboxyl-1,4-
    phenylene-carbonyl)

Poly[imino(1-oxo-1,11-undecanediyl)]
  E448, 456

Polyisobutylene
  see 1-propene, 2-methyl- homopolymer

Poly(oxy-1,2-ethanediyl), \(a\)-acetyl-\(\omega\)-(acetyloxy)-
  E182, E183, 244, 245

Poly(oxy-1,2-ethanediyl), \(a\)-ethyl-\(\omega\)-ethoxy-
  E182, E183, 244, 245

Poly(oxy-1,2-ethanediyl), \(a\)-hydro-\(\omega\)-hydroxy-
  E182, E183, 244, 245

Poly(oxy-1,2-ethanediyl), \(a\)-methyl-\(\omega\)-(1-methylethoxy-
  E182, E183, 250

Poly(oxy-1,2-ethanediyl), \(a\)-methyl-\(\omega\)-(1-methylethoxy-
  E182, E183, 250

Poly(oxy-1,2-ethanediyl), \(a\)-propyl-\(\omega\)-propoxy-
  E182, E183, 244, 245

Poly(oxy-1,2-ethanediyl)oxycarboxyl-1,4-phenylene-carbonyl
  E448, 450-453

Polystyrene
  see benzene, ethenyl- homopolymer

Polyvinyl acetate
  see acetic acid, ethenyl ester homopolymer

Propane
  E1, E13, 14-16

Propane, 1-bromo-2-chloro-
  E256, 282

Propane, 2-bromo-1-chloro-
  E256, 282

Propane, 1-chloro-2-methyl-
  E256, E259, 279

Propane, 1,2-dibromo-
  E256, E259, 280

1,3-Propanediol (ternary)
  E384, 390

Propane, 2,2-dimethyl-
  E2, E5, E13, 19

Propane, 2-methyl-
  E1, E13, 16

Propanenitrile
  E306, 353

Propanenitrile, 3-(dimethylamino)-
  E306, 356

1,2,3-Propanetriol
  E133, 177

1,2,3-Propanetriol, triacetate
  E181, E187, 234, 235

Propanoic acid
  E179, E180, E187, 221

1-Propanol
  E130, E135, 148, 153-156

1-Propanol (ternary)
  153, E384, 400

2-Propanol
  E130, E135, 146, 149, 155, E257, E259

1-Propanol, 2,3-dichloro-
  E257, E259, 294

1-Propanol, 1,3-dichloro-
  E257, E259, 294

1-Propanol, 2-methyl-
  E131, E135, 149, 158, 159,
      399, 405

1-Propanol, 2-methyl- (ternary)
  E384, E385, 399, 405

Propanol, oxybis-
  E181, E187, 241

Propanol, oxybis- (ternary)
  E384, 390

2-Propanone (ternary)
  E178, E179, E187, E188, 189-198, 401

2-Propanone (ternary)
  E385, 199, 401, 407, 411, 412

Propene
  E8, E10, 14, 15, 83, 84

1-Propene, 2-methyl- homopolymer (ternary)
  E385, 409

2-Propanenitrile homopolymer (ternary)
  E385, 410

Propylene bromide
  see propane, 1,2-dibromo-

Propylene carbonate
  see 1,3-dioxolan-2-one, 4-methyl-

Propylene glycol
  see 1,3-propanediol
1H-Pyrazole, 1,3-dimethyl-  E303, E306, 324
1H-Pyrazole, 1-ethyl-3-methyl-  E303, E306, 325
1H-Pyrazole, 3-methyl-  E303, E306, 323
1H-Pyrazole, methyl(3-methylbutyl)-  E303, E306, 327
1H-Pyrazole, methyl(1-methyl-2-propyl)-  E303, E306, 326
Pyridine  E302, E306, E307, 309, 315, 316
2-Pyrrolidinone (ternary)  E384, 393
2-Pyrrolidinone, 1-methyl-  86, 216, E303, E306, E307, 329-341
2-Pyrrolidinone, 1-methyl- (ternary)  E384, 392-396

Quinoline  E302, E306, E307, 317, 318
Ramol 351  E418, 425
Rubber  E448, 454
Rubber, natural  E448, 449
Sapseolv MPE  E182, E183, 250
Silane, tetramethyl-  E359, 372
Sodium iodide (ternary)  E385, 411, 413, 415, 416
Soybean oil  E430, 444, 445
Squalane  see tetracosane, 2,6,10,15,19,23-hexamethyl-
Stearic acid  see octadecanoic acid
Sulfinylbismethane  see methane, sulfinylbis-
Sulfolane  see thiophene, tetrahydro-, 1,1-dioxide
Tetracosane, 2,6,10,15,19,23-hexamethyl-  E7, E9, E13, 57
Tetradecane  E6, E10, E13, 48, 49
1-Tetradecane  E10, E13, 71
Tetraethylene glycol see ethanol, 2,2'-[oxybis(2,1-ethanediyl)]bis-
Tetraethylene glycol dimethyl ether  see 2,5,8,11,14-pentaoxapentadecane
Tetrahydrofurfuryl alcohol  see 2-furanmethanol, tetrahydro-
Tetrahydrothiophene, 1,1-dioxide  see thiophene, tetrahydro-, 1,1-dioxide
Tetratin  see naphthalene, 1,2,3,4-tetrahydro-
Tetramethylsilane  see silane, tetramethyl-
Tetraoxadodecane  E182, E183, 249
3,6,9,12-Tetraoxatetradecane  E182, E183, 244, 245
Tetratetracontane  E7, E13, 60
Thiophene, tetrahydro-, 1,1-dioxide  E359, E361, E362, 373-377
m-Toluidine  see benzenamine, 3-methyl-
o-Toluidine  see benzenamine, 2-methyl-
Triacetin  see 1,2,3-propanetriol, triacetate
Tributyl phosphate  see phosphoric acid, tributyl ester
Tridecane  E5, 47
Triethylene glycol see ethanol, 2,2'-[1,2-ethanediylbis(oxy)]bis-
Triethylene glycol butyl ether  see 3,6,9-trioxatridecane-1-ol
Triethylene glycol diethyl ether  see 3,6,9,12-tetraoxatetradecane
Triethyl phosphate  see phosphoric acid, triethyl ester
Triisobutyl phosphate  see phosphoric acid, tris(2-methylpropyl) ester
<table>
<thead>
<tr>
<th>Substance</th>
<th>E Numbers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trimethyl phosphate</td>
<td>E182, E183, 249</td>
</tr>
<tr>
<td>see phosphoric acid, trimethyl ester</td>
<td></td>
</tr>
<tr>
<td>3,6,9-Trioxatridecan-1-ol</td>
<td>E5, 27, 44</td>
</tr>
<tr>
<td>Tripropyl phosphate</td>
<td>E132, 168</td>
</tr>
<tr>
<td>see phosphoric acid, tripropyl ester</td>
<td></td>
</tr>
<tr>
<td>Undecane</td>
<td>E178, 197</td>
</tr>
<tr>
<td>1-Undecanol</td>
<td>86, 174</td>
</tr>
<tr>
<td>2-Undecanone</td>
<td>174</td>
</tr>
<tr>
<td>Water</td>
<td>86, 174</td>
</tr>
<tr>
<td>Water (ternary)</td>
<td>174</td>
</tr>
<tr>
<td>Wax</td>
<td>E418, 429</td>
</tr>
</tbody>
</table>
### Registry Number Index

Page numbers preceded by E refer to evaluation texts whereas page numbers not preceded by E refer to compiled tables.

<table>
<thead>
<tr>
<th>Numbers</th>
<th>Pages</th>
</tr>
</thead>
<tbody>
<tr>
<td>56-23-5</td>
<td>E255, E259, E260, 261-264, E384, 397, 398</td>
</tr>
<tr>
<td>56-81-5</td>
<td>E133, 177</td>
</tr>
<tr>
<td>57-11-4</td>
<td>E385, 412, 414</td>
</tr>
<tr>
<td>57-88-5</td>
<td>E385, 404, 405</td>
</tr>
<tr>
<td>60-29-7</td>
<td>E181-E183, E187, 236</td>
</tr>
<tr>
<td>64-19-7</td>
<td>E179, E180, E187, E188, 218, 219</td>
</tr>
<tr>
<td>67-63-0</td>
<td>E130, E135, 146, 149, 155, E257, E259</td>
</tr>
<tr>
<td>67-66-3</td>
<td>E255, E259, E260, 265-268, E385, 402</td>
</tr>
<tr>
<td>67-68-5</td>
<td>E359, E361, E362, 382, 383</td>
</tr>
<tr>
<td>71-23-8</td>
<td>E130, E135, 148, 153-156, E384, 400</td>
</tr>
<tr>
<td>71-36-3</td>
<td>E130, E135, 146, 149, 157</td>
</tr>
<tr>
<td>71-41-0</td>
<td>E131, E135, 160-162</td>
</tr>
<tr>
<td>71-43-2</td>
<td>E90, E94, E95, 96-98, 100-105, 114, E257, E384, E385, 397, 400-404, 408, 409</td>
</tr>
<tr>
<td>74-82-8</td>
<td>E1, E4, E5, 14, 15, 36, 37, 461</td>
</tr>
<tr>
<td>74-84-0</td>
<td>E1, E8, 14-16, 85</td>
</tr>
<tr>
<td>74-85-1</td>
<td>E8, E10, 83, 85</td>
</tr>
<tr>
<td>74-86-2</td>
<td>E178, 199, E303, E304, 348</td>
</tr>
<tr>
<td>74-90-8</td>
<td>E304, 352</td>
</tr>
<tr>
<td>74-98-6</td>
<td>E1, E13, 14-16</td>
</tr>
<tr>
<td>75-07-0</td>
<td>E178, E179, 204</td>
</tr>
<tr>
<td>75-09-2</td>
<td>E255, E259, 269, 270</td>
</tr>
<tr>
<td>75-12-7</td>
<td>E304, E384, 399</td>
</tr>
<tr>
<td>75-15-0</td>
<td>E359, E361, E362, 378-381</td>
</tr>
<tr>
<td>75-19-4</td>
<td>E7, 62</td>
</tr>
<tr>
<td>75-28-5</td>
<td>E1, E13, 16</td>
</tr>
<tr>
<td>75-69-4</td>
<td>E255, E259, 271, 272</td>
</tr>
<tr>
<td>75-71-8</td>
<td>E255, E259, 271</td>
</tr>
<tr>
<td>75-76-3</td>
<td>E359, 372</td>
</tr>
<tr>
<td>76-13-1</td>
<td>E255, E256, E259, 281</td>
</tr>
<tr>
<td>76-14-2</td>
<td>E256, E259, 271, 272</td>
</tr>
<tr>
<td>78-40-0</td>
<td>E358, E362, 363, 370</td>
</tr>
<tr>
<td>78-75-1</td>
<td>E256, E259, 280</td>
</tr>
<tr>
<td>78-83-1</td>
<td>E131, E135, 149, 158, 159, E384, E385, 399, 405</td>
</tr>
<tr>
<td>78-92-2</td>
<td>E131, 149</td>
</tr>
<tr>
<td>78-93-3</td>
<td>109, E178, 196</td>
</tr>
<tr>
<td>79-09-4</td>
<td>E179, E180, E187, 221</td>
</tr>
<tr>
<td>79-20-9</td>
<td>E180, E187, 225, 226</td>
</tr>
<tr>
<td>90-12-0</td>
<td>126, 127</td>
</tr>
<tr>
<td>91-17-8</td>
<td>E8, E10, 71, 81</td>
</tr>
<tr>
<td>91-22-5</td>
<td>E302, E306, E307, 317, 318</td>
</tr>
<tr>
<td>92-51-3</td>
<td>E6, E13, 79, 80</td>
</tr>
<tr>
<td>95-47-6</td>
<td>E90, E91, E94, E95, 98, 114, 115</td>
</tr>
<tr>
<td>95-53-4</td>
<td>E302, E306, 314</td>
</tr>
<tr>
<td>95-63-6</td>
<td>E91, E95, 105</td>
</tr>
<tr>
<td>96-22-0</td>
<td>E178, 196</td>
</tr>
<tr>
<td>96-23-1</td>
<td>E257, E259, 294</td>
</tr>
<tr>
<td>96-48-0</td>
<td>E184, 254</td>
</tr>
<tr>
<td>96-49-1</td>
<td>E179, 206</td>
</tr>
<tr>
<td>97-53-0</td>
<td>E184, 253</td>
</tr>
<tr>
<td>97-99-4</td>
<td>E384, 391</td>
</tr>
</tbody>
</table>
3017-96-7 E256, 282
3610-26-2 E182, E183, 234
3610-27-3 E182, E183, 234
4394-85-8 E302, E306, 321, 322
4499-99-4 E182, E183, 244, 245
4792-83-0 E303, 328
6876-23-9 E8, E13, 75
7098-22-8 E7, E13, 60
7440-37-1 E457, 460, 461
7447-41-8 E385, 415, 416
7550-35-8 E385, 415, 416
7681-82-5 E385, 411, 413, 415, 416
7727-37-9 E457, 460
7732-18-5 E6, 174
7782-44-7 E457, 459, 460
7782-50-5 E457, 463
9002-88-4 E448, 449, 450
9003-20-7 E448, 455
9003-27-4 E385, 409
9003-53-6 E385, 408
9004-35-7 E385, 406, 407
10377-51-2 E385, 415, 416
10544-72-6 E457, 462
23228-90-2 E259, 291
25014-41-9 E385, 410
25035-04-5 E448, 456
25038-59-9 E448, 451-453
25265-71-8 E181, E187, 241, E384, 390
25265-75-2 E133, 176
25322-68-3 E182, E183, 244, 245
25640-78-2 E92, 125
26264-14-2 E384, 390
27234-05-5 E181, E187, 233
27252-83-1 E182, E183, 244, 245
28555-06-8 E181, E187, 233
30433-57-9 E303, E306, 325
37340-18-4 269
40464-54-8 E256, E259, 286-288
41719-16-8 E257, E259, E260, 289, 290
53609-62-4 E182, E183, 244, 245
60314-50-3 E182, E183, 244, 245
67759-35-7 E303, E306, 326
67759-37-9 E303, E306, 327
AUTHOR INDEX

Page numbers preceded by E refer to evaluation texts whereas page numbers not preceded by E refer to compiled tables.

Abib, O. E179, E184, 215
Alcalay, H.H. E448, 451
Al-Najjar, H. E2, E3, E5, E6, E11, 23, 32, 41, 46, 49, 54
Amamchyan, R.G. E457, E458, 459
Arai, C. E181, E185, E187, 233
Asano, K. E5, E11, 36, 37
Ash, R. E448, 450, 456
Balog-Megyery, K. see Megyery-Balog, K.
Baldwin, R.R. E417, E418, 423
Barrer, P.M. E448, 450, 456
Berengarten, M.G. E2, E3, E7, E11, 24, 69, E90, E92, 102
Bertsev, V.V. E457, E458, 459
Bixler, H.J. E448, 449
Bodor, E. E178, E180, E182-E184, E185-E187, 194, 195, 204, 227, 228, 237, 238, 246, 247
Bogdanov, F. E92, E93, 125
Bor, G. E178, E180-E187, 194, 195, 227, 228, 237, 238, 246, 247
Bratzler, K.D. E10, E12, 86, E91, E93, E128, E133, E179, E185, E303, E305, E358, E360
Braude, G.E. E303, E305, 345
Buell, D.S. E255, E256, E259, 269
Bulanin, M.O. E457, E458, 459
Burk, W. E304, E306, 357
Byrne, J.E. E90, E92, E93, 100, 115, 117, 119, E385, E386, 402-405
Capell, R.G. 429
Cargill, R.W. E128, E133, 151
Caquili, G. E132, E134, 170
Chai, C.-P. E6, E7, E11, E13, 55, 57, 61, E92, E93, 126, E302, E304, E306, 318
Chao, K.-C. E5, E6, E10, E11, 43, 58, 59, 88, E90-E92, 103, 112, 118, 123, 127, E182, E186, 252, E302, E304, 317
Chang, E.T. E457, E458, 462
Chen, H. E90, E92, 118
Cheng, H. E1, E11, 18
Chung, H. E1, E10, 14, 15
Christoff, A. E181, E183, E185, E187, 236
Chung, D.K. E128, E133, 145, 152
Clark, A.M.  E1, E8, E11, 85
Cucuist, M.  E179, E185, 206
Daniel, S.G.  E417, E418, 423
Dantzler, E.M.  E255, E256, E258, E259, 271, 272
Demidova, Yu.A.  E303, E305, 331
Dim, A.  E129, E132, E134, 164
Din, F.  E1, E8, E11, 85
Doerges, A.  E10, E12, 86, E91, E93, E128, E133, E179, E185, E303, E358, E358, E360
Du Pont de Nemours and Co.  E303, E305, 343
Durban, S.A.  E178, E184, 191
Durkina, A.G.  E179, E185, 211
Dymond, J.H.  E7, E12, 65, 66, E359-E362, 382
Eckert, C.S.  E7, E12, 63
Efimova, N.M.  E358, E360, 369
Egorova, V.I.  E303, E305, E306, 323-327
Eiback, R.E.  E257, E258, 290
Eldridge, J.W.  E255, E258, E259, 269, 270
Emel'yanova, E.A.  E132-E134, 173, 176
Eto, Y.  E128, E133, 143
Evans, F.D.  E131, E134, 159, E257-E260, 299, E430, E431, 436
Fai Wu, M.  E457, E458, 460
Felsing, W.A.  E178, E184, 191
Fernandez, M.E.P.  E1, E11, 18
Field, L.R.  E7, E12, E13, 73, E90, E92, 110
Fogg, P.G.T.  E182, E186
Frabetti, A.J.  E448, 451
Funk, E.W.  E1, E10, E457, E458, 461
Furmanov, A.S.  E303, E305, E306, 323-327
Furmer, I.E.  E2, E3, E7, E11, 24, 69, E90, E92, 102, E304, E306, 354, E358, E360, 368, 369
Fuwa, T.  E448, 454
Gao Guanghua  E2, E5, E11, 27
Gardner, G.R.  E129, E132, E134, 164
Garsem, K.A.M.  E6, E7, E11, E13, 60
Geller, E.B.  E8, E12, E13, 75-78
Gerber, A.  E304, E306, 352
Gestrich, W.  E7, E10, E12, 68, 87, E90, E92, 101, 111
Glazunova, T.V.  E91, E93, 124
Gniewosz, S.  E417, E418, 428
Gocken, N.A.  E457, E458, 462
Gracheva, N.V.  E358, E360, 369
Grishko, N.I.  E303, E305, E306, 313-327
Gudasheva, V.M.  E356, E360, 368
Haidegger, E.  E303, E305, 344
Haller, H.S.  E431, 447
Haselden, G.G.  E7, E8, E12, 62, 84
Hayduk, W.  E2, E5, E6, E11, 30, E132, E134, E135, 174
Lipshtein, R.A.  E91, E93, 124
Liu, D.D.  E448, 455
Liu, M.  E90, E92, 113
Logvinvuk, V.P.  E417, E418, 424
Lopez, M.C.  E178, E184, E187, 200, 202, E257-E260, 292, 293, 297
Luther, H.  E132, E134, 169, E417, E418, 419
Lynn, S.  E182, E183, E186, 249
McHale, J.L.  E358, E360, E362, 371
Macphee, D.E.  E128, E133, 151
Makarenkov, V.V.  E417, E418, 424
Makarov, K.  E182, E183, E186, 244, 245
Maleczkine, M.  E178, E180-E187, 194, 195, 227, 228, 237, 238, 246, 247
Malik, V.K.  E132, E134, E135, 174
Malyshiev, V.V.  E417, E418, 424
Malyutin, S.P.  E182, E183, E186, 244, 245
Mantor, P.D.  E179, E184, 215
Mason, D.M.  E457, E458, 463
Masuoka, H.  E128, E133, 143
Mate, E.  E178, E184, 196, 197
Maude, A.H.  E417, E418, 426
Meder, A.P.  E179, E185, 211
Melendo, J.M.  E178, E184, E187, 201
Mesko, G.  E178, E180-E187, 194, 195, 227, 228, 237, 238, 246, 247
Messow, U.  E417, E418, 420, 427
Michaels, A.S.  E448, 449, 452, 453
Mills, A.F.  E128, E133, 145, 152
Modell, J.H.  E256-E260, 287, 289, 291
Molinet, G.  E304, E306, 351
Murrieta-Guevara, F.  E179, E185, 217, E303, E305, 341, E359, E360, 374

Nagahama, K.  E1, E8, E10, E11, E13, 16, 83
Nakahara, T.  E5, E11, 36, 37
Navari, R.M.  E256, E258, E259, 288
Neokladnova, L.N.  E303, E305, E306, 323-327
Nichols, G.  E430, E431, 438
Nishihara, K.  E181, E185, E187, 233
Nychka, H.R.  E257, E258, 290
Ouellet, C.  E180, E181, E185, E187, 222, 232
Palmer, D.G.  E448, 450, 456
Panchenkov, G.M.  E417, E418, 424
Pape, D.  E417, E418, 420, 427
Weatherford, W.D.  E417, E418, 429
Wehner, K.  E304, E306, 357
Wilcock, R.J.  E2, E5, E8, E11-E13, 35, 42, 74, E129,
Wilhelm, E.  E2, E5, E7, E8, E11-E13, 35, 42, 67, 73-78, E90,
            E92, E93, 110, 115, 117, 119, E129, E131, E132,
Williams, B.  E132, E134, E135, 171, E255, E256, E258,
             E260, 275, 282, E417, E418, 425
Williams, D.L.  E90, E92, 107
Williams, J.M.  E2, E11, 19
Wolfer, W.  E182, E183, E186, E187, 250
Won, Y.S.  E128, E133, 145, 152
Wood, T.  E129, E132, E134, 164
Woukoloff  E255, E258, 265, E359, E360, 378
Wu, Z.  E303, E305, 339
Xu, S.  E359, E360, 377
Yeh, S.Y.  E430, E431, 434, 439-441
Yokoyama, C.  E2, E3, E7, E11, 26, 70, E90, E92, 104
Yorizane, M.  E128, E133, 143
Yoshitama, T.  E181, E185, E187, 233
Yushko, V.L.  E358, E360, 366, 367
Zainel, H.A.  E181, E184, E185, 240, 254, E302, E303,
             E305, 321, 340, E359, E360, 375
Zander, E.H.  E1, E10, 14, 15
Zeck, S.  E303, E305, 339
Zelevenskii,  E90, E93, 109, E128, E130, E131, E133, 140,
            E148, E149, E178, E180, E184
Zheng, L.  E90, E92, 113
Zhu, Z.  E11, 18
<table>
<thead>
<tr>
<th>Volume</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>H. L. Clever, <em>Helium and Neon</em></td>
</tr>
<tr>
<td>2</td>
<td>H. L. Clever, <em>Krypton, Xenon and Radon</em></td>
</tr>
<tr>
<td>3</td>
<td>M. Salomon, <em>Silver Azide, Cyanide, Cyanamides, Cyanate, Selenocyanate and Thiocyanate</em></td>
</tr>
<tr>
<td>4</td>
<td>H. L. Clever, <em>Argon</em></td>
</tr>
<tr>
<td>5/6</td>
<td>C. L. Young, <em>Hydrogen and Deuterium</em></td>
</tr>
<tr>
<td>7</td>
<td>R. Battino, <em>Oxygen and Ozone</em></td>
</tr>
<tr>
<td>8</td>
<td>C. L. Young, <em>Oxides of Nitrogen</em></td>
</tr>
<tr>
<td>9</td>
<td>W. Hayduk, <em>Ethane</em></td>
</tr>
<tr>
<td>10</td>
<td>R. Battino, <em>Nitrogen and Air</em></td>
</tr>
<tr>
<td>11</td>
<td>B. Scrosati and C. A. Vincent, <em>Alkali Metal, Alkaline Earth Metal and Ammonium Halides, Amide Solvents</em></td>
</tr>
<tr>
<td>12</td>
<td>C. L. Young, <em>Sulfur Dioxide, Chlorine, Fluorine and Chlorine Oxides</em></td>
</tr>
<tr>
<td>13</td>
<td>S. Siekierski, T. Mioduski and M. Salomon, <em>Scandium, Yttrium, Lanthanum and Lanthanide Nitrate</em></td>
</tr>
<tr>
<td>14</td>
<td>H. Miyamoto, M. Salomon and H. L. Clever, <em>Alkaline Earth Metal Halates</em></td>
</tr>
<tr>
<td>15</td>
<td>A. F. M. Barton, <em>Alcohols with Water</em></td>
</tr>
<tr>
<td>16/17</td>
<td>E. Tomlinson and A. Regosz, <em>Antibiotics: 1, β-Lactam Antibiotics</em></td>
</tr>
<tr>
<td>18</td>
<td>O. Popovych, <em>Tetrphenyldiborates</em></td>
</tr>
<tr>
<td>19</td>
<td>C. L. Young, <em>Cumulative Index: Volumes 1-18</em></td>
</tr>
<tr>
<td>20</td>
<td>A. L. Horvath and F. W. Getzen, <em>Halogenated Benzenes, Toluenes and Phenols with Water</em></td>
</tr>
<tr>
<td>22</td>
<td>T. Mioduski and M. Salomon, <em>Scandium, Yttrium, Lanthanum and Lanthanide Halides in Nonaqueous Solvents</em></td>
</tr>
<tr>
<td>23</td>
<td>T. P. Dirkse, <em>Copper, Silver, Gold and Zinc, Cadmium, Mercury Oxides and Hydroxides</em></td>
</tr>
<tr>
<td>24</td>
<td>W. Hayduk, <em>Propane, Butane and 2-Methylpropane</em></td>
</tr>
<tr>
<td>25</td>
<td>C. Hirayama, Z. Galus and C. Guminski, <em>Metals in Mercury</em></td>
</tr>
<tr>
<td>26</td>
<td>M. R. Masson, H. D. Lutz and B. Engelen, <em>Sulfites, Selenites and Tellurites</em></td>
</tr>
<tr>
<td>27/28</td>
<td>H. L. Clever and C. L. Young, <em>Methane</em></td>
</tr>
<tr>
<td>29</td>
<td>H. L. Clever, <em>Mercury in Liquids, Compressed Gases, Molten Salts and Other Elements</em></td>
</tr>
<tr>
<td>30</td>
<td>H. Miyamoto and M. Salomon, <em>Alkali Metal Halates, Ammonium Iodate and Iodic Acid</em></td>
</tr>
<tr>
<td>31</td>
<td>J. Eysseltová and T. P. Dirkse, <em>Alkali Metal Orthophosphates</em></td>
</tr>
<tr>
<td>Volume 32</td>
<td>P. G. T. Fogg and C. L. Young, <em>Hydrogen Sulfide, Deuterium Sulfide and Hydrogen Selenide</em></td>
</tr>
<tr>
<td>Volume 33</td>
<td>P. Franzosini, <em>Molten Alkali Metal Alkanoates</em></td>
</tr>
</tbody>
</table>
  *Part I: Non-cyclic Substituents* |
  *Part II: 5-Membered Heterocyclic Substituents* |
  *Part III: 6-Membered Heterocyclic Substituents and Miscellaneous Systems* |
| Volume 37 | D. G. Shaw, *Hydrocarbons with Water and Seawater.*  
  *Part I: Hydrocarbons C₅ to C₇* |
| Volume 38 | D. G. Shaw, *Hydrocarbons with Water and Seawater.*  
  *Part II: Hydrocarbons C₈ to C₃₆* |
| Volume 39 | C. L. Young, *Cumulative Index: Volumes 20-38* |
| Volume 40 | J. Hala, *Halides, Oxyhalides and Salts of Halogen Complexes of Titanium, Zirconium, Hafnium, Vanadium, Niobium and Tantalum* |
| Volume 41 | C.-Y. Chan, I. N. Lepeshkov and K. H. Khoo, *Alkaline Earth Metal Perchlorates* |
| Volume 42 | P. G. T. Fogg and W. Gerrard, *Hydrogen Halides in Non-aqueous Solvents* |
| Volume 43 | R. W. Cargill, *Carbon Monoxide* |
| Volume 44 | H. Miyamoto, E. M. Woolley and M. Salomon, *Copper and Silver Halates* |
| Volume 45/46 | R. P. T. Tomkins and N. P. Bansal, *Gases in Molten Salts* |
  *Part II: Esters 7-C to 32-C* |
| Volume 50 | P. G. T. Fogg, *Carbon Dioxide in Non-aqueous Solvents at Pressures less than 200 kPa* |
| Volume 51 | J. G. Osteryoung, M. M. Schreiner, C. Guminski and Z. Galus, *Intermetallic Compounds in Mercury* |
| Volume 52 | I. Lambert and H. L. Clever, *Alkaline Earth Hydroxides in Water and Aqueous Solutions* |