SOLUBILITY DATA SERIES

Volume 57

ETHENE

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OXFORD UNIVERSITY PRESS
IUPAC Solubility Data Series Rates for 1994

Subscriptions: UK and Europe Rest of World

Full subscription £265 $395
Single volume £75 $115

Reduced rates are available to members of IUPAC. Please apply directly to the publisher for details.

Prices include postage by surface mail or, for subscribers in the USA and Canada by Airfreight or in Japan, India, Australia and New Zealand by Air Speeded Post. Airmail rates are available on request.

The IUPAC Solubility Data Series is published quarterly in March, June, September and December by Oxford University Press. Subscription is $395 per year. Second Class postage paid at Newark, New Jersey. ISSN 0191-5622.

POSTMASTER: Send address corrections to IUPAC Solubility Data Series, c/o Virgin Mailing and Distribution, Cargo Atlantic, 10 Camptown Road, Irvington, New Jersey 07111-1105, USA.

New subscriptions may be registered at any time during the year but will be reckoned as running from January 1st of the year in which the subscription is received. Claims regarding non-receipt of issues must be received within 4 months of publication or date of order, whichever is later. Back issues are available—for information contact Journals Customer Services Department, Oxford University Press, Walton Street, Oxford OX2 6DP.

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Any enquiries regarding this publication should be addressed to:
USA and Canada: Oxford University Press, 2001 Evans Road, Cary, NC 27513, USA.
Rest of World: Journals Customer Services Department, Oxford University Press, Walton Street, Oxford OX2 6DP, UK.

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Printed and bound in Great Britain by Antony Rowe Ltd, Chippenham, Wiltshire
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NATURE OF THE PROJECT

The Solubility Data project (SDP) has as its aim a comprehensive review of published data for solubilities of gases, liquids and solids in liquids or solids. Data of suitable precision are compiled for each publication on data sheets in a uniform format. The data for each system are evaluated and, where data from independent sources agree sufficiently, recommended values are proposed. The evaluation sheets, recommended values, and compiled data sheets are published on consecutive pages.

COMPILATIONS AND EVALUATIONS

The formats for the compilations and critical evaluations have been standardized for all volumes. A description of these formats follows.

Compilations

The format used for the compilations is, for the most part, self-explanatory. Normally, a compilation sheet is divided into boxes, with detailed contents described below.

Components: Each component is listed according to IUPAC name, formula, and Chemical Abstracts (CA) Registry Number. The Chemical Abstracts name is also included if this differs from the IUPAC name, as are trivial names if appropriate. IUPAC and common names are cross-referenced to Chemical Abstracts names in the System Index.

The formula is given either in terms of the IUPAC or Hill (1) system and the choice of formula is governed by what is usual for most current users: i.e., IUPAC for inorganic compounds, and Hill system for organic compounds. Components are ordered on a given compilation sheet according to:

(a) saturating components;
(b) non-saturating components according to chemical families; within carbon compounds, according to increasing carbon number;
(c) solvents according to chemical families; within carbon compounds, according to increasing carbon number.

In each class, ordering follows the 18-column IUPAC periodic table. The same order is followed in arranging the compilation sheets within a given volume.

Original Measurements: References are abbreviated in the forms given by Chemical Abstracts Service Source Index (CASSI). Names originally in other than Roman alphabets are given as transliterated by Chemical Abstracts. In the case of multiple entries (for example, translations) an asterisk indicates the publication used for compilation of the data.

Variables: Ranges of temperature, pressure, etc. are indicated here.

Prepared by: The names of all compilers are given here.

Experimental Values: Components are described as (1), (2), etc., as defined in the "Components" box. Data are reported in the units used in the original publication, with the exception that modern names for units and quantities are used; e.g., mass per cent for weight per cent; mol dm$^3$ for molar; etc. Usually, only one type of value (e.g., mass per cent) is found in the original paper, and the compiler has added the mole fractions from calculations based on 1989 atomic weights (2) and referenced sources of densities, where necessary. Temperatures are expressed as $t/°C$, $t/°F$ or $T/K$ as in the original; if necessary, conversions to $T/K$ are made, sometimes in the compilations, and always in the critical evaluation. However, the author's units are expressed according to IUPAC recommendations (3) as far as possible.

Errors in calculations, fitting equations, etc. are noted, and where possible corrected.

Material inserted by the compiler is identified by the word "compiler" or by the compiler's name in parentheses or in a footnote. Details of smoothing equations (with limits) are included if they are present in the original publication and if the temperature or pressure ranges are wide enough to justify this procedure and if the compiler finds that the equations are consistent with the data.

The precision of the original data is preserved when derived quantities are calculated, if necessary by the inclusion of one additional significant figure. In some cases, compilers note that numerical data have been obtained from published graphs using digitizing techniques. In these
cases, the precision of the data can be determined by the quality of the original graph and the limitations of the digitizing technique.

**Method:** The apparatus and procedure are mentioned briefly. Abbreviations used in Chemical Abstracts are often used here to save space, reference being made to sources of further detail if these are cited in the original paper. Several reviews on experimental methods of determining gas solubilities are given in (4-10).

**Source and Purity of Materials:** For each component, referred to as (1), (2), etc., the following information (in this order and in abbreviated form) is provided if available in the original paper: source and specified method of preparation; properties; degree of purity. The solubility is usually more sensitive to impurities in the gaseous component than in the liquid component. However, the most important source of impurities is traces of unwanted gas dissolved in the liquid. Inadequate preliminary degassing of the absorbing liquid is probably the most often overlooked serious source of error in gas solubility measurements.

**Estimated Error:** If estimated errors were omitted by the original authors, and if relevant information is available, the compilers have attempted to estimate errors (identified by "compiler" or the compiler's name in parentheses or in a footnote) from the internal consistency of data and type of apparatus used. Methods used by the compilers for estimating and reporting errors are based on Ku and Eisenhart (11).

**Comments and/or Additional Data:** Compilations may include this section, in which short comments relevant to the general nature of the work or additional experimental and thermodynamic data are included which are judged by the compiler to be of value to the reader.

**References:** The format for these follows the format for the Original Measurements box, except that final page numbers are omitted. References (usually cited in the original paper) are given where relevant to interpretation of the compiled data, or where cross-reference can be made to other compilations.

**Evaluations**

The evaluator's task is to assess the reliability and quality of the data, to estimate errors where necessary, and to recommend "best" values. The evaluation takes the form of a summary in which all the data supplied by the compiler have been critically reviewed. There are only three boxes on a typical evaluation sheet, and these are described below.

**Components:** The format is the same as on the Compilation sheets.

**Evaluator:** Name and affiliation of the evaluator(s); date up to which the literature was checked.

**Critical Evaluation:**

(a) Critical text. The evaluator checks that the compiled data are correct, assesses their reliability and quality, estimates errors where necessary, and recommends numerical values based on all the published data (including theses, reports and patents) for each given system. Thus, the evaluator reviews the merits or shortcomings of the various data. Only published data are considered. Documented rejection of some published data may occur at this stage, and the corresponding compilations may be removed.

The solubilities in comparatively few systems are known with sufficient accuracy to enable a set of recommended values to be presented, either for measurements near atmospheric pressure or at high pressures. Although many systems have been studied by at least two independent groups of workers, the range of pressures or temperatures is often sufficiently different to make meaningful comparison impossible.

Occasionally, it is not clear why two groups of workers obtained very different but internally consistent sets of results at the same temperature and pressure, although both sets were obtained by reliable methods. In such cases, a decisive assessment may not be possible. In some cases, two or more sets of data have been classified as tentative even though 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 be regarded only as an "informed guess".

As well, many 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). As an example, it is difficult to
determine coexisting liquid and vapor compositions near the critical point of a mixture using some common experimental techniques which yield accurate high pressure solubility data. As another 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.

Sometimes it is possible to judge the reliability of data for a particular gas-liquid system by testing whether the data are consistent with the behavior of homologous gases or liquids.

(b) Fitting equations. If the use of a smoothing equation is justifiable the evaluator may provide an equation representing the solubility as a function of the variables reported on all the compilation sheets, stating the limits within which it should be used.

(c) Graphical summary. In addition to (b) above, graphical summaries are often given.

(d) Recommended values. Data are recommended if the results of at least two independent groups are available and they are in good agreement, and if the evaluator has no doubt as to the adequacy and reliability of the applied experimental and computational procedures. Data are reported as tentative if only one set of measurements is available, or if the evaluator considers some aspect of the computational or experimental method as mildly undesirable but estimates that it should cause only minor errors. Data are considered as doubtful if the evaluator considers some aspect of the computational or experimental method as undesirable but still considers the data to have some value where the order of magnitude of the solubility is needed. Data determined by an inadequate method or under ill-defined conditions are rejected. However, references to these data are included in the evaluation together with a comment by the evaluator as to the reason for their rejection.

(e) References. All pertinent references are given here, including all those publications appearing in the accompanying compilation sheets and those which, by virtue of their poor precision, have been rejected and not compiled.

(f) Units. While the original data may be reported in the units used by the investigators, the final recommended values are reported in SI units (3) when the data can be accurately converted.

QUANTITIES AND UNITS USED IN COMPILATION AND EVALUATION OF SOLUBILITY DATA

Mixtures, Solutions and Solubilities

A mixture (12) describes a gaseous, liquid or solid phase containing more than one substance, where the substances are all treated in the same way.

A solution (12) describes a liquid or solid phase containing more than one substance, when for convenience one of the substances, which is called the solvent, and may itself be a mixture, is treated differently than the other substances, which are called solutes. If the sum of the mole fractions of the solutes is small compared to unity, the solution is called a dilute solution.

The solubility of a solute 1 (solid, liquid or gas) is the analytical composition of a saturated solution, expressed in terms of the proportion of the designated solute in a designated solvent (13). “Saturated” implies equilibrium with respect to the processes of dissolution and vaporization; the equilibrium may be stable or metastable. The solubility of a substance in metastable equilibrium is usually greater than that of the same substance in stable equilibrium. (Strictly speaking, it is the activity of the substance in metastable equilibrium that is greater.)

Either point of view, mixture or solution, may be taken in describing solubility. The two points of view find their expression in the reference states used for definition of activities, activity coefficients and osmotic coefficients. Note that the composition of a saturated mixture (or solution) can be described in terms of any suitable set of thermodynamic components.

For gases, the solubility is quoted, where possible, as mole fraction of the saturating gaseous component in the liquid phase at 1 bar partial pressure of gas. The distinction between vapor-liquid equilibria and the solubility of gases in liquids is arbitrary. It is generally accepted that the equilibrium at 300 K between a typical gas such as argon and a liquid such as water is gas liquid solubility whereas the equilibrium between hexane and cyclohexane at 350 K is an example of vapor-liquid equilibria.

Physicochemical Quantities and Units

Solubilities of gases have been the subject of research for a long time, and have been
expressed in a great many ways, as described below. In each case, specification of the temperature
and either partial or total pressure of the saturating gaseous component is necessary. The
nomenclature and units follow, where possible, ref. (3)

A note on nomenclature. In the IUPAC Green Book (3), the solute is component B and the
solvent is component A. In compilations and evaluations, the first-named component (component
1) is the solute, and the second (component 2 for a two-component system) is the solvent. The
reader should bear these distinctions in nomenclature in mind when comparing equations given here
with those in the Green Book.

1. Mole fraction of substance 1, \(x_1\) or \(x(1)\):

\[
x_1 = \frac{n_1}{\sum_{s=1}^{c} n_s}
\]

where \(n_s\) is the amount of substance of \(s\), and \(c\) is the number of distinct substances present (often
the number of thermodynamic components in the system). Mole per cent of substance 1 is 100 \(x_1\).

2. Ionic mole fractions of salt \(i\), \(x_{i+}, x_{i-}\):

For a mixture of \(s\) binary salts \(i\), each of which ionizes completely into \(v_{i+}\) cations and \(v_{i-}\) anions,
with \(v_{i} = v_{i+} + v_{i-}\), and a mixture of \(p\) non-electrolytes \(j\), of which some may be solvent
components, a generalization of the definition in (14) gives:

\[
x_{i+} = \frac{v_{i+} x_i}{1 + \sum_{i=1}^{s} (v_i-1)x_i}, \quad x_{i-} = \frac{v_{i-} x_i}{v_{i+}}, \quad i = 1...s
\]

\[
x_{j} = \frac{x_j}{1 + \sum_{i=1}^{s} (v_i-1)x_i}, \quad j = (s+1)...p
\]

The sum of these mole fractions is unity, so that, with \(c = s + p\),

\[
\sum_{i=1}^{s} (x_{i+} + x_{i-}) + \sum_{j=1}^{p} x_{j} = 1
\]

General conversions to other units in multicomponent systems are complicated. For a three-
component system containing non-electrolyte 1, electrolyte 2 and solvent 3,

\[
x_1 = \frac{v_{2+} x_{1}'}{v_{2+} - (v_{2-} - 1)x_2}, \quad x_2 = \frac{x_{2}}{v_{2+} - (v_{2-} - 1)x_2}.
\]

These relations are used in solubility equations for salts, and for tabulation of salt effects on
solubilities of gases (see below).

3. Mass fraction of substance 1, \(w_1\) or \(w(1)\):

\[
w_1 = \frac{g_1}{\sum_{s=1}^{c} g_s} \sum_{s=1}^{c} g_s
\]

where \(g_s\) is the mass of substance \(s\). Mass per cent of substance 1 is 100 \(w_1\). The equivalent terms
weight fraction, weight per cent and \(g(1)/100 g solution\) are no longer used.

4. Molality of solute 1 in a solvent 2, \(m_1\):
SI base units: mol kg⁻¹. Here, \( M_2 \) is the molar mass of the solvent. The equivalent term weight solubility, \( C_w \), is no longer used.

5. **Amount concentration** of solute 1 in a solution of volume \( V \), \( c_1 \):

\[
c_1 = \frac{[\text{formula of solute}]}{V} = \frac{n_1}{V}
\]

SI base units: mol m⁻³. The symbol \( c_1 \) is preferred to \([\text{formula of solute}]\), but both are used. The old terms molarity, molar and moles per unit volume are no longer used.

6. **Mass concentration** of solute 1 in a solution of volume \( V \), \( \rho_1 \) or \( \gamma_1 \):

\[
\rho_1 = \frac{\gamma_1}{V}
\]

SI base units: kg m⁻³.

7. **Mole ratio**, \( r_{n,12} \) (dimensionless)

\[
r_{n,12} = \frac{n_1}{n_2}
\]

Mass ratio, symbol \( r_{g,12} \), may be defined analogously.

8. **Ionic strength**, \( I_m \) (molality basis), or \( I_c \) (concentration basis):

\[
I_m = \frac{1}{2} \sum_i m_i z_i^2
c_i = \frac{1}{2} \sum_i c_i z_i^2
\]

where \( z_i \) is the charge number of ion \( i \). While these quantities are not used generally to express solubilities, they are used to express the compositions of non-saturating components. For a single salt with ions of charges \( z_+, z_- \),

\[
I_m = |z_+ z_-| \nu m_\rho \quad I_c = |z_+ z_-| \nu c_i
\]

Mole and mass fractions are appropriate to either the mixture or the solution point of view. The other quantities are appropriate to the solution point of view only. Conversions between some pairs of these quantities can be carried out using the equations given in Table 1 at the end of this Introduction. Other useful quantities will be defined in the prefaces to individual volumes or on specific data sheets.

In addition to these well-defined SI-based units, other units have been used to express the solubilities of gases. Units and nomenclature follow (4, 5, 7, 16), as modified by IUPAC recommendations (3). The equations describing Bunsen, Kuenen, Ostwald and absorption coefficients, as well as Henry's law constants, hold for ideal gases and perfect solutions only. Corrections for non-idealities should be made where possible. The corrections are less than 1% for most gases near atmospheric pressure (5).

In much published data, the reference pressure is 1 atm = 0.101325 MPa rather than 1 bar = 0.1 MPa.

9. **Bunsen coefficient**, \( \alpha \) (dimensionless):

The volume of saturating gas, \( V_1 \), reduced to \( T^0 = 273.15 \) K, \( \rho^0 = 1 \) bar, which is absorbed by unit volume \( V_2 \) of pure solvent at the temperature of measurement and partial pressure \( \rho^0 = 1 \) bar. If the gas is ideal, Henry's law (see below) holds, and the liquid is incompressible, then
10. **Kuenen coefficient, \( S \):**

The volume of saturating gas, \( V(g) \), reduced to \( T = 273.15 \) K, \( p^o = 1 \) bar, which is dissolved by unit mass of pure solvent at the temperature of measurement and partial pressure 1 bar. Thus,

\[
S = \frac{V_1 T^o}{g^o T} = \frac{\alpha V_{n,2}}{M_2}
\]  

SI base units: m\(^3\) kg\(^{-1}\). Here, \( M_2 \) is the molar mass of the solvent. The Kuenen coefficient is proportional to the molality of the dissolved gas.

11. **Ostwald coefficient, \( L \) (dimensionless) (16):**

The volume of saturating gas, \( V_1 \), absorbed by a volume \( V_2 \) of pure solvent at the temperature and pressure of the measurement. Thus,

\[
L = \frac{V_1}{V_2^o} = \left( \frac{\alpha T}{T^o} \right) \left( \frac{p^o}{p} \right)
\]

The Ostwald coefficient is equal to the ratio of the amount concentrations in the gas and in the liquid.

12. **Absorption coefficient, \( \beta \) (dimensionless):**

The most common of several definitions of absorption coefficient is the volume of gas, reduced to \( T^o = 273.15 \) K, \( p^o = 1 \) bar absorbed per unit volume of pure solvent at a total pressure of 1 bar. The absorption and Bunsen coefficients are therefore very similar, and are connected by

\[
\beta = \alpha (1 - p_2/p^o)
\]

where \( p_2 \) is the partial pressure of the vapor of the solvent.

13. **Henry's Law constant, \( K_n \):**

\[
K_n = \lim_{x_1 \to 0} \left( \frac{P_1}{x_1} \right)
\]

SI base units: Pa. Unfortunately, the definition is used often at finite mole fractions, even though this is a limiting law. The following have also been defined as Henry's Law constants:

\[
K_2 = \frac{p_1}{c_1} \quad K_c = \frac{c_g}{c_1}
\]

where superscript \( g \) refers to the gas phase. \( K_2 \) has SI base units Pa m\(^3\) mol\(^{-1}\), and \( K_c \) is dimensionless. The Henry's law constant has also been called the Henry coefficient and the Henry coefficient. Henry's law can be used, with great caution, to convert data from the experimental pressure to 1 bar if the mole fraction of the gas in the liquid is small, and the difference in pressures is small.

The relations between the mole fraction solubility and the various quantities given above are as follows. Note again that these relations hold for ideal gaseous and perfect solution phases only.
1. Salt Effects on the Solubility of Gases (17)

These are often reported as Sechenov (Setchenow, Setschenow) salt effect parameters $k_{\text{sys}}$, which are defined in various ways. The general semi-empirical Sechenov equation is

$$\log(z_1/z_0) = k_{\text{sys}} y$$

where solubility is expressed in quantities $z$, with superscript $o$ designating pure solvent, and salt composition is expressed in quantities $y$. The quantities $c_1$, $m_2$, $x_1$, $I_m$ and $I_s$ are used for $y$, and the quantities $c_1$, $m_2$, $x_1$, $\alpha$, $S$ and $L$ for $z$, giving 30 definitions of $k_{\text{sys}}$. Here, components 1 and 2 are the gaseous solute and electrolyte, respectively. The ratios of $z$-values are the same for $z = c_1$, $x_1$ and for $m_2$ and $S$, respectively, leaving 15 distinct definitions. If $z$ is the same, the definitions of $k_{\text{sys}}$ are related simply through 10 equations between pairs of $c_1$, $x_1$, $I_m$ and $I_s$. Some relations among the definitions, in terms of $k_{\text{sec}}$, $k_{\text{smm}}$, and $k_{\text{axx}}$, are:

$$k_{\text{sec}} = k_{\text{secL}} = \frac{m_2 k_{\text{sec}}}{c_2} = \frac{x_2 k_{\text{sec}}}{c_2} = \frac{I_s k_{\text{sec}}}{c_2}$$
$$k_{\text{smm}} = \frac{x_2 k_{\text{smm}}}{m_2} = k_{\text{smS}} = \frac{c_2 k_{\text{scm}}}{m_2} = \frac{I_m k_{\text{smm}}}{m_2}$$
$$k_{\text{axx}} = \frac{c_2 k_{\text{axx}}}{x_2} = k_{\text{axS}} = \frac{m_2 k_{\text{axx}}}{x_2} = \frac{I_s k_{\text{axx}}}{x_2}$$

These relations hold when a single salt is present; note that the relations between ionic strength and either molality or concentration are simple. If more than one salt is present, the ionic strength is the only practical quantity to be used for $y$.

Conversions between pairs of $k_{\text{sec}}$, $k_{\text{smm}}$, and $k_{\text{axx}}$ are more complicated, and can be found using eqn [5] and Table 1 at the end of this Introduction. For example,

$$k_{\text{sec}} = f(m) \left( \frac{k_{\text{smm}} + 1}{v_2} - \frac{\log f(m)}{m_2} \right)$$

where

$$f(m) = 1 + (c_1 + c_2 m_2) I_3 \quad f(m^o) = 1 + m_3^o I_3$$

Errors in the salt effect parameters, as defined above, can be large. If the relative standard deviation in measurement of solubility is $s(c_1)/c_1$, then the relative standard deviation in $k_{\text{sec}}$ is

$$\frac{s(k_{\text{sec}})}{k_{\text{sec}}} = \frac{\sqrt{2}}{c_2 k_{\text{sec}}} \ln 10 \cdot \frac{s(c_1)}{c_1}$$
For example, for \( k_{sec} = 0.1 \) and \( c_2 = 0.01 \text{ mol dm}^{-3} \), \( s(k_{sec})/k_{sec} \) is 30\% when \( s(c_1)/c_1 = 0.05 \% \) and 1200\% when \( s(c_1)/c_1 = 2 \% \). At \( c_2 = 1 \text{ mol dm}^{-3} \), the corresponding errors are 0.3 and 12\%, respectively.

If the solubility of a gas is greater than about \( x = 0.01 \) at partial pressure 1 bar, then several other factors must be taken into account, such as the density of the solution or the partial molar volume of the dissolved gas. In addition, corrections should be made for non-ideality of the gas. See (18) for details.

In addition, the following definitions concerning density are useful in conversions between concentrations and other quantities.

15. Density, \( \rho \) or \( \gamma \):

\[
\rho = \frac{g}{V} \tag{25}
\]

SI base units: \( \text{kg m}^{-3} \). Here \( g \) is the total mass of the system.

16. Relative density, \( d = \rho / \rho^0 \); the ratio of the density of a mixture at temperature \( t \), pressure \( p \) to the density of a reference substance at temperature \( t' \), pressure \( p' \). For liquid solutions, the reference substance is often water at 4°C, 1 bar. (In some cases 1 atm is used instead of 1 bar.) The term specific gravity is no longer used.

Thermodynamics of Solubility (18)

Thermodynamic analysis of solubility phenomena provides a rational basis for the construction of functions to represent solubility data, and thus aids in evaluation, and sometimes enables thermodynamic quantities to be extracted. Both these aims are often difficult to achieve because of a lack of experimental or theoretical activity coefficients. Where thermodynamic quantities can be found, they are not evaluated critically, since this task would involve examination of a large body of data that is not directly relevant to solubility. Where possible, procedures for evaluation are based on established thermodynamic methods. Specific procedures used in a particular volume will be described in the Preface to that volume.

Only one thermodynamic result is mentioned here: the temperature dependence of solubility. Sometimes it is possible to fit the mole fraction solubility at various temperatures using the equation

\[
\ln x_1 = A + B(\frac{T}{K}) + C\ln(\frac{T}{K}) + D(\frac{T}{K})^2 \tag{26}
\]

where \( A, B, C \) and \( D \) are constants to be determined from least-squares fitting of the data. Sometimes, to avoid singular matrices of the least-squares normal equations, \( T \) is scaled; e.g., \( T \) is replaced by \( T/100 \).

If the gas and the solution of the dissolved gas are ideal, the coefficients can be used to find standard thermodynamic functions for transfer of the gas from the vapor to the liquid phase at the standard pressure (1 bar) and infinitely-dilute dissolved gas, as follows.

\[
\Delta G_{m,1}^0/R = -A(\frac{T}{K}) - B - C(\frac{T}{K})\ln(\frac{T}{K}) - D(\frac{T}{K})^2 \tag{27}
\]

\[
\Delta S_{m,1}^0/R = A + C\ln(\frac{T}{K}) + C + 2D(\frac{T}{K})^2 \tag{28}
\]

\[
\Delta H_{m,1}^0/R = -B + C(\frac{T}{K}) + D(\frac{T}{K})^2 \tag{29}
\]

\[
\Delta C_{p,m}^0/R = C + 2D(\frac{T}{K}) \tag{30}
\]

Alternatively (but equivalently), the standard state of infinitely-dilute dissolved gas can be described as a hypothetical ideal dissolved gas at mole fraction \( x_1 = 1, p = 1 \text{ bar} \).
REFERENCES


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January, 1994
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<thead>
<tr>
<th>$x_i$</th>
<th>$w_i$</th>
<th>$m_i$</th>
<th>$c_i$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$x_i = \frac{1}{1 + \sum_{j \neq i} \left( \frac{M_j}{M_i} \frac{x_j}{x_i} \right)}$</td>
<td>$\frac{1}{1 + \sum_{j \neq i} \left( \frac{M_j}{M_i} \frac{x_j}{x_i} \right)}$</td>
<td>$\frac{1}{1 + \sum_{j \neq i} \left( \frac{M_j}{M_i} \frac{m_j}{m_i} \right)}$</td>
<td>$\frac{1}{1 + \sum_{j \neq i} \left( \frac{c_j}{c_i} \left( 1 - \frac{M_j}{M_i} \right) \right)}$</td>
</tr>
<tr>
<td>$w_i = \frac{1}{1 + \sum_{j \neq i} \left( \frac{M_j}{M_i} \frac{w_j}{w_i} \right)}$</td>
<td>$\frac{1}{1 + \sum_{j \neq i} \left( \frac{M_j}{M_i} \frac{w_j}{w_i} \right)}$</td>
<td>$\frac{1}{1 + \sum_{j \neq i} \left( \frac{c_j}{c_i} \left( 1 - \frac{M_j}{M_i} \right) \right)}$</td>
<td>$\frac{1}{\rho \left( \sum_{j \neq i} c_j M_j - M_i \right)}$</td>
</tr>
<tr>
<td>$m_i = \frac{1}{1 + \sum_{j \neq i} \left( \frac{M_j}{M_i} \frac{m_j}{m_i} \right)}$</td>
<td>$\frac{1}{1 + \sum_{j \neq i} \left( \frac{M_j}{M_i} \frac{m_j}{m_i} \right)}$</td>
<td>$\frac{1}{1 + \sum_{j \neq i} \left( \frac{c_j}{c_i} \left( 1 - \frac{M_j}{M_i} \right) \right)}$</td>
<td>$\frac{1}{\rho \left( \sum_{j \neq i} c_j M_j - M_i \right)}$</td>
</tr>
<tr>
<td>$c_i = \frac{\rho}{M_i + \sum_{j \neq i} \left( \frac{M_j}{M_i} \frac{c_j}{c_i} \left( 1 - \frac{M_j}{M_i} \right) \right)}$</td>
<td>$\frac{\rho w_i}{M_i}$</td>
<td>$\frac{\rho}{1 + \sum_{j \neq i} M_j m_j + M_i}$</td>
<td>$\frac{1}{\rho \left( \sum_{j \neq i} c_j M_j - M_i \right)}$</td>
</tr>
</tbody>
</table>

$\rho$ - density of solution; $M_i$ - molar masses of $i$. For relations for 2-component systems, set summations to 0.
Ethene is a chemical produced in large volumes both as a monomer for polymerization to produce poly(ethylene) as well as a reagent to produce a host of chemical intermediates. What is surprising is that in spite of the great commercial utilization of ethene, the published solubility data are, for the most part, scanty; only in a very few instances are the solubilities corroborated by two or more groups of researchers for any one solvent.

Ethene solubilities have been collected from technical publications up to the end of 1991 with the help of a number of IUPAC members from around the world; these data have since been compiled and critically evaluated in this Solubility of Ethene volume. It is anticipated that use will be made of these data in the development and operation of processes for the production and separation of ethene and products derived from it.

Certain phase equilibrium data involving high concentrations of ethene in the dense phase have been excluded from this volume. The exclusions are those at extremely low temperatures, generally termed vapor-liquid equilibria, as well as those at pressures above the critical pressure for ethene, termed the supercritical equilibrium region. The criteria for these fore-mentioned equilibria are considered to be outside the scope of this volume. Instead, this volume deals exclusively with the regular solubilities of the gas in pure solvents and mixed solvent solutions.

The physical and solution properties of ethene can be compared with those of ethane. Because of its lower molecular weight and lower normal boiling point, ethene is often less soluble in simple, non-polar solvents than ethane. On the other hand, because of its unsaturation or its higher chemical activity, ethene is often more soluble in polar and/or associating solvents than is ethane. Further, the molar volume of ethene gas differs from that of an ideal gas; the extent of the deviation is customarily expressed in terms of its second virial coefficient. Using the second virial coefficients from Dymond and Smith (1) an equation expressing the ethene molar volume as a function of temperature (from $T = 240$ K to $T = 450$ K) was developed.

For the second virial coefficient:

$$B = -3.083 \times 10^7 (T/K)^{-2.162}$$  (1)

For molar volume:

$$V = 0.5 C + 0.5 [C^2 + 4BC]^{0.5}$$  (2)

In the above equations B, C and V are in cm$^3$/mol and $C = RT/P$.

The magnitude of the deviation from ideality is relatively small, ranging from 1.0% at 240 K to 0.1% at 450 K, but not negligible. As much as possible in this volume, where published solubilities are reported on a volumetric basis for the gas, the true gas molar volumes are used in converting the gas volumes to the number of moles of dissolved gas.

In the critical evaluations of the solubilities, two equations are used to describe the mole fraction solubilities as a function of the saturation temperature at constant gas partial pressure, and as a function of the gas partial pressure at constant temperature:

$$\log x = A + B (T/K)^{-1} + C \log(T/K)$$  (3)

$$\log x = D + E \log(p/MPa) + F(p/MPa)$$  (4)
In the above equations A-F are constants. For the simplest relation between solubility and temperature the constant C is equal to zero; however, in certain cases, the empirical correction term gives an improved representation of the solubility data. Similarly, if Henry's law applies, the first three terms of equation (4) represent another form of Henry's law and the constant D is related to Henry's constant while the constant E is equal to 1. For data which are not exactly described by Henry's law, the constant E varies somewhat from 1 and the constant F allows for some curvature of the log x - log p relation. A graph of log x versus log p is useful for solubilities obtained over a range of pressures because at the higher pressures the scale is compressed, but at lower pressures the scale is expanded while the linear relation between log x and log p is still maintained if Henry's law is obeyed. Therefore, it is possible to extrapolate high pressure solubility data to lower pressures and sometimes to 0.1013 MPa for comparison with solubilities obtained at this lower, atmospheric pressure. In some cases, this procedure serves as a consistency check for solubility data. A combined equation, a summation of equations (3) and (4), is also used to represent certain solubility data as a function of both temperature and gas partial pressure. The constants are evaluated by simple regression, or, if necessary by multivariate regression.

As the title page shows, this volume is the product of the efforts of a number of people: contributors, members of the Editorial Board past and present, and other members of the IUPAC Commission V8. I wish to acknowledge their combined contributions in their various capacities and to thank them for it. Finally, I wish to thank Francine Pétrin, and my wife, Bev, who did much of the word processing for the data sheets and critical evaluations.

Walter Hayduk
Ottawa, Canada
June 1994.

Critical Evaluation of Ethene Solubility in Water for Pressures Less Than 0.2 MPa

Considering the importance of ethene industrially (mostly as a feedstock) it is surprising that there have been so few studies of its solubility in water. In fact, most of the measurements were made only at one temperature, with only Ref. 3, 4, and 9 at more than one temperature. The best of the earlier data and those which cover the widest temperature range (287-346 K) are those of Morrison and Billett (3). The data of Wu et al. (10) and Orcutt and Seevers (2) are in reasonable accord with (3). An initial least squares fitting of the 14 points in (3) showed that the value at 294.25 K was significantly deviant. The remaining 13 points were fit to yield:

\[ \ln x_1 = -66.9156 + 92.2101/t + 24.3792 \ln t \]  

(1)

In the above equation \( t = T/100 \) K and \( x_1 \) is for a gas partial pressure of 101.3 kPa. The standard deviation in \( \ln x_1 \) was 0.0036 and the standard deviation in \( x_1 \) was 2.5 E-7 for an average standard deviation of 0.39%. The compiler of the Morrison and Billett paper estimated the precision of the solubility measurements to be 2%. This is obviously the best of the older data.

Tentative values of solubility based on Eq. (1) expressed as Henry coefficient, \( H_{1.2} (T, P_{S,2}) \), mole fraction at 101.325 kPa partial pressure of gas, \( x_1 \), and the Ostwald coefficient at infinite dilution, \( L_{1.2}^{\infty} \), are given in Table 1.

This table also gives tentative values of changes in the cited thermodynamic functions on solution. The mole fraction was simply calculated as \( 101.325/\ln x_1 (T, P_{S,2}) \) since (11) shows that this results in an error of less than 0.15%. The thermodynamic functions were calculated in a straightforward manner (12).

Table 1: Tentative values for the solubility of ethene in water for a gas partial pressure of 0.1013 MPa

<table>
<thead>
<tr>
<th>T/K</th>
<th>( 10^{-9} H_{1.2} / Pa )</th>
<th>( 10^5 x_1 )</th>
<th>( L_{1.2}^{\infty} )</th>
<th>( \Delta H_f^0 / \text{kJ mol}^{-1} )</th>
<th>( \Delta S_f^0 / \text{J mol}^{-1} \text{K}^{-1} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>278.15</td>
<td>0.6800</td>
<td>14.71</td>
<td>0.1863</td>
<td>-20.29</td>
<td>-146.3</td>
</tr>
<tr>
<td>283.15</td>
<td>0.7909</td>
<td>12.64</td>
<td>0.1630</td>
<td>-19.27</td>
<td>-142.7</td>
</tr>
<tr>
<td>288.15</td>
<td>0.9082</td>
<td>11.01</td>
<td>0.1444</td>
<td>-18.26</td>
<td>-139.1</td>
</tr>
<tr>
<td>293.15</td>
<td>1.031</td>
<td>9.70</td>
<td>0.1293</td>
<td>-17.25</td>
<td>-135.7</td>
</tr>
<tr>
<td>298.15</td>
<td>1.156</td>
<td>8.65</td>
<td>0.1171</td>
<td>-16.23</td>
<td>-132.2</td>
</tr>
<tr>
<td>303.15</td>
<td>1.284</td>
<td>7.79</td>
<td>0.1071</td>
<td>-15.22</td>
<td>-128.9</td>
</tr>
<tr>
<td>308.15</td>
<td>1.412</td>
<td>7.08</td>
<td>0.0988</td>
<td>-14.21</td>
<td>-125.5</td>
</tr>
<tr>
<td>313.15</td>
<td>1.537</td>
<td>6.50</td>
<td>0.0921</td>
<td>-13.19</td>
<td>-122.3</td>
</tr>
<tr>
<td>318.15</td>
<td>1.660</td>
<td>6.02</td>
<td>0.0865</td>
<td>-12.18</td>
<td>-119.1</td>
</tr>
<tr>
<td>323.15</td>
<td>1.777</td>
<td>5.63</td>
<td>0.0818</td>
<td>-11.17</td>
<td>-115.9</td>
</tr>
</tbody>
</table>
COMPONENTS:
1. Ethene; C2H4; [74-85-1]
2. Water; H2O; [7732-18-5]

EVALUATOR:
Rubin Battino
Department of Chemistry
Wright State University
Dayton, OH 45435 USA
April, 1994

CRITICAL EVALUATION:

References
COMPONENTS: ORIGINAL MEASUREMENTS:

(1) Ethene; C₂H₄; [74-85-1]
(2) Water; H₂O; [7732-18-5]

Clever, H. L.; Baker, E. R.; Hale, W. R.

VARIABLES:

\[ T/K = 303.15 \]
\[ P_t/kPa = 101.3 \]

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>Temperature t/°C</th>
<th>Bunsen Coefficient ( \alpha )/cm³(STP)cm⁻¹atm⁻¹</th>
<th>Ostwald Coefficient ( L/cm³ cm⁻¹ )</th>
<th>Mol Fraction ( 10^2x_1 )</th>
<th>Molality ( 10^3m_1/mol kg⁻¹ )</th>
<th>Henry's Constant ( 10^kK_H/kPa )</th>
</tr>
</thead>
<tbody>
<tr>
<td>30.0</td>
<td>0.0982</td>
<td>0.1090</td>
<td>7.98</td>
<td>4.43</td>
<td>1.27</td>
</tr>
</tbody>
</table>

\[ a \] All values except the Bunsen coefficient were calculated by the compiler. Values for 1 atm (101.3 kPa) assuming Henry's law.

The ethene molar volume at STP, \( V_j/cm^3 mol⁻¹ = 22,246 \).

Henry's constant, \( K_H/kPa = (P_j/kPa)/x_j \)

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The apparatus and method were similar to those described by Markham and Kobe (ref 1).

The water was degassed by refluxing under partial vacuum, and transferred to the solubility apparatus without contact with atmospheric gases. The solubility of ethene at a total pressure of one atm (101.3 kPa) was measured by observing the volume of gas absorbed by 88.5 cm³ of water at 30 °C.

SOURCE AND PURITY OF MATERIALS:

(1) Ethene. Matheson Co., Inc. Stated to be 99.5 % minimum purity.
(2) Water. Distilled.

ESTIMATED ERROR:

\[ \delta T/K = \pm 0.05 \]
\[ \delta \alpha/\alpha = \pm 0.01 \]

REFERENCES:

1. Markham, A. E.; Kobe, K. A.
J. Am. Chem. Soc. 1941, 63, 449.
**COMPONENTS:**
1. Ethene; \( \text{C}_2\text{H}_4; [74-85-1] \)
2. Water; \( \text{H}_2\text{O}; [7732-18-5] \)

**ORIGIANAL MEASUREMENTS:**

**VARIABLES:**
- \( T/K = 298.15 \)
- \( P/kPa = 100 \text{ (1 bar) } \)

**PREPARED BY:**
W. Hayduk

**EXPERIMENTAL VALUES:**

<table>
<thead>
<tr>
<th>( T/K )</th>
<th>( K/\text{Bar} )</th>
<th>( 1/\text{H/atm (mole fraction)} )</th>
<th>( 1/\text{L/cm}^3 \text{ gas(cm}^3 \text{ solvent)})</th>
<th>( 10^5x_1 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>298.15</td>
<td>11490</td>
<td>11590</td>
<td>0.118</td>
<td>8.63</td>
</tr>
</tbody>
</table>

1Calculated by compiler.
2Calculated by compiler for a gas partial pressure of 101.325 kPa.

Values personally received from the first author for the gas and liquid phase compositions corresponding to a pressure of 1 bar were respectively: \( y_1 = 0.968 \), and \( x_1 = 0.0000824 \text{ mole fraction.} \)

**AUXILIARY INFORMATION**

**METHOD APPARATUS/PROCEDURE:**
Ethylene gas was stored in a glass burette equipped with an accurate manometer for measuring pressure and situated in a constant temperature air bath. A known quantity of completely degassed solvent was charged into an equilibrium cell immersed in a liquid bath. The volume of gas absorbed was measured after the gas was admitted into the cell. The solubility was determined from the quantities of gas and solvent used. The apparatus and procedure are described in detail in reference 1.

**SOURCE AND PURITY OF MATERIALS:**
1. Ethene purity was 99.9 vol. percent.
2. Water was bidistilled and had a conductivity of 2 micromhos/cm.

**ESTIMATED ERROR:**
- \( \delta P/kPa = \pm 0.05 \)
- \( \delta T/K = \pm 0.01 \)
- \( \delta L/L = \pm 0.01 \)

**REFERENCES:**
1. Zeck, S.
COMPONENTS:
1. Ethene; C\textsubscript{2}H\textsubscript{4}; [74-85-1]
2. Water; H\textsubscript{2}O; [7732-18-5]

ORIGINAL MEASUREMENTS:
Narasimhan, S.; Natarajan, G.S.;
Nageshwar, G.D.

VARIABLES: \( T/K = 293.15-303.15 \)
\( P/kPa = 101.325 \)

PREPARED BY:
W. Hayduk

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>( t/\degree C )</th>
<th>( T/K )</th>
<th>Ethene Solubility ( a/g(10^6 \text{g water})^{-1} )</th>
<th>Mole Fraction, ( 10^5x_1 )</th>
<th>*Henry’s Constant H/atm(mole fraction)(^{-1} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>293.15</td>
<td>143</td>
<td>9.40</td>
<td>10640</td>
</tr>
<tr>
<td>25</td>
<td>298.15</td>
<td>119</td>
<td>7.89</td>
<td>12670</td>
</tr>
<tr>
<td>30</td>
<td>303.15</td>
<td>104</td>
<td>6.97</td>
<td>14340</td>
</tr>
</tbody>
</table>

*Calculated by compiler. In the calculations it is assumed that the solubility as given is for a total pressure of one atmosphere. The mole fraction, \( x_1 \), is for a partial pressure of 101.325 kPa and \( H \) is based on the ethene partial pressure.

It was confirmed by private communication with Dr. Nageshwar that \( a \) was for a total pressure of one atmosphere.

AUXILIARY INFORMATION

METHOD APPARATUS/PROCEDURE:
The solvent was held in a jacketed burette. Constant temperature water was circulated through the jacket. Gas was bubbled through the solvent until saturated. The dissolved gas content was determined by an electrometric dead-stop titration technique which yielded the bromine number. The electrometric titrator was based on a design given in reference 1.

SOURCE AND PURITY OF MATERIALS:
1. Ethene prepared by catalytic dehydration of ethanol over activated alumina at 350-400°C and analyzed by chromatography. Purity not given.
2. Water treatment not specified.

ESTIMATED ERROR:
\[ \frac{\delta a}{a} = \pm 3\% \]

REFERENCES:
1. Dubois, H.D.; Skoog, D.A.
COMPONENTS:
1. Ethene; \( \text{C}_2\text{H}_4; \) [74-85-1]
2. Water; \( \text{H}_2\text{O}; \) [77-32-18-5]

ORIGINAL MEASUREMENTS:
Yano, T.; Kidaka, T.; Miyamoto, H.; Murakami, T.

VARIABLES:
\( T/K = 298.15 \)
\( P/\text{kPa} = 101.325 \)

PREPARED BY:
W. Hayduk

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>Mole Fraction Ethene, ( 10^3 \chi_1 ) For:</th>
<th>( \text{L}/\text{cm}^3\text{gas cm}^{-3} )</th>
<th>( \text{H/atm} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>( T/K )</td>
<td>( P = 101.325 \text{ kPa} )</td>
<td>( p_1 = 101.325 \text{ kPa} )</td>
</tr>
<tr>
<td>Ethene</td>
<td>25.0</td>
<td>298.15</td>
</tr>
</tbody>
</table>

\(^1\)Calculated by compiler.

\(^2\)Although not specifically stated in paper it was assumed by the compiler that the reported solubility was for a total pressure of 101.325 kPa; therefore, the solubility for a partial pressure of 101.325 kPa was calculated assuming Henry's law and an ethene molar volume of 24320 cm\(^3\)/mole at 298.15 K and 101.325 kPa.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
A glass apparatus was employed in which the uptake of gas by a known volume of solvent in a dissolution cell was volumetrically determined. The gas was displaced by mercury as the gas dissolved at constant pressure. A magnetically operated gas circulating pump and bubbling tip were provided for bubbling the gas through the solvent in the dissolution cell.

SOURCE AND PURITY OF MATERIALS:
1. Source and purity not given.
2. Treatment not specified.

ESTIMATED ERROR:
\( \delta \chi_1 / \chi_1 = \pm 0.03 \) (Compiler)

REFERENCES:
COMPONENTS:
1. Ethene; C₂H₄; [74-85-1]
2. Water; H₂O; [7732-18-5]

ORIGINAL MEASUREMENTS:
McAuliffe, C.

VARIABLES:
T/K = 298.15 ± 1.5
P/kPa = 101.325

PREPARED BY:
W. Hayduk

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>t/C</th>
<th>T/K</th>
<th>Ethene Solubility (s/g gas (10⁶ g water))⁻¹</th>
<th>Mole Fraction, ¹H/atm(mole fraction)⁻¹</th>
<th>Henry's Constant</th>
</tr>
</thead>
<tbody>
<tr>
<td>25.0</td>
<td>298.15</td>
<td>131 ± 10</td>
<td>8.41</td>
<td>11890</td>
</tr>
</tbody>
</table>

¹Calculated by compiler. It is assumed that the solubility as given is for a gas partial pressure of 101.325 kPa.

The variation for a, as given, is from the original paper corresponding to a standard deviation.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
A bottle was three-fourths filled with distilled water. A gas pressure of 1 atm was maintained over the water from a rubber balloon reservoir in the line from the gas cylinder. The bottle was vigorously shaken for 5-10 min to establish equilibrium. The equilibrated solution was allowed to stand at least 30 min prior to analysis for separation of gas bubbles. Samples of aqueous solutions of 50 µl were injected into a U-tube desorber containing firebrick and Ascarite drying agent, heated to 100°C and through which helium carrier gas from a gas chromatograph was allowed to flow. The GC analyzer used a hydrogen flame ionization detector.

SOURCE AND PURITY OF MATERIALS:
1. Ethene minimum purity 99.0%.
2. Distilled water.

ESTIMATED ERROR:
δs/a = ± 8% (Compiler)
δT/K = ± 1.5

REFERENCES:
**COMPONENTS:**

1. Ethene; \( \text{C}_2\text{H}_4; [74-85-1] \)
2. Water; \( \text{H}_2\text{O}; [7732-18-5] \)

**VARIABLES:**

\[ \frac{T}{K} = 273.153 \]
\[ P/kPa = 101.325 \]

**ORIGINAL MEASUREMENTS:**

Truchard, A.M.; Harris, H.G.; Himmelblau, D.M.


**PREPARED BY:**

W. Hayduk

**EXPERIMENTAL VALUES:**

<table>
<thead>
<tr>
<th>( \frac{T}{K} )</th>
<th>Henry's Constant ( H/\text{atm(mole fraction)}^{-1} )</th>
<th>¹Mole Fraction Ethane, ( (10^6)\omega_1 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>273.15</td>
<td>5280</td>
<td>1.894</td>
</tr>
</tbody>
</table>

¹Mole fraction ethene calculated by compiler for a gas partial pressure of 101.325 kPa.

**AUXILIARY INFORMATION**

**METHOD/APPARATUS/PROCEDURE:**

Two calibrated glass spheres, one larger than the other, immersed in a bath connected to a mercury manometer were used. Approximately 200 cm³ of solvent was placed in the larger sphere and both were thoroughly evacuated. A supply of ethene was charged to the smaller flask to 2 atm pressure. Ethene was admitted to the flask containing the solvent and allowed to reach equilibrium by stirring. The pressures were read and material balances made to determine the solubility. Solubilities were measured for equilibrium pressures between 50 and 1300 mm of mercury pressure and Henry's law was found to apply in all cases.

**SOURCE AND PURITY OF MATERIALS:**

1. Ethene source and purity not given.
2. Water treatment not specified.

**ESTIMATED ERROR:**

\[ \delta\frac{H}{H} = \pm 0.02 \]
\[ \delta\frac{T}{K} = \pm 0.05 \]

**REFERENCES:**
COMPONENTS:

1. Ethene; C₂H₄; [74-85-1]
2. Water; H₂O; [7732-18-5]

VARIABLES:

\[ T/K = 293.15-303.15 \]
\[ P/kPa = 101.325 \]

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>( t/C )</th>
<th>( T/K )</th>
<th>( \text{Inverse of Henry's Constant,} 10^4 \frac{h}{\text{mole (1 atm)}}^{-1} )</th>
<th>( \text{Ethene Mole Fraction,} 10^5 x )</th>
<th>( \text{Henry's Constant H/atm (mole fraction)}^{-1} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>20.00</td>
<td>293.15</td>
<td>5.17</td>
<td>9.330</td>
<td>10718</td>
</tr>
<tr>
<td>25.00</td>
<td>298.15</td>
<td>4.66</td>
<td>8.419</td>
<td>11878</td>
</tr>
<tr>
<td>30.00</td>
<td>303.15</td>
<td>4.11</td>
<td>7.437</td>
<td>13447</td>
</tr>
</tbody>
</table>

1 Calculated by compiler.
2 Mole fraction solubility calculated by compiler for a partial pressure of 101.325 kPa.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

A 200 cm³ glass flask was connected to a pressure-measuring manometer by means of a horizontally-mounted spiral tube. The spiral tube permitted the flask to be shaken with an amplitude of up to 2 cm for equilibration. The solvent (80-125 cm³) was deaerated in the flask. The change in pressure of a known volume of gas was measured from which the solubility was determined. The total volume of the apparatus was initially determined by weighing the apparatus filled with distilled water. The "distribution constant", \( h \), was determined for pressures below 101.325 kPa.

SOURCE AND PURITY OF MATERIALS:

1. Ethene was from Matheson, purity 99.5%.
2. Water was distilled.

ESTIMATED ERROR:

\[ \delta T/K = \pm 0.02 \]
\[ \delta h/h = \pm 0.01 \]

REFERENCES:

   J. Amer. Chem. Soc. 1951, 73, 3792.
COMPONENTS:
1. Ethene; C$_2$H$_4$; [74-85-1]
2. Water; H$_2$O; [7732-18-5]

ORIGINAL MEASUREMENTS:
Morrison, T.J.; Billett, F.

VARIABLES:
$T/K = 286.9 - 346.0$
$P/kPa = 101.3$

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>$t/^{\circ}C$</th>
<th>$T/K$</th>
<th>$s/10^5$ cm$^3$ (STP) kg$^{-1}$</th>
<th>$L/10^{3} x_1$</th>
<th>$10^3 \alpha_{Ostwald}$ cm$^3$</th>
<th>$10^3 \alpha_{Bunsen}$ cm$^3$</th>
</tr>
</thead>
<tbody>
<tr>
<td>13.8</td>
<td>286.95</td>
<td>140.9</td>
<td>11.40</td>
<td>0.1480</td>
<td>0.1409</td>
</tr>
<tr>
<td>17.8</td>
<td>290.25</td>
<td>128.8</td>
<td>10.42</td>
<td>0.1367</td>
<td>0.1287</td>
</tr>
<tr>
<td>20.5</td>
<td>293.65</td>
<td>118.0</td>
<td>9.54</td>
<td>0.1266</td>
<td>0.1176</td>
</tr>
<tr>
<td>21.1</td>
<td>294.25</td>
<td>115.1</td>
<td>9.31</td>
<td>0.1238</td>
<td>0.1149</td>
</tr>
<tr>
<td>25.0</td>
<td>298.15</td>
<td>107.2</td>
<td>8.67</td>
<td>0.1167</td>
<td>0.1069</td>
</tr>
<tr>
<td>30.3</td>
<td>303.45</td>
<td>95.5</td>
<td>7.72</td>
<td>0.1056</td>
<td>0.0951</td>
</tr>
<tr>
<td>35.2</td>
<td>308.35</td>
<td>87.3</td>
<td>7.05</td>
<td>0.0980</td>
<td>0.0868</td>
</tr>
<tr>
<td>40.0</td>
<td>313.15</td>
<td>81.1</td>
<td>6.55</td>
<td>0.0923</td>
<td>0.0805</td>
</tr>
<tr>
<td>44.6</td>
<td>317.75</td>
<td>75.2</td>
<td>6.07</td>
<td>0.0866</td>
<td>0.0745</td>
</tr>
<tr>
<td>49.0</td>
<td>322.15</td>
<td>70.5</td>
<td>5.69</td>
<td>0.0822</td>
<td>0.0697</td>
</tr>
<tr>
<td>54.9</td>
<td>328.05</td>
<td>65.5</td>
<td>5.29</td>
<td>0.0775</td>
<td>0.0646</td>
</tr>
<tr>
<td>60.2</td>
<td>333.35</td>
<td>62.2</td>
<td>5.02</td>
<td>0.0745</td>
<td>0.0611</td>
</tr>
<tr>
<td>65.0</td>
<td>338.15</td>
<td>59.2</td>
<td>4.78</td>
<td>0.0719</td>
<td>0.0581</td>
</tr>
<tr>
<td>72.9</td>
<td>346.05</td>
<td>56.1</td>
<td>4.53</td>
<td>0.0694</td>
<td>0.0548</td>
</tr>
</tbody>
</table>

1Original data expressed as cm$^3$ (STP) per 1000 g water at a total pressure of 101.3 kPa. A smoothing equation (ref. 1) is as follows:

$$\log_{10} s = -69.697 + 3900/T + 23.70 \log_{10} T \div T/K$$

2Calculated by Compiler for a gas partial pressure of 101.3 kPa and using real gas molar volumes.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
The equipment consisted of a solvent degassing system, an absorption spiral and a gas burette for measuring the gas volume. Degassed solvent was allowed to flow down the absorption spiral containing the gas which was saturated with solvent vapor, at a total pressure of one atmosphere. The volume of gas absorbed was measured by means of the attached burette system. The volume of solution was also accumulated in a burette. Details were previously described in reference 2.

SOURCE AND PURITY OF MATERIALS:
1. Ethene prepared from ethanol using phosphoric acid. Actual purity not determined.
2. Water degassed. No additional details given.

ESTIMATED ERROR:
$$\delta T/K = \pm 0.02$$
$$\delta s/s = \pm 0.02 \text{ (Compiler)}$$

REFERENCES:
1. Morrison, T.J.
2. Morrison, T.J.
COMPONENTS:
1. Ethene; C₂H₄; [74-85-1]
2. Water; H₂O; [7732-18-5]

ORIGINAL MEASUREMENTS:
Orcutt, F.S.; Seevers, M.H.

VARIABLES:
\[ T/K = 298.15 \]
\[ P/kPa = 101.325 \]

PREPARED BY:
W. Hayduk

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>t/°C</th>
<th>T/K</th>
<th>Bunsen Coefficient ( \alpha/\text{cm}^3\text{gas(STP)} )</th>
<th>Ostwald Coefficient ( L/\text{cm}^3\text{gas} )</th>
<th>Mole Fraction ( x_1 \times 10^5 \text{ atm (mole fraction)} )</th>
<th>Henry's Constant/</th>
</tr>
</thead>
<tbody>
<tr>
<td>25</td>
<td>298.15</td>
<td>0.108</td>
<td>0.118</td>
<td>8.771</td>
<td>11400</td>
</tr>
</tbody>
</table>

'Calculated by Compiler.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
The liquid is saturated by ordinary tonometer methods. It is then transferred to a manometric extraction chamber (which was previously evacuated) by a modified Ostwald pipette as described in reference 1. The gas is then extracted and by comparing the manometer reading after extraction to the reading obtained using a "blank" determination, the volume of gas is determined.

SOURCE AND PURITY OF MATERIALS:
1. Ethene source and purity not specified.
2. Water is deaerated by bubbling with ethene.

ESTIMATED ERROR:
\[ \sigma/\alpha = \pm 0.02(\text{Compiler}) \]

REFERENCES:
J. Biol. Chem. 1924, 61, 523.
COMPONENTS:
1. Ethene; C2H4; [74-85-1]
2. Water; H2O; [7732-18-5]

ORIGINAL MEASUREMENTS:
Grollman, A.
J. Biol. Chem. 1929, 82, 317-325.

VARIABLES:
\[ T/K = 298.15 \text{ (25.0°C)} \]
\[ p/kPa = 73.3-133.3 \]

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>Ethene Partial Pressure</th>
<th>Ostwald Coefficient ( \frac{L}{cm^3} \text{gas(cm}^3\text{ solvent)}^{-1} )</th>
<th>( p /kPa )</th>
<th>( 10^2 x )</th>
</tr>
</thead>
<tbody>
<tr>
<td>550</td>
<td>0.112</td>
<td>73.33</td>
<td></td>
</tr>
<tr>
<td>600</td>
<td>0.113</td>
<td>80.0</td>
<td></td>
</tr>
<tr>
<td>650</td>
<td>0.113</td>
<td>86.7</td>
<td></td>
</tr>
<tr>
<td>700</td>
<td>0.112</td>
<td>93.3</td>
<td></td>
</tr>
<tr>
<td>750</td>
<td>0.113</td>
<td>100.0</td>
<td></td>
</tr>
<tr>
<td>800</td>
<td>0.113</td>
<td>106.7</td>
<td></td>
</tr>
<tr>
<td>850</td>
<td>0.113</td>
<td>113.3</td>
<td></td>
</tr>
<tr>
<td>900</td>
<td>0.114</td>
<td>112.0</td>
<td></td>
</tr>
<tr>
<td>950</td>
<td>0.113</td>
<td>126.7</td>
<td></td>
</tr>
<tr>
<td>1000</td>
<td>0.113</td>
<td>133.3</td>
<td></td>
</tr>
</tbody>
</table>

Average: 0.1129 8.39

\(^2\)Mole fraction solubility for a gas partial pressure of 101.325 kPa and based on the average value for the Ostwald coefficient calculated by compiler.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
A glass bubbling-type of saturator immersed in a constant temperature bath was used. A known volume of saturated solution was transferred over mercury into a Van Slyke desorption apparatus. Gas removed in three evacuations was transferred to a sample tube where the volume was determined and a sample of the gas was analyzed. Solubilities were determined at several pressures below atmospheric and above atmospheric and expressed as Ostwald coefficients.

SOURCE AND PURITY OF MATERIALS:
1. Ethene source and purity not given.
2. Water distilled.

ESTIMATED ERROR:
\[ \delta T/K = \pm 0.05 \]
\[ \delta L /L = \pm 4\% \text{ (Compiler)} \]

REFERENCES:
COMPONENTS:
1. Ethene; C₂H₄; [74-85-1]
2. Water; H₂O; [7732-18-5]

ORIGINAL MEASUREMENTS:
Grollman, A.

VARIABLES:

| $T/\text{K}$ = 310.65 (37.5°C) |
| $P/\text{kPa}$ = 101.325 |

PREPARED BY:
W. Hayduk

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>$t/\text{C}$</th>
<th>$T/\text{K}$</th>
<th>Bunsen Coefficient $\beta/\text{cm}^3\text{gas NTP/cm}^3\text{solvent}$</th>
<th>¹Ostwald Coefficient $L/\text{cm}^3\text{gas/(cm}^3\text{solvent)}^{-1}$</th>
<th>²Solubility Mole fraction, $10^5 x_1$</th>
</tr>
</thead>
<tbody>
<tr>
<td>37.5</td>
<td>310.65</td>
<td>0.078</td>
<td>0.0887</td>
<td>6.34</td>
</tr>
</tbody>
</table>

¹Calculated by compiler.

²Calculated by compiler using a gas molar volume at a temperature of 310.65 K and a pressure of 101.325 kPa of 25360 cm³/mole.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
A glass bubbling-type of saturator immersed in a constant temperature bath was used. The gas was presaturated with water vapor. A known volume of saturated solution was transferred over mercury into a Van Slyke desorption apparatus. Gas removed in three evacuations was transferred to a sample tube where the volume was determined and a sample of the gas was analyzed. The solubilities were expressed as the Bunsen coefficients.

SOURCE AND PURITY OF MATERIALS:
1. Ethene source and purity not given.
2. Water distilled.

ESTIMATED ERROR:
$\delta \beta/\beta = \pm 0.04$ (Compiler)
$\delta T/\text{K} = \pm 0.05$

REFERENCES:
COMPONENTS:
1. Ethene; C₂H₄; [74-85-1]
2. Water; H₂O; [7732-18-5]

EVALUATOR:
Walter Hayduk
Department of Chemical Engineering
University of Ottawa
Ottawa, Ontario
Canada K1N 6N5
June 1994

CRITICAL EVALUATION:

Critical Evaluation of Ethene Solubility in Water for Pressures greater than 0.2 MPa (2 atm)

Ethene solubilities in water at elevated pressures have been reported in 6 publications (1-6) for temperatures ranging from 298 K to 573 K and pressures to 86 MPa. Data for the solubilities of mixtures of ethane and ethene in water at elevated pressures have also been reported (6). Since the solubility measurements were made at widely differing pressures and temperatures, ethene partial pressure data were needed for a meaningful evaluation. These partial pressures were calculated based on the gas phase compositions where reported or they were evaluated from the vapour pressure of water assuming Raoult's law applies for water. Both approaches gave very similar results.

Values of log \( x \) versus log \( p \) were plotted for each set of data. A linear relationship usually suggests a satisfactory consistency in the data but such a test is not rigorous and, in general, deviations from linearity are to be expected at high pressures. These plots were used to extrapolate the solubilities to obtain a value at a partial pressure of 0.1013 MPa. The procedure for the extrapolation was to give preference to the data for the lowest pressures available, and to extrapolate these values to a pressure of 0.1013 MPa assuming a direct relationship between log \( x \) and log \( p \). It appears likely that Henry's law will be best obeyed at the lowest pressures and if it is, as data are extrapolated to low pressures, the slope of the log \( x \) - log \( p \) line will be equal to one. It is noted that at elevated pressures the log \( x \) - log \( p \) line is often somewhat curved and the slope is often less than one.

Solubilities which have been extrapolated to an effective gas partial pressure of 0.1013 MPa are compared with those actually measured at a partial pressure of 0.1013 MPa where possible, in Table 1 and Figure 1. The source of the oxygen solubilities in water for Figure 1 is the Solubility Data Series volume on Oxygen (7). From Figure 1 it is evident that all the six sources of data when extrapolated using Henry's law are relatively consistent, agreeing with one another, agreeing with the low pressure solubilities of ethene in water, and having a similar temperature effect on solubility as that for oxygen dissolving in water. Although certain individual extrapolated values show deviations of as much as 20% from a line representing the data, such deviations are probably mostly the result of extrapolations over large pressure ranges, rather than of errors in the experimental results themselves. The data of Anthony and McKetta (6) and Davis and McKetta (2) appear to be the most consistent of the data. It is apparent that the solubility of ethene in water has a minimum, as does the solubility of oxygen in water, at a temperature near the normal boiling temperature of water \( (T_{np}) \). It is also apparent that the high pressure solubilities for ethene in water are accurate only to about ± 5%. It is clear, therefore, that experimental work of higher accuracy and for a larger range of pressures and for higher temperatures is required to fully define the solubility relationship for ethene in water.

The data of Bradbury et al. (1), Davis and McKetta (2), Anthony and McKetta (3,6), Sanchez and Lentz (4) and Sokolov and Konshin (5) are all classified as tentative.
COMPONENTS:
1. Ethene; C₂H₄; [74-85-1]
2. Water; H₂O; [7732-18-5]

EVALUATOR:
Walter Hayduk
Department of Chemical Engineering
University of Ottawa
Ottawa, Ontario
Canada K1N 6N5
June 1994

CRITICAL EVALUATION:

Table 1 Comparison of extrapolated high pressure solubilities with those measured at 0.1013 MPa pressure for various temperatures.

<table>
<thead>
<tr>
<th>T/K</th>
<th>10^5 x₁ For 0.1013 MPa pressure</th>
<th>10^5 x₁ Extrapolated to 0.1013 MPa</th>
<th>Difference</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>298.15</td>
<td>8.70</td>
<td>10.4</td>
<td>+19.5</td>
<td>(5)</td>
</tr>
<tr>
<td>308.15</td>
<td>7.08</td>
<td>6.85</td>
<td>-3.4</td>
<td>(1)</td>
</tr>
<tr>
<td>310.93</td>
<td>6.75</td>
<td>6.90</td>
<td>+2.2</td>
<td>(2)</td>
</tr>
<tr>
<td>327.59</td>
<td>5.32</td>
<td>4.95</td>
<td>-7.1</td>
<td>(6)</td>
</tr>
<tr>
<td>328.15</td>
<td>5.29</td>
<td>6.05</td>
<td>+14.4</td>
<td>(1)</td>
</tr>
<tr>
<td>344.26</td>
<td>4.49</td>
<td>4.32</td>
<td>-3.9</td>
<td>(3)</td>
</tr>
<tr>
<td>344.26</td>
<td>4.49</td>
<td>4.52</td>
<td>+0.7</td>
<td>(6)</td>
</tr>
<tr>
<td>348.15</td>
<td>4.34</td>
<td>4.73</td>
<td>+9.0</td>
<td>(1)</td>
</tr>
<tr>
<td>360.93</td>
<td>4.10</td>
<td>4.80</td>
<td>+17.1</td>
<td>(2)</td>
</tr>
</tbody>
</table>

Figure 1 Mole fraction ethene and oxygen solubility in water extrapolated to 0.1013 MPa partial pressure.
CRITICAL EVALUATION:
Ethane; C₂H₆; [74-84-0] and Ethene; C₂H₄; [74-85-1] Gas mixtures.

This system has been investigated by Anthony and McKetta (6). It is of interest that Henry's law is obeyed for both gas components even up to the high pressures utilized in this work. From these solubilities it is possible to estimate solubilities for lower pressures. These results are entirely consistent with those involving only two components. No comparable data are available for comparison.

The results of Anthony and McKetta (6) are classified as tentative.

References
COMPONENTS:

1. Ethene; C\textsubscript{2}H\textsubscript{4}; [74-85-1]
2. Water; H\textsubscript{2}O; [7732-18-5]

VARIABLES:

\[ T/\text{K} = 298.15 \]
\[ P/\text{MPa} = 0.20 - 1.11 \]

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>( t/\text{°C} )</th>
<th>( T/\text{K} )</th>
<th>( P/\text{MPa} )</th>
<th>( C_1/\text{mM} )</th>
<th>( x_1, \text{mol fraction} )</th>
<th>( K_d )</th>
<th>( H/\text{MPa (mol fraction)} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>25.0</td>
<td>298.15</td>
<td>0.20</td>
<td>11.6</td>
<td>0.000210</td>
<td>0.143</td>
<td>950 ± 50</td>
</tr>
<tr>
<td>0.31</td>
<td>298.15</td>
<td>0.31</td>
<td>18.0</td>
<td>0.000325</td>
<td>± 0.005</td>
<td></td>
</tr>
<tr>
<td>0.51</td>
<td>298.15</td>
<td>0.51</td>
<td>29.6</td>
<td>0.000535</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.71</td>
<td>298.15</td>
<td>0.71</td>
<td>41.8</td>
<td>0.000755</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.91</td>
<td>298.15</td>
<td>0.91</td>
<td>52.8</td>
<td>0.000954</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.11</td>
<td>298.15</td>
<td>1.11</td>
<td>64.4</td>
<td>0.001164</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1. Calculated by Compiler with \( C_1 \) taken to mean millimolar or millimoles per litre.
2. Distribution constant \( K_d = C_1/C \) where \( C_1 \) = mole/litre in liquid and \( C \) = mole/litre in gas.
3. Stated by authors to be \( \lim (p_1/x_1) \) for \( p_1 = \) partial pressure of gas.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The solubilities were measured using a stirred reactor with a magnetic drive having a volume of 250 cm\textsuperscript{3} and equipped with a pressure gauge and a surrounding jacket for temperature control. Gas and sample handling systems were attached. A volume of 100-200 cm\textsuperscript{3} of deaerated solvent was charged to the reactor and equilibrated. A small liquid sample chamber was used to confine a known volume of saturated solution. The sample was then completely evaporated into a much larger vessel. Helium carrier gas was used to increase the pressure of the vapor-gas mixture to about 0.12 MPa. The sample was then analyzed by gas chromatography. Details are in Ref. 1.

SOURCE AND PURITY OF MATERIALS:

No information about gas or solvent source or purity was supplied.

ESTIMATED ERROR:

\[ \delta x/x = \pm 5\% \] (Compiler)

REFERENCES:

1. Sokolov, Yu. A.; Konshin, A.I.
COMPONENTS:
1. Ethene; C₂H₄; [74-85-1]
2. Water; H₂O; [7732-18-5]

ORIGINAL MEASUREMENTS:
Sanchez, M.; Lentz, H.

VARIABLES:  \( T/K = 439.15 - 573.15 \)
\( P/\text{MPa} = 10.0 - 94.5 \)

PREPARED BY: W. Hayduk

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>( t/°C )</th>
<th>( T/K )</th>
<th>( \text{Pressure} )</th>
<th>( \text{in Gas, } y_1 )</th>
<th>( \text{in Liquid, } x_1 )</th>
<th>( \text{Partial Pressure Ethene, } p_1/\text{MPa} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>166</td>
<td>439.15</td>
<td>100</td>
<td>0.860</td>
<td>0.004</td>
<td>8.60</td>
</tr>
<tr>
<td></td>
<td></td>
<td>150</td>
<td>0.890</td>
<td>0.005</td>
<td>13.35</td>
</tr>
<tr>
<td></td>
<td></td>
<td>635</td>
<td>0.959</td>
<td>0.010</td>
<td>60.90</td>
</tr>
<tr>
<td></td>
<td></td>
<td>945</td>
<td>0.910</td>
<td>(0.008)²</td>
<td>86.00</td>
</tr>
<tr>
<td>250</td>
<td>523.15</td>
<td>190</td>
<td>0.630</td>
<td>0.014</td>
<td>11.97</td>
</tr>
<tr>
<td></td>
<td></td>
<td>240</td>
<td>0.688</td>
<td>0.018</td>
<td>16.51</td>
</tr>
<tr>
<td></td>
<td></td>
<td>375</td>
<td>0.766</td>
<td>0.026</td>
<td>28.73</td>
</tr>
<tr>
<td></td>
<td></td>
<td>570</td>
<td>0.750</td>
<td>0.034</td>
<td>42.75</td>
</tr>
<tr>
<td></td>
<td></td>
<td>730</td>
<td>0.810</td>
<td>0.040</td>
<td>59.13</td>
</tr>
<tr>
<td>300</td>
<td>573.15</td>
<td>240</td>
<td>0.516</td>
<td>0.024</td>
<td>12.38</td>
</tr>
<tr>
<td></td>
<td></td>
<td>380</td>
<td>0.597</td>
<td>0.036</td>
<td>22.69</td>
</tr>
<tr>
<td></td>
<td></td>
<td>550</td>
<td>0.550</td>
<td>0.047</td>
<td>30.25</td>
</tr>
</tbody>
</table>

¹Calculated by compiler.
²Brackets as in original paper.
Smoothed values as obtained by extrapolation and interpolation are also available in this paper.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
The apparatus consisted of a high pressure piston pump, Bourdon pressure gauges, a stainless steel capillary tube equilibrium cell 4.7 mm in inside diameter, a tubular storage chamber for the gas, as well as an associated temperature sensing element, sampling probes and valves. The apparatus was mounted in a constant temperature chamber. The equilibrium cell was charged with a known quantity of solvent by rotating it to a horizontal position. The quantity of gas was determined by material balance and the PV relation in the gas supply tube.

SOURCE AND PURITY OF MATERIALS:
1. Ethene purity was specified to be 99.99%.
2. Water was double distilled.

ESTIMATED ERROR:
\( \delta T/K = \pm 0.5 \)
\( \delta y_1/x_1 = \pm 0.05 \) or \( \pm 5\% \) (Compiler)

REFERENCES:
## COMPONENTS:

1. Ethene; $C_2H_4$; [74-85-1]

2. Water; $H_2O$; [7732-18-5]

## ORIGINAL MEASUREMENTS:

Anthony, R.G.; McKetta, J.J.


## VARIABLES:

$T/K = 310.9-410.9$

$P/MPa = 3.43-34.40$

## PREPARED BY:

W. Hayduk

## EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>$t/P(1/T)$</th>
<th>Total Pressure $p/psia$</th>
<th>Partial Pressure $p/MPa$</th>
<th>Ethene in Liquid, $10^3x_1$</th>
<th>Water in Vapor, $10^3y_1$</th>
</tr>
</thead>
<tbody>
<tr>
<td>99.9(310.87)</td>
<td>497.2</td>
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<td>10.22</td>
<td>10.21</td>
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<td>3.538</td>
<td>3.532</td>
<td>3.530</td>
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<td>1.545</td>
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<tr>
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<td>13.81</td>
<td>13.77</td>
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<td>19.87</td>
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</tr>
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<td>3.530</td>
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<td>10.32</td>
<td>10.29</td>
<td>2.921</td>
</tr>
</tbody>
</table>

$^1$Calculated by compiler. $^2$Partial pressure $p$ is calculated from the vapor pressure of water and $p_f$ from the composition of the vapor $y_1$.

**AUXILIARY INFORMATION**

**METHOD/APPARATUS/PROCEDURE:**

The high pressure apparatus is described in reference 1. It consisted of a high pressure cell mounted in a thermostat and equipped for mixing and pressure measurement. A water analyzer (Meeco Model W) was used for the water vapor content of the vapor phase. The water phase was sampled and analyzed by means of an absolute manometer and Orsat gas burette. To maintain equilibrium in the cell during sampling, a volume of mercury was injected into the cell equal to that of the saturated solution withdrawn. The hydrocarbon was desorbed at low pressure in the Orsat gas burette at constant temperature, and then the gas volume and pressure was determined. The minimum accuracy of the liquid sampling and analysis method was stated to be $± 5\%$ as described in reference 2.

**SOURCE AND PURITY OF MATERIALS:**

1. Ethene was Phillips pure grade.

2. Water was distilled and deaerated.

**ESTIMATED ERROR:**

$\delta T/K = ± 0.1$  
$\delta p/p = ± 0.001$  
$\delta x_1/x_1 = ± 5\%$ (Reference 2)

**REFERENCES:**

1. Wehe, A.H.; McKetta, J.J.  

2. Wehe, A.H.; McKetta, J.J.  
### COMPONENTS:
1. Ethene; $\text{C}_2\text{H}_4$; [74-85-1]
2. Water; $\text{H}_2\text{O}$; [7732-18-5]

### ORIGINAL MEASUREMENTS:
Anthony, R.G.; McKetta, J.J.

### VARIABLES:
- $T/K = 310.9 - 410.9$
- $P/\text{MPa} = 3.43 - 34.40$

### EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>$t/P$ ($^\circ\text{C}$)</th>
<th>Total Pressure $P/\text{psia}$</th>
<th>Partial Pressure $p/\text{MPa}$</th>
<th>Liquid, $10^2 \xi_1$</th>
<th>Vapor, $10^3 y_1$</th>
</tr>
</thead>
<tbody>
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<td>3.826</td>
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<td>7.377</td>
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</tr>
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<td>34.22</td>
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<td>219.9 (377.54)</td>
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<td>28.15</td>
<td>27.89</td>
</tr>
<tr>
<td>220.0 (377.59)</td>
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<td>6.904</td>
<td>2.240</td>
</tr>
<tr>
<td>220.1 (377.65)</td>
<td>534.2</td>
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<td>3.565</td>
<td>1.329</td>
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<tr>
<td>220.2 (377.71)</td>
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<td>21.56</td>
<td>21.38</td>
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<td>279.7 (410.76)</td>
<td>616.7</td>
<td>4.252</td>
<td>3.911</td>
<td>1.540</td>
</tr>
</tbody>
</table>

1. Calculated by compiler. 2. Partial pressure $p$ is calculated from the vapor pressure of water and $p_1$ from the composition of the vapor $y_1$.

### AUXILIARY INFORMATION

**METHOD/APPARATUS/PROCEDURE:**
The high pressure apparatus is described in reference 1. It consisted of a high pressure cell mounted in a thermostat and equipped for mixing and pressure measurement. A water analyzer (Meeco Model W) was used for the water vapor content of the vapor phase. The water phase was sampled and analyzed by means of an absolute manometer and Orsat gas burette. To maintain equilibrium in the cell during sampling, a volume of mercury was injected into the cell equal to that of the saturated solution withdrawn. The hydrocarbon was desorbed at low pressure in the Orsat gas burette at constant temperature, and then the gas volume and pressure was determined. The minimum accuracy of the liquid sampling and analysis method was stated to be ± 5% as described in reference 2.

**SOURCE AND PURITY OF MATERIALS:**
1. Ethene was Phillips pure grade.
2. Water was distilled and deaerated.

**ESTIMATED ERROR:**
- $\delta T/K = \pm 0.1$
- $\delta P/P = \pm 0.001$
- $\delta \xi_1/\xi_1 = \pm 5\%$ (Reference 2)

**REFERENCES:**
1. Wehe, A.H.; McKetta, J.J.
2. Wehe, A.H.; McKetta, J.J.
COMPONENTS:
1. Ethene; \( \text{C}_2\text{H}_4; [74-85-1] \)
2. Water; \( \text{H}_2\text{O}; [7732-18-5] \)

ORIGINAL MEASUREMENTS:
Anthony, R.G.; McKetta, J.J.


VARIABLES: 
\[ T/K = 310.9-410.9 \]
\[ P/\text{MPa} = 3.43-34.40 \]

PREPARED BY:
W. Hayduk

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>( t/F(1 T/K) )</th>
<th>( T/K )</th>
<th>( P/\text{PSia} )</th>
<th>( I_1P/\text{MPa} )</th>
<th>( I_1P/\text{MPa} )</th>
<th>( I_1P/\text{MPa} )</th>
<th>( I_1P/\text{MPa} )</th>
<th>( I_1P/\text{MPa} )</th>
<th>( I_1P/\text{MPa} )</th>
<th>( I_1P/\text{MPa} )</th>
<th>( I_1P/\text{MPa} )</th>
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<tr>
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<td>3.652</td>
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<tr>
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<td>280.2(411.04)</td>
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</tr>
</tbody>
</table>

1 Calculated by compiler. 2 Partial pressure \( p \) is calculated from the vapor pressure of water and \( p_1 \) from the composition of the vapor \( y_1 \).

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
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1. Ethene was Phillips pure grade.
2. Water was distilled and deaerated.

ESTIMATED ERROR:
\[ \delta T/K = \pm 0.1 \]
\[ \delta P/P = \pm 0.001 \]
\[ \delta x_1/x_1 = \pm 5\% \text{ (Reference 2)} \]

REFERENCES:
1. Wehe, A.H.; McKetta, J.J.
2. Wehe, A.H.; McKetta, J.J.
COMPONENTS:
1. Ethene; C₂H₄; [74-85-1]
2. Water; H₂O; [7732-18-5]

ORIGINAL MEASUREMENTS:
Anthony, R.G.; McKetta, J.J.

VARIABLES:
\[ \frac{T}{K} = 310.9-410.9 \]
\[ \frac{P}{MPa} = 1.38-34.47 \]

PREPARED BY:
W. Hayduk

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>( t/F (\frac{1}{T/K}) )</th>
<th>Total Pressure ( P/PSia )</th>
<th>Partial Pressure ( p/MPa )</th>
<th>Ethene in Liquid ( 10^3 x_1 )</th>
<th>Water in Vapor ( 10^3 y_1 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>100 (310.93)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
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</table>

1 Calculated by compiler.

2 Partial pressure \( p \) is calculated from the vapor pressure of water and \( p_1 \) from the composition of the vapor \( y_1 \).

The data above are smoothed data as listed in the paper. continued...

AUXILIARY INFORMATION

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ESTIMATED ERROR:
\[ \delta \frac{T}{K} = \pm 0.1 \]
\[ \delta \frac{P}{P} = \pm 0.001 \]
\[ \delta x_1 / x_1 = \pm 5\% \text{ (Reference 2)} \]

REFERENCES:
1. Wehe, A.H.; McKetta, J.J.
2. Wehe, A.H.; McKetta, J.J.
**COMPONENTS:**
1. Ethene; $C_2H_4$; [74-85-1]
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**ORIGINAL MEASUREMENTS:**
Anthony, R.G.; McKetta, J.J.

**VARIABLES:**
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- $P/MPa = 1.38-34.47$

**PREPARED BY:**
W. Hayduk

**EXPERIMENTAL VALUES: continued**

<table>
<thead>
<tr>
<th>$t/P (1/K)$</th>
<th>$T/MPa$</th>
<th>$P/psia$</th>
<th>$T/MPa$</th>
<th>$p_i/MPa$</th>
<th>$p/MPa$</th>
<th>$\gamma_i$</th>
<th>$10^3 x_i$</th>
<th>$10^3 y_i$</th>
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</thead>
<tbody>
<tr>
<td>160 (344.26)</td>
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</tr>
</tbody>
</table>

1. Calculated by compiler.
2. Partial pressure $p$ is calculated from the vapor pressure of water and $p_i$ from the composition of the vapor $y_i$.

The data above are smoothed data as listed in the paper. continued...

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- $\delta T/K = \pm 0.1$
- $\delta p_i/p = \pm 0.001$
- $\delta x_i/x_i = \pm 5\%$ (Reference 2)

**REFERENCES:**
1. Wehe, A.H.; McKetta, J.J.
2. Wehe, A.H.; McKetta, J.J.
COMPONENTS:
1. Ethene; C₂H₄; [74-85-1]
2. Water; H₂O; [7732-16-5]

ORIGINAL MEASUREMENTS:
Anthony, R.G.; McKetta, J.J.

VARIABLES:
\[ T/K = 310.9 - 410.9 \]
\[ P/MPa = 1.38 - 34.47 \]

PREPARED BY:
W. Hayduk

EXPERIMENTAL VALUES: 

<table>
<thead>
<tr>
<th>t/P (°C)</th>
<th>Total Pressure P/psia</th>
<th>Partial Pressure ( p_1/MPa )</th>
<th>Ethene in Liquid, ( 10^3 x_1 )</th>
<th>Water in Vapor, ( 10^3 y_1 )</th>
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1Calculated by compiler.
2Partial pressure \( p \) is calculated from the vapor pressure of water and \( p_1 \) from the composition of the vapor \( y_1 \).
The data above are smoothed data as listed in the paper.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
The high pressure apparatus is described in reference 1. It consisted of a high pressure cell mounted in a thermostat and equipped for mixing and pressure measurement. A water analyzer (Meeco Model W) was used for the water vapor content of the vapor phase. The water phase was sampled and analyzed by means of an absolute manometer and Orsat gas burette. To maintain equilibrium in the cell during sampling, a volume of mercury was injected into the cell equal to that of the saturated solution withdrawn. The hydrocarbon was desorbed at low pressure in the Orsat gas burette at constant temperature, and then the gas volume and pressure was determined. The minimum accuracy of the liquid sampling and analysis method was stated to be ± 5% as described in reference 2.

SOURCE AND PURITY OF MATERIALS:
1. Ethene was Phillips pure grade.
2. Water was distilled and deaerated.

ESTIMATED ERROR:
\[ \delta T/K = \pm 0.1 \quad \delta P/P = \pm 0.001 \]
\[ \delta x_1/x_1 = \pm 5\% \text{ (Reference 2)} \]

REFERENCES:
1. Wehe, A.H.; McKetta, J.J.
2. Wehe, A.H.; McKetta, J.J.
COMPONENTS:
1. Ethene; C\(_2\)H\(_4\); [74-85-1]
2. Water; H\(_2\)O; [7732-18-5]

ORIGINAL MEASUREMENTS:
Davis, J.E.; McKetta, J.J.

VARIABLES:
\( \frac{T}{K} = 310.9-394.3 \)
\( P/\text{MPa} = 0.12-3.74, (1.16-36.9 \text{ atm}) \)

EXPERIMENTAL VALUES:

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<th>P/psia</th>
<th>( \frac{P}{\text{MPa}} )</th>
<th>Partial Pressure ( \frac{P}{\text{MPa}} )</th>
<th>Ethene Mole Fraction, ( 10^4 x_1 )</th>
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\(^1\) Calculated by compiler.
Henry's law is not obeyed.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
A rocking autoclave was used in which the cell was charged with ethylene and water and rocked for 45 min at constant temperature. The cell was kept at rest for 15 min to allow for phase separation. The water solution was sampled and the sample was fed into an analytical train. A 50 cm\(^3\) sample was fed into an evacuated, jacketed flask. After equilibrium was established in the flask the pressure was measured by a mercury manometer. The vapor was completely displaced into a second flask by using mercury. A second stripping operation was obtained by draining the mercury from the first flask. The solubility was based on the sum of the two stripped quantities.

SOURCE AND PURITY OF MATERIALS:
1. Ethene analyzed as 99.2\% pure with nitrogen the major impurity.
2. Water was distilled and degassed.

ESTIMATED ERROR:
\( \frac{\delta x_1}{x_1} = \pm 2\% \) at high pressures
\( \frac{\delta x_1}{x_1} = \pm 4\% \) at the lowest pressure (compiler)

REFERENCES:
COMPONENTS:
1. Ethene; C₂H₄; [74-85-1]
2. Water; H₂O; [7732-18-5]

ORIGINAL MEASUREMENTS:
Davis, J.E.; Mcketta, J.J.

VARIABLES: $T/K = 310.9-394.3$
$P/MPa = 0.12-3.74, (1.16-36.9 \text{ atm})$

PREPARED BY:
W. Hayduk

EXPERIMENTAL VALUES: ...continued

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1'Calculated by compiler.

Henry's law is not obeyed. ...continued...

METHOD/APPARATUS/PROCEDURE:
A rocking autoclave was used in which the cell was charged with ethylene and water and rocked for 45 min at constant temperature. The cell was kept at rest for 15 min to allow for phase separation. The water solution was sampled and the sample was fed into an analytical train. A 50 cm³ sample was fed into an evacuated jacketed flask. After equilibrium was established in the flask the pressure was measured by a mercury manometer. The vapor was completely displaced into a second flask by using mercury. A second stripping operation was obtained by draining the mercury from the first flask. The solubility was based on the sum of the two stripped quantities.

SOURCE AND PURITY OF MATERIALS:
1. Ethene analyzed as 99.2% pure with nitrogen the major impurity.
2. Water was distilled and degassed.

ESTIMATED ERROR:
$\delta x_1/x_1 = \pm 2\%$ at high pressures
$\delta x_1/x_1 = \pm 4\%$ at the lowest pressure (compiler)

REFERENCES:
COMPONENTS:
1. Ethene; C₂H₄; [74-85-1]
2. Water; H₂O; [7732-18-5]

ORIGINAL MEASUREMENTS:
Davis, J.E.; McKetta, J.J.

VARIABLES:
T/K = 310.9-394.3
P/MPa = 0.12-3.74, (1.16-36.9 atm)

EXPERIMENTAL VALUES: ...continued

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<th>T/K</th>
<th>P/psia</th>
<th>¹P/MPa</th>
<th>¹p₁/MPa</th>
<th>Ethene Mole Fraction, 10⁻¹x₁</th>
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¹Calculated by compiler.
Henry's law is not obeyed.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
A rocking autoclave was used in which the cell was charged with ethylene and water and rocked for 45 min at constant temperature. The cell was kept at rest for 15 min to allow for phase separation. The water solution was sampled and the sample was fed into an analytical train. A 50 cm³ sample was fed into an evacuated, jacketed flask. After equilibrium was established in the flask the pressure was measured by a mercury manometer. The vapor was completely displaced into a second flask by using mercury. A second stripping operation was obtained by draining the mercury from the first flask. The solubility was based on the sum of the two stripped quantities.

SOURCE AND PURITY OF MATERIALS:
1. Ethene analyzed as 99.2% pure with nitrogen the major impurity.
2. Water was distilled and degassed.

ESTIMATED ERROR:
δ x₁/x₁ = ± 2% at high pressures
δ x₁/x₁ = ± 4% at the lowest pressure (compiler)

REFERENCES:
COMPONENTS:
1. Ethene; C₂H₄; [74-85-1]
2. Water; H₂O; [7732-18-5]

ORIGINAL MEASUREMENTS:
Davis, J.E.; McKetta, J.J.

VARIABLES:
T/K = 310.9-394.3
P/kPa = 101.3, 344.6

PREPARED BY:
W. Hayduk

EXPERIMENTAL VALUES:

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<th>t/F</th>
<th>T/K</th>
<th>P/psia</th>
<th>P/kPa</th>
<th>p/kPa</th>
<th>Ethene Mole Fraction, 10⁻²x₁</th>
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¹Calculated by compiler.

These smoothed data have been taken directly from the paper; additional smoothed data also available at higher pressures.

AUXILIARY INFORMATION

METHOD/APPROATUS/PROCEDURE:
A rocking autoclave was used in which the cell was charged with ethylene and water and rocked for 45 min at constant temperature. The cell was kept at rest for 15 min to allow for phase separation. The water solution was sampled and the sample was fed into an analytical train. A 50 cm³ sample was fed into an evacuated, jacketed flask. After equilibrium was established in the flask the pressure was measured by a mercury manometer. The vapor was completely displaced into a second flask by using mercury. A second stripping operation was obtained by draining the mercury from the first flask. The solubility was based on the sum of the two stripped quantities.

SOURCE AND PURITY OF MATERIALS:
1. Ethene analyzed as 99.2% pure with nitrogen the major impurity.
2. Water was distilled and degassed.

ESTIMATED ERROR:
δx₁/x₁ = ± 3% (compiler)

REFERENCES:
COMPONENTS:
1. Ethene; C₂H₄; [74-85-1]
2. Water; H₂O; [7732-18-5]

ORIGINAL MEASUREMENTS:
Bradbury, E.J.; McNulty, D.; Savage, R.L.; McSweeney, E.E.

VARIABLES:
T/K = 308.15-379.15
P/MPa = 0.46-53.1, (4.55-524 atm)

EXPERIMENTAL VALUES:
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</table>

1Calculated by compiler.
2Ethene partial pressure was calculated by compiler based on the vapor pressure of water.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
A rocking autoclave equipped with a temperature controller, pressure tester and burette system for measuring the volumes of gas and solvent was used. A mercury pump provided pressure as required. Ethylene was compressed in a storage reservoir and supplied to the autoclave through a needle valve. After equilibration in the autoclave a saturated sample was depressurized to atmospheric pressure and 298.15 K. Volumes of gas and liquid were obtained. Corrections were made for the residual ethene in the water and non-ideality of the gas. The Solubility is reported as a mass of gas.

SOURCE AND PURITY OF MATERIALS:
1. Ethene from Ohio Chemical Company was of 99.5% purity.
2. Water was distilled, and boiled for degeneration.

ESTIMATED ERROR: δT/K = ± 0.1
δP/P = ± 0.25%
δα/α = ± 2%

REFERENCES: 
### COMPONENTS:
1. Ethene; C₂H₄; [74-85-1]
2. Water; H₂O; [7732-18-5]

### ORIGINAL MEASUREMENTS:
Bradbury, E.J.; McNulty, D.;
Savage, R.L.; McSweeney, E.E.

### VARIABLES:

<table>
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<th>T/K</th>
<th>P/MPa = 0.46-53.1, (4.55-524 atm)</th>
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<td>308.15-379.15</td>
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### EXPERIMENTAL VALUES:

<table>
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<tr>
<th>T/C t(K)</th>
<th>Total Pressure P/MPa</th>
<th>Ethene Partial Pressure P₁/MPa</th>
<th>Solubility Ethene s/g (100g)⁻¹Mole Fraction, x₁</th>
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</tr>
</tbody>
</table>

1 Calculated by compiler.

2 Ethene partial pressure was calculated by compiler based on the vapor pressure of water.

### AUXILIARY INFORMATION

#### METHOD/APPARATUS/PROCEDURE:
A rocking autoclave equipped with a temperature controller, pressure tester and burette system for measuring the volumes of gas and solvent was used. A mercury pump provided pressure as required. Ethylene was compressed in a storage reservoir and supplied to the autoclave through a needle valve. After equilibration in the autoclave a saturated sample was depressurized to atmospheric pressure and 298.15 K. Volumes of gas and liquid were obtained. Corrections were made for the residual ethene in the water and non-ideality of the gas. The Solubility is reported as a mass of gas.

#### SOURCE AND PURITY OF MATERIALS:
1. Ethene from Ohio Chemical Company was of 99.5% purity.
2. Water was distilled, and boiled for deaeration.

#### ESTIMATED ERROR:

<table>
<thead>
<tr>
<th>Error Source</th>
<th>Error</th>
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<tbody>
<tr>
<td>δT/K</td>
<td>± 0.1</td>
</tr>
<tr>
<td>δP/P</td>
<td>± 0.25%</td>
</tr>
<tr>
<td>δs/s</td>
<td>± 2%</td>
</tr>
</tbody>
</table>

#### REFERENCES:

COMPONENTS:
1. Ethene; C₂H₄; [74-85-1]
2. Water; H₂O; [7732-18-5]

VARIABLES:

\[ T/K = 308.15 - 379.15 \]
\[ P/MPa = 0.46 - 53.1, (4.55 - 524 \text{ atm}) \]

EXPERIMENTAL VALUES: ...

<table>
<thead>
<tr>
<th>t/C</th>
<th>T/K</th>
<th>Total Pressure P/atm</th>
<th>Ethene Partial Pressure, p₂/MPa</th>
<th>Solubility Ethene ( s ) (100g⁻¹)</th>
<th>Mole Fraction, ( x_2 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>75</td>
<td>348.15</td>
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<td>1.55</td>
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<td>0.000635</td>
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1Calculated by compiler.

2Ethene partial pressure was calculated by compiler based on the vapor pressure of water.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
A rocking autoclave equipped with a temperature controller, pressure tester and burette system for measuring the volumes of gas and solvent was used. A mercury pump provided pressure as required. Ethylene was compressed in a storage reservoir and supplied to the autoclave through a needle valve. After equilibration in the autoclave a saturated sample was depressured to atmospheric pressure and 298.15 K. Volumes of gas and liquid were obtained. Corrections were made for the residual ethene in the water and non-ideality of the gas. The Solubility is reported as a mass of gas.

SOURCE AND PURITY OF MATERIALS:
1. Ethene from Ohio Chemical Company was of 99.5% purity.
2. Water was distilled, and boiled for deaeration.

ESTIMATED ERROR:
\[ \delta T/K = \pm 0.1 \]
\[ \delta P/\text{atm} = \pm 0.25\% \]
\[ \delta s/100g = \pm 2\% \]

REFERENCES:

### COMPONENTS:
1. Ethene; C\textsubscript{2}H\textsubscript{4}; [74-85-1]
2. Ethane; C\textsubscript{2}H\textsubscript{6}; [74-84-0]
3. Water; H\textsubscript{2}O; [7732-18-5]

### ORIGINAL MEASUREMENTS:
Anthony, R.G.; McKetta, J.J.

### VARIABLES:
\[ T/K = 310.9 - 410.9 \]
\[ P/\text{MPa} = 3.47 - 34.60 \]
\[ y_1/\text{mole fraction} = 0 - 1 \]

### EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>Temp. °F (°K)</th>
<th>Pressure psia</th>
<th>&quot;Hydrocarbon Dry Basis Ethane, y_2&quot;</th>
<th>Water in Gas, 10\textsuperscript{-3} y_1</th>
<th>Ethane Ethene</th>
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</thead>
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<td>0.1993</td>
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</table>

*Calculated by Compiler. It was shown that Henry's law was obeyed for both gas components for the complete pressure range to 4000 psia.* continued...

### AUXILIARY INFORMATION

**METHOD/APPARATUS/PROCEDURE:**

The apparatus consisted of a high pressure cell mounted in a thermostat and equipped for mixing and pressure measurement. A water analyzer was used for the water vapor content of the vapor phase. The water phase was sampled and analyzed by means of an absolute manometer and an Orsat gas burette. To maintain equilibrium in the cell during sampling, a volume of mercury was injected into the cell equal to that of the saturated solution withdrawn. The hydrocarbon was desorbed at low pressure in the gas burette at constant temperature, and then the gas volume and pressure was determined. The gas was also analyzed.

Details are given in Ref. 1 and 2.

**SOURCE AND PURITY OF MATERIALS:**
1. Ethene minimum purity 99.3%.
2. Ethene minimum purity 99.1%.
3. Water was distilled and deaerated.

**ESTIMATED ERROR:**
\[ \delta T/K = \pm 0.1 \]
\[ \delta P/\text{MPa} = \pm 0.2\% \]
\[ \delta x/y = \pm 5\% \] (Authors)
\[ \delta y/y = \pm 2\% - 5\% \]

**REFERENCES:**
1. Wehe, A.H.; McKetta, J.J.
2. Wehe, A.H.; McKetta, J.J.
COMPONENTS: ORIGINAL MEASUREMENTS:
1. Ethene; C$_2$H$_4$; [74-85-1] Anthony, R.G.; McKetta, J.J.
2. Ethane; C$_2$H$_6$; [74-84-0]
3. Water; H$_2$O; [7732-18-5]

VARIABLES: $T/K = 310.9 - 410.9$
$P/MPa = 3.47 - 34.60$
$y_1$/mole fraction $= 0 - 1$

PREPARED BY: W. Hayduk

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>Temp. $^\circ$F, ($^\circ$K)</th>
<th>Pressure psia</th>
<th>Hydrocarbon Dry Basis</th>
<th>Water in Ethane</th>
<th>Ethane $y_2$</th>
<th>Ethene $y_1$</th>
<th>Gas, 10$^5$</th>
<th>Ethane 10$^4$ $x_2$</th>
<th>Ethene 10$^4$ $x_1$</th>
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1 Calculated by Compiler.

continued...
### COMPONENTS:
1. Ethene; C₂H₄ [74-85-1]
2. Ethane; C₂H₆ [74-84-0]
3. Water; H₂O [7732-18-5]

### ORIGINAL MEASUREMENTS:
Anthony, R.G.; McKetta, J.J.

### VARIABLES:
- \( T / K = 310.9 - 410.9 \)
- \( P / \text{MPa} = 3.47 - 34.60 \)
- \( y / \text{mole fraction} = 0 - 1 \)

### PREPARED BY:
W. Hayduk

### EXPERIMENTAL VALUES:
...continued

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\(^1\) Calculated by Compiler.
AN EVALUATION OF THE SOLUBILITY OF ETHENE IN AQUEOUS ELECTROLYTE SOLUTIONS.

The solubility of a gas in an aqueous electrolyte solution often approximates the behavior pointed out by Sechenov over 100 years ago. It obeys the equation, \((1/c_2)\log (S^0/S) = k_{scc}\), where \(S^0\), \(S\) represent the solubility of the gas in pure water and in the aqueous electrolyte solution, respectively, \(c_2\) is the concentration of the electrolyte, and \(k_{scc}\) the Sechenov salt effect parameter when both the gas and electrolyte concentrations are in volume units.

Other gas and electrolyte measures lead to slightly different values of the salt effect parameter. The commonly used forms are:

- \(k_{scc}/L\) mol\(^{-1}\) = \((1/(c_2/L))\log (c_j/mol L^{-1})/(c_1/mol L^{-1})\)
- \(k_{smb}/kg\) mol\(^{-1}\) = \((1/(m_2/mol kg^{-1}))\log (m_j/mol kg^{-1})/(m_1/mol kg^{-1})\)
- \(k_{scx}/L\) mol\(^{-1}\) = \((1/(c_2/mol L^{-1}))\log (x_j/x_1)\)
- \(k_{cmx}/kg\) mol\(^{-1}\) = \((1/(m_2/mol kg^{-1}))\log (x_j/x_1)\)

where subscript 1 represents the non-electrolyte gas and subscript 2 the electrolyte.

The gas solubility ratio in pure water and electrolyte solution, \(c_j/c_1\) will be numerically the same using the Bunsen coefficient ratio, \(a^0/a\), or the Ostwald coefficient ratio, \(L^0/L\), as well as the mol L\(^{-1}\) ratio. The molality ratio, \(m_j/m_1\), is the same as the Kuenen coefficient ratio, \(S^0/S\), or the solvomolaity ratio, \(A^0/A\). The mole fraction ratio, \(x_j/x_1\), is the same as the inverse Henry's constant ratio, \(H/H^0\), when the Henry's constant is of the form, \((H/kPa)/(p_j/kPa)/(x_1)\). The gas mol fractions are usually calculated treating each electrolyte ion as an entity. A more detailed description of these units and the interconversions among them is in Solubility Series volume 10, Nitrogen, pp. xxix - xliii.

A useful graphical test of salt effect data of either a particular worker or to compare different workers data is to put the Sechenov equation in the form:

\[ \log S = \log S^0 - k_{scc} c_2 \]

and plot \(\log S\) vs. \(c_2\), the linear slope will be the negative of the salt effect parameter in what ever set of units is used for \(S\) and \(c_2\). Several such figures follow in this evaluation.

Two groups of workers have measured the solubility of ethene in several of the same aqueous electrolyte solutions. Unfortunately the two report values of the solubility of ethene in water at 298 K which differ by 2.6 percent. The difference makes for some difficulty in comparing their results by a plot of \(\log L\) vs. \(c_2\) as we have used here. There are data on 18 single electrolyte systems and 8 systems containing mixtures of two or three electrolytes. In general the data for ethene solubility in aqueous electrolyte solutions show better consistency than the data...
for less soluble gases reviewed in previous Solubility Series volumes.

Many workers use electrolyte ionic strength instead of volume concentration, and the salt effect parameter is given in electrolyte ionic strength. There are valid reasons to do this; however, we have used the electrolyte volume concentration in all of the single electrolyte solutions evaluations. The conversion to ionic strength basis requires dividing our result by the small whole number of one for 1-1 electrolytes, three for 1-2 and 2-1 electrolytes, four for 2-2 electrolytes and six for 1-3 and 3-1 electrolytes. The solubilities in the mixed electrolyte solutions are plotted as a function of ionic strength. The salt effect parameters in ionic strength are symbolized $k_{\text{stec}}$ and $k_{\text{stml}}$ for ionic strength in volume concentration and molality units, respectively.

The systems containing a single electrolyte are given in the order of the standard arrangement for inorganic compounds used by the U. S. National Institute of Science and Technology. The number before each system is the standard order number for the electrolyte cation.

I. Systems with a single electrolyte component.

There are problems with ethene that one does not see with less reactive or inert gases. Ethene may form complexes with some cations, e.g. silver, and the reaction of ethene with water may be catalyzed by certain cations, e.g. mercury. With the exception of silver nitrate we do not believe this to be a problem with the systems and temperatures reviewed here.

2(1) Ethene + Hydrochloric acid [7647-01-0] + Water

Yano, Suetaka, Umehara and Horiuchi (7) measured the solubility of ethene in water and four concentrations of HCl up to 1.520 mol L$^{-1}$. Their data (fig 1A) shows a slope of $-0.046$ with a standard deviation of the slope of 0.003. Thus, we take as the tentative salt effect parameter, $k_{\text{stec}} = 0.046$ L mol$^{-1}$.

2(2) Ethene + Perchloric acid [7601-90-3] + Water

Purlee and Taft (3) measured the solubility of ethene in water and six perchloric acid solutions up to 9.36 mol L$^{-1}$ at 303 K. We have converted their Henry's constants to Ostwald coefficients and the results are in figure 1B. There is little doubt the acid salts out more at concentrations greater than 6.0 mol L$^{-1}$ perchloric acid than at lower concentrations. The slope of $-0.018$ fits the data well up to 6.0 mol L$^{-1}$ if one treats the value at 3.90 mol L$^{-1}$ as an error. The tentative value is $k_{\text{stec}} = 0.018$ at 303.15 K.

2(3) Ethene + Sulfuric acid [7664-93-9] + Water

Yano et al. (7) measured the solubility of ethene in water and in sulfuric acid solutions of 0.258, 0.516 and 0.786 mol L$^{-1}$ sulfuric acid at 298.15 K. The data are plotted in figure 1A. The slope of $-0.123$ with standard deviation of the slope of 0.002 gives the tentative salt effect parameter, $k_{\text{stec}} = 0.123$. In ionic strength this would be $k_{\text{stml}} = 0.041$.

2(4) Ethene + nitric acid [7697-37-2] + Water

Both Yano, Suetaka, Umehara and Horiuchi (7) and Onda, Sada, Kobayashi, Kito and Ito (5) have studied this system at 298.15 K and 1 atm up to 1.81 mol L$^{-1}$ nitric acid. Although their solubility values differ by only 2 - 3 percent, statistically their data do not accord well. The Onda et al. data has a slope of $-0.003$ with a standard deviation of 0.002, the Yano et al. data has a slope of $-0.004$ with a standard deviation of 0.004, and the combined data set has a slope of $-0.002$ with a standard deviation of 0.005. We choose as the tentative salt effect...
COMPONENTS:
(1) Ethene: C₂H₄; [74-85-1]
(2) Electrolyte
(3) Water: H₂O; [7732-18-5]

EVALUATOR:
H. Lawrence Clever
Department of Chemistry
Emory University
Atlanta, GA USA
August 1992

CRITICAL EVALUATION:

Parameter, \( k_{ac} = 0.002 \) at 298 K (fig 1A). One could use a salt effect parameter of zero and not be in any appreciable error over the 0 - 2 mol L⁻¹ nitric acid concentration range at 298 K.

\[ \text{Figure 1. Log Ostwald vs. Electrolyte Concentration.} \]

C₂H₄ + Strong Acids + H₂O.

18(1) Ethene + Ammonium Nitrate [6484-52-2] + Water

Onda et al. (4) measured the solubility of ethene in water and five ammonium nitrate concentrations up to 3.8 mol L⁻¹ at 1 atm (101.3 kPa) and 298 K. A plot of log \( L \) vs. \( c \) is linear with slope -0.0513 and standard deviation 0.0005. The tentative salt effect parameter, \( k_{so} = 0.0513 \) L mol⁻¹ at 298.15 K.


Yano et al. (7) measured the solubility of ethene in water and solutions of 0.500, 1.500 and 3.000 mol L⁻¹ CuCl₂ at 298 K and 1 atm (101.3 kPa). The Sechenov plot is linear with slope -0.207 and standard deviation 0.002. The tentative salt effect parameter is \( k_{so} = 0.207 \) L mol⁻¹ at 298.15 K. As a function of ionic strength it is \( k_{ai(c)} = 0.069 \).

37(1) Ethene + Silver nitrate [7761-88-8] + Water
Clever, Baker and Hale (6) measured the solubility of ethene in dilute silver nitrate solution at 303.15 K and 95.75 kPa partial pressure. The system appears to strongly salt in because of formation of a silver-ethene complex. No salt effect parameter was calculated. Instead the authors estimated the aqueous solution concentration of free ethene from the solubility in potassium nitrate solutions of the same concentration, and assumed the remainder of the ethene in solution was in the form of the silver complex. The data treatment gives an equilibrium constant, \( K_{\text{eq}} = 76 \text{ L mol}^{-1} \) for the reaction \( \text{Ag}^+(aq) + \text{C}_2\text{H}_4(aq) = (\text{C}_2\text{H}_4)^+\text{Ag}^+(aq) \).

Morrison and Billett (2) measured the solubility of ethene in water and in 1.0 mol kg\(^{-1}\) LaCl\(_3\) solutions at temperatures of 285.75, 303.15, 322.45 and 344.85 K. They did not report the solubility in the lanthanum chloride solution, but gave the salt effect parameters. They are:

\[
\begin{array}{cccc}
T/K & 285.75 & 303.15 & 322.55 & 344.85 \\
\kappa_{\text{sec}}/\text{kg mol}^{-1} & 0.336 & 0.300 & 0.315 & 0.285 \\
\kappa_{\text{sec}}/\text{kg mol}^{-1} & 0.056 & 0.050 & 0.053 & 0.048 \\
\end{array}
\]

One would expect a steady decrease in the salt effect parameter as temperature increases, thus one must question the values at 303.15 and 322.55 K which show the opposite trend. The results are classed as tentative, but use with caution.

Morrison and Billett (2) measured the solubility of ethene in pure water and in 1 molal LiCl solutions at four temperatures. They report the solubility in water and the salt effect parameter in molal units. Yano et al. (7) report the ethene solubility at concentrations of 0.500, 1.000 and 1.500 mol L\(^{-1}\) LiCl at 298.15 K. The Sechenov plot of their data is linear with slope -0.273 and standard deviation 0.003. The tentative salt effect parameter is \( \kappa_{\text{sec}} = 0.273 \text{ L mol}^{-1} \) and in ionic strength \( \kappa_{\text{sec}} = 0.091. \)

Morrison and Billett (2) measured the solubility of ethene in pure water and in 1.0 molal BaCl\(_2\) solutions at temperatures of 285.75, 303.15, 322.45 and 344.85 K. The Sechenov plot is linear with slope -0.273 and standard deviation 0.003. The tentative salt effect parameter is \( \kappa_{\text{sec}} = 0.273 \text{ L mol}^{-1} \) and in ionic strength \( \kappa_{\text{sec}} = 0.091. \)

Morrison and Billett (2) measured the solubility of ethene in water and in 1.0 molal BaCl\(_2\) solutions at four temperatures. They report the solubility in water and the salt effect parameter in molal units. Yano et al. (7) report the ethene solubility at concentrations of 0.500, 1.000 and 1.500 mol L\(^{-1}\) BaCl\(_2\) at 298.15 K. The Sechenov plot of their data is linear with slope -0.119 and standard deviation 0.006. The Morrison and Billett results were converted by the evaluator to volume units and are compared with the Yano et al. results below.

\[
\begin{array}{cccc}
T/K & 285.75 & 298.15 & 303.15 & 322.55 & 344.85 \\
\kappa_{\text{sec}}/\text{L mol}^{-1} & 0.114 & 0.119 & 0.099 & 0.093 & 0.092 \\
\kappa_{\text{sec}}/\text{kg mol}^{-1} & 0.104 & 0.108 & 0.089 & 0.082 & 0.083 \\
\kappa_{\text{sec}}/\text{kg mol}^{-1} & 0.119 & 0.123 & 0.104 & 0.097 & 0.098 \\
\end{array}
\]

The two groups did not report any results at a common temperature. Their results do not lie on a smooth curve as a function of temperature. The Yano et al. value is based on more measurements so might be considered more reliable, but their data do scatter as shown by a standard deviation that is 5 per cent of the slope.

Morrison and Billett (2) measured the solubility of ethene in pure water and in seven NaCl solutions ranging up to 4.224 mol L\(^{-1}\) at 298.15 K. Yano et al. (7) measured the solubility in water and in three NaCl solutions up to 1.500 mol L\(^{-1}\) at 298.15 K and Morrison and Billett (2) measured the solubility in water and in 1 molal NaCl at temperatures of 285.75, 303.15, 322.55 and 344.85 K. The Sechenov plot of the Onda et al. data was linear with slope -0.139 and standard deviation 0.001, the Yano et al. data was linear and of slope 0.154 and standard deviation 0.003, the combined data set was linear with slope 0.137 and standard deviation 0.003. The evaluator has arbitrarily chosen the Onda et al. slope to represent the salt effect parameter (fig 2). The Morrison and Billett values were converted to volume units and are compared in the table below. Other representations of the salt effect parameter are also compared.
COMPONENTS:
(1) Ethene; \( \text{C}_2\text{H}_4 \); [74-85-1]
(2) Electrolyte
(3) Water; \( \text{H}_2\text{O} \); [7732-18-5]

EVALUATOR:
H. Lawrence Clever
Department of Chemistry
Emory University
Atlanta, GA USA
August 1992

CRITICAL EVALUATION:

<table>
<thead>
<tr>
<th>T/K</th>
<th>285.75</th>
<th>298.15</th>
<th>303.15</th>
<th>322.55</th>
<th>344.85</th>
</tr>
</thead>
<tbody>
<tr>
<td>( k_{\text{sec}} / \text{L mol}^{-1} )</td>
<td>0.150</td>
<td>0.139</td>
<td>0.138</td>
<td>0.123</td>
<td>0.114</td>
</tr>
<tr>
<td>( k_{\text{mm}} / \text{kg mol}^{-1} )</td>
<td>0.140</td>
<td>0.127</td>
<td>0.114</td>
<td>0.101</td>
<td></td>
</tr>
<tr>
<td>( k_{\text{mm}} / \text{kg mol}^{-1} )</td>
<td>0.155</td>
<td>0.142</td>
<td>0.129</td>
<td>0.116</td>
<td></td>
</tr>
</tbody>
</table>

The agreement among the data sets is reasonable and the salt effect parameters are classed as tentative.

Figure 2. Log Ostwald vs. NaCl Concentration at Several Temperatures. The Morrison and Billett (2) lines are based on only two points, the solubility in water and in one mol \( \text{L}^{-1} \) NaCl (The compiler converted the author's molality value).

99(2) Ethene + Sodium bromide [7647-15-6] + Water

Yano et al. (7) measured the solubility of ethene in water and at 0.500, 1.000 and 1.500 mol \( \text{L}^{-1} \) NaBr at 298.15 K and 1 atm (101.3 kPa) partial pressure. The Sechenov plot is linear with a slope of -0.132 and standard deviation of 0.002. The tentative salt effect parameter is \( k_{\text{sec}} = 0.132 \text{ L mol}^{-1} \).

99(3) Ethene + Sodium sulfite [7757-83-7] + Water
Two groups report data on this system. Onda et al. (4) report the solubility of ethene in water and five solutions up to 0.818 mol L\(^{-1}\) \(\text{Na}_2\text{SO}_3\) at 298.15 K and 1 atm (101.3 kPa) partial pressure. The Sechenov plot is linear with slope -0.353 and standard deviation 0.013. Yano et al. (7) report the ethene solubility in water and three solutions up to 1.500 mol L\(^{-1}\) \(\text{Na}_2\text{SO}_3\). The Sechenov plot is linear with slope -0.416 and standard deviation 0.002. The combined data sets have a slope of -0.416 and a standard deviation of 0.020. We have made the arbitrary decision to average the slopes of the two groups giving a weight of one to the slope of larger standard deviation and a weight of two to the other slope. Thus, the tentative salt effect parameter becomes \(k_{\text{salt}} = 0.395\) L mol\(^{-1}\). In terms of ionic strength this would be \(k_{\text{IUO})0} = 0.132\).


Onda et al. (4) measured the solubility in water and five solutions up to 1.139 mol L\(^{-1}\) \(\text{Na}_2\text{SO}_3\) at 298.15 K and 1 atm (101.3 kPa) partial pressure ethene. The Sechenov plot is linear with slope -0.394 and a standard deviation of 0.004. The tentative salt effect parameter is \(k_{\text{salt}} = 0.394\) L mol\(^{-1}\) and in ionic strength its \(k_{\text{IUO})0} = 0.133\).

100(1) Ethene + Potassium chloride [7747-40-7] + Water

Yano et al. (7) measured the solubility of ethene in water and in 0.500, 1.000 and 1.500 mol L\(^{-1}\) \(\text{KCl}\) at 298.15 K at 1 atm (101.3 kPa) partial pressure. The Sechenov plot is linear with slope -0.136 and standard deviation 0.001. The tentative salt effect parameter is \(k_{\text{salt}} = 0.136\) L mol\(^{-1}\).

100(2) Ethene + Potassium bromide [7758-02-3] + Water

Yano et al. (7) measured the solubility of ethene in water and in 0.500, 1.000 and 1.500 mol L\(^{-1}\) \(\text{KBr}\) at 298.15 K at 1 atm (101.3 kPa) partial pressure. The Sechenov plot is linear with slope -0.118 and standard deviation 0.002. The tentative salt effect parameter is \(k_{\text{salt}} = 0.118\) L mol\(^{-1}\).

100(3) Ethene + Potassium iodide [7681-11-0] + Water

Morrison and Billett (2) measured the solubility of ethene in water and in 1 mol kg\(^{-1}\) \(\text{KI}\) at four temperatures. They report only the solubility in water and the salt effect parameter \(k_{\text{salt}}\). The evaluator has converted the author’s parameter to volume and molar fraction units. The results are summarized below. The 298.15 K values were interpolated from the author’s data by the evaluator.

<table>
<thead>
<tr>
<th>(T/K)</th>
<th>(k_{\text{vol}}/\text{L mol}^{-1})</th>
<th>(k_{\text{mole}}/\text{kg mol}^{-1})</th>
<th>(k_{\text{vol}}/\text{kg mol}^{-1})</th>
</tr>
</thead>
<tbody>
<tr>
<td>285.75</td>
<td>0.093</td>
<td>0.070</td>
<td>0.085</td>
</tr>
<tr>
<td>298.15</td>
<td>0.088</td>
<td>0.064</td>
<td>0.079</td>
</tr>
<tr>
<td>303.15</td>
<td>0.085</td>
<td>0.061</td>
<td>0.076</td>
</tr>
<tr>
<td>322.25</td>
<td>0.072</td>
<td>0.050</td>
<td>0.065</td>
</tr>
<tr>
<td>344.85</td>
<td>0.060</td>
<td>0.036</td>
<td>0.051</td>
</tr>
</tbody>
</table>

The values are classed as tentative.

100(4) Ethene + Potassium nitrate [7757-79-1] + Water

Clever, Baker and Hale (6) measured the solubility of ethene in water and aqueous \(\text{KNO}_3\) at six concentrations up to 1.080 mol L\(^{-1}\). Four of the measurements were made at concentrations of 0.115 mol L\(^{-1}\) or less. They show a much larger than normal salting out. Similar claims for unusual salt effects at low salt concentrations have been made by others, see SDS Oxygen volume (V. 10) salt effect evaluation for several examples. So far none of these claims have been substantiated. The unusual effect may be true, but for the present we suspect some systematic error. A small error in the solubility can cause a large error in the salt effect parameter at low salt concentrations. The solubility in water and in the 1.080 mol L\(^{-1}\) \(\text{KNO}_3\) solution give a salt effect parameter of 0.133. It is a doubtful value.

II. Systems with multi-electrolyte components

These systems have been studied as a function of total ionic strength. In most of the systems a constant mole ratio between or among the electrolytes components is maintained at each total ionic strength. The evaluator has used the single electrolyte "ionic strength" salt effect
COMPONENTS:
(1) Ethene; C2H4; [74-85-1]
(2) Electrolyte
(3) Water; H2O; [7732-18-5]

EVALUATOR:
H. Lawrence Clever
Department of Chemistry
Emory University
Atlanta, GA 30322
August 1992

CRITICAL EVALUATION:

parameters to predict the mixed electrolyte parameter. The sum of the fraction of ionic strength from each electrolyte times its ionic strength salt effect parameter is the predicted salt effect parameter for the mixed electrolyte.

Ethene + Nitric acid [7697-37-2] 
+ Sodium chloride [7647-14-5] + Water

Onda, Sada, Kobayashi, Kito and Ito (5) measured the solubility of ethene in water and in four solutions containing a NaCl/HNO3 ionic strength ratio of 0.615/0.385. A Sechenov plot of log L vs. I (I = ionic strength, mol L-1) is linear and of slope -0.083 and standard deviation 0.003 (fig 3, line 2). The predicted salt effect parameter is (0.615)(0.139) + (0.385)(0.002) = 0.086 which is within a standard deviation of the observed constant. The data are classed as tentative.

Ethene + Ammonium Nitrate [6484-52-2] 
+ Sodium chloride [7647-14-5] + Water

Onda, Sada, Kobayashi, Kito and Ito (5) measured the solubility of ethene in water and in four solutions containing NaCl/NH4NO3 at an ionic strength ratio of 0.482/0.518. A Sechenov plot of log L vs. I (I = ionic strength, molality) is linear and of slope -0.090 and standard deviation 0.0009 (fig 3, line 3). The predicted salt effect parameter is (0.482)(0.139) + (0.518)(0.051) = 0.094 which is within 5 percent of the observed constant. The data are classed as tentative.

Ethene + Ammonium nitrate [6484-52-2] 
+ Barium chloride [14832-99-6] + Water

Onda, Sada, Kobayashi, Kito and Ito (5) measured the solubility of ethene in water and in four solutions containing BaCl2/NH4NO3 at an ionic strength ratio of 0.540/0.460. A Sechenov plot of log L vs. I (I = ionic strength, mol L-1) is linear and of slope -0.078 and standard deviation 0.005 (fig 3, line 1). The predicted salt effect parameter is (0.540)(0.091) + (0.460)(0.051) = 0.072 which is just over one standard deviation of the observed constant. The data are classed as tentative.


Onda, Sada, Kobayashi, Kito and Ito (5) measured the solubility of ethene in water and in seven solutions containing NH4NO3/BaCl2/NaCl at an ionic strength ratio of 0.333/0.333/0.333. A Sechenov plot of log L vs. I (I = ionic strength, mol L-1) is linear and of slope -0.089 and standard deviation 0.002 (fig 3, line 5). The predicted salt effect parameter is (0.333)(0.051) + (0.333)(0.091) + (0.333)(0.139) = 0.094 which is 5.6 percent larger than the observed constant. The data are classed as tentative.

Ethene + Sulfuric acid [7664-93-9] 
+ Sodium sulfate [7757-82-6] + Water

Kobe and Kenton (1) report one measurement of the solubility of ethene in a mixture of 0.90 molal H2SO4 and 1.76 molal Na2SO4. The solution has a total ionic strength of 7.98 in molal units. The evaluator used an accepted solubility in water to calculate an ionic strength salt effect parameter, ksolute = 0.088. The value is classed tentative.

Ethene + Ammonium nitrate [6484-52-2] 
+ Sodium sulfate [7757-82-6] + Water

Onda, Sada, Kobayashi, Kito and Ito (5) measured the solubility of ethene in water and in seven solutions containing NH4NO3/Na2SO4 at an ionic strength ratio of 0.613/0.387. A Sechenov plot of log L vs. I (I = ionic strength, mol L-1) is linear and of slope -0.088 and standard deviation 0.005 (fig 3, line 5). The predicted salt effect parameter is (0.613)(0.139) + (0.387)(0.002) = 0.086 which is within a standard deviation of the observed constant. The data are classed as tentative.
strength, mol L⁻¹) is linear and of slope -0.079 and standard deviation 0.004 (fig 3, line 4). The predicted salt effect parameter is (0.613)(0.051) + (0.387)(0.132) = 0.082 which is within one standard deviation of the observed constant. The data are classed as tentative.


Onda, Sada, Kobayashi, Kito and Ito (5) measured the solubility of ethene in water and in three solutions containing NaHCO₃/Na₂CO₃ at an ionic strength ratio of 0.822/0.178. A Sechenov plot of log L vs. I (I = ionic strength, mol L⁻¹) is linear and of slope -0.195 and standard deviation 0.008 (fig 3, line 7). The single electrolyte salt effect parameters are not available to predict the constant. The result is classed as tentative.

Figure 3. Log Ostwald vs. Ionic Strength, mol L⁻¹, 298.2 K. Mixed electrolytes. The electrolytes are kept at a constant ionic strength ratio in each set of measurements. In most cases the salt effect parameter calculated from the individual electrolyte parameters is within a standard deviation of the experimental parameter for the mixed electrolyte.
CRITICAL EVALUATION:

Ethene + Potassium hydrogen carbonate [298-14-6] + Potassium carbonate [584-08-7] + Water

Onda, Sada, Kobayashi, Kito and Ito (5) measured the solubility of ethene in water and in five solutions containing KHCO₃/K₂CO₃ at an ionic strength ratio of 0.834/0.166. A Sechenov plot of log L vs. I (I = ionic strength, mol L⁻¹) is linear and of slope ~0.189 and standard deviation 0.011 (fig 3, line 6). The single electrolyte salt effect parameters are not available to predict the constant. The result is classed as tentative.

REFERENCES

COMPONENTS:
1. Ethene; C₂H₄; [74-85-1]
2. Hydrochloric acid, nitric acid or sulfuric acid
3. Water; H₂O; [7732-18-5]

ORIGINAL MEASUREMENTS:
Kagaku Kogaku,
1974, 38, 320-323.

VARIABLES:
T/K = 298.15
P/kPa = 101.3

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>Concentration of electrolyte /mol L⁻¹</th>
<th>Solubility of ethene /mmol L⁻¹</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hydrochloric acid; HCl; [7647-01-0]</td>
<td>Solubility of ethene /mmol L⁻¹</td>
</tr>
<tr>
<td>0.000</td>
<td>4.83</td>
</tr>
<tr>
<td>0.200</td>
<td>4.79</td>
</tr>
<tr>
<td>0.400</td>
<td>4.72</td>
</tr>
<tr>
<td>0.770</td>
<td>4.46</td>
</tr>
<tr>
<td>1.520</td>
<td>4.15</td>
</tr>
<tr>
<td>Nitric acid; HNO₃; [7697-37-2]</td>
<td>4.72</td>
</tr>
<tr>
<td>0.500</td>
<td>4.72</td>
</tr>
<tr>
<td>1.061</td>
<td>4.72</td>
</tr>
<tr>
<td>1.520</td>
<td>4.75</td>
</tr>
<tr>
<td>Sulfuric acid; H₂SO₄; [7664-93-9]</td>
<td>4.51</td>
</tr>
<tr>
<td>0.258</td>
<td>4.19</td>
</tr>
<tr>
<td>0.516</td>
<td>3.87</td>
</tr>
</tbody>
</table>

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
Volumetric apparatus. Salt solution allowed to enter stirred absorption chamber. Pressure within absorption chamber adjusted to be as near atmospheric pressure as possible. Details in source and ref. 1.

SOURCE AND PURITY OF MATERIALS:
1. High purity sample, purity better than 99.5 mole per cent.
2. Special grade.
3. Distilled.

ESTIMATED ERROR:
Solubility = ±2% (Compiler)

REFERENCES:
1. Yano, T.; Suetaka, T.; Umehara, T.
Nippon Kagaku Kaishi
1972, 11, 2194.
COMPONENTS:
1. Ethene, (Ethylene); C₂H₄; [74-85-1]
2. Nitric acid; HNO₃; [7697-37-2]
3. Water; H₂O; [7732-18-5]

ORIGINAL MEASUREMENTS:

VARIABLES:
\( T / K = 298.15 \)
\( P / \text{kPa} = 101.3 \)

PREPARED BY:
C.L. Young

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>( T / K )</th>
<th>Concentration of nitric acid ( / \text{mol l}^{-1} )</th>
<th>Ionic Strength* ( / \text{mol l}^{-1} )</th>
<th>Bunsen coefficient,* ( \alpha )</th>
</tr>
</thead>
<tbody>
<tr>
<td>298.15</td>
<td>0.646</td>
<td>0.646</td>
<td>0.1114</td>
</tr>
<tr>
<td></td>
<td>0.657</td>
<td>0.657</td>
<td>0.1113</td>
</tr>
<tr>
<td></td>
<td>0.979</td>
<td>0.979</td>
<td>0.1103</td>
</tr>
<tr>
<td></td>
<td>1.408</td>
<td>1.408</td>
<td>0.1096</td>
</tr>
<tr>
<td></td>
<td>1.810</td>
<td>1.810</td>
<td>0.1105</td>
</tr>
</tbody>
</table>

* quoted in original paper.

Pressure = 1 atmosphere = \( 1.01325 \times 10^5 \text{Pa} \).

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
Concentrated solution prepared by weighing, less concentrated solutions prepared by subsequent dilution. Concentration of acid estimated by titration. Equilibrium established between a measured volume of gas and a measured amount of gas-free liquid in a cell fitted with a magnetic stirrer. Amount of gas absorbed estimated from change in volume of gas. Details in source and ref. (1).

SOURCE AND PURITY OF MATERIALS:
1. Commercial sample, purity 99.6 mole per cent.
2. Analytical grade sample.
3. No details given.

ESTIMATED ERROR:
\( \delta T / K = \pm 0.2; \delta \alpha = \pm 2\% \).
(estimated by compiler).

REFERENCES:
COMPONENTS:
1. Ethene; C₂H₄; [74-85-1]
2. Perchloric acid; HClO₄; [7601-90-3]
3. Water; H₂O; [7732-18-5]

ORIGINAL MEASUREMENTS:
Purlee, E.L.; Taft, R.W.


VARIABLES:
T/K = 303.15
p/kPa = 101.325
M₂/moles/l = 0-9.36

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>t/C</th>
<th>T/K</th>
<th>Perchloric acid Conc. in Water</th>
<th>Ethene Solubility expressed as Inverse of Henry's Constant</th>
<th>10³k/mol (1 atm)⁻¹</th>
</tr>
</thead>
<tbody>
<tr>
<td>30.0</td>
<td>303.15</td>
<td>0.0</td>
<td>0.0</td>
<td>4.11</td>
</tr>
<tr>
<td></td>
<td></td>
<td>9.75</td>
<td>1.027</td>
<td>3.97</td>
</tr>
<tr>
<td></td>
<td></td>
<td>20.80</td>
<td>2.34</td>
<td>3.74</td>
</tr>
<tr>
<td></td>
<td></td>
<td>32.01</td>
<td>3.90</td>
<td>3.79</td>
</tr>
<tr>
<td></td>
<td></td>
<td>43.60</td>
<td>5.85</td>
<td>3.24</td>
</tr>
<tr>
<td></td>
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<td>53.73</td>
<td>7.80</td>
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</tr>
<tr>
<td></td>
<td></td>
<td>60.71</td>
<td>9.36</td>
<td>2.10</td>
</tr>
</tbody>
</table>

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
A 200 cm³ glass flask was connected to a pressure-measuring manometer by means of a horizontally-mounted spiral tube. The spiral tube permitted the flask to be shaken with an amplitude of up to 2 cm for equilibration. The solvent (80-125 cm³) was deaerated in the flask. The change in pressure of a known volume of gas was measured from which the solubility was determined. The total volume of the apparatus was initially determined by weighing the apparatus filled with distilled water. The "distribution constant", k, was determined for pressures below 101.325 kPa. Method described in reference 1.

SOURCE AND PURITY OF MATERIALS:
1. Ethene was from Matheson, purity 99.5%.
2. Perchloric acid was from Baker and was the CP grade.

ESTIMATED ERROR:
δT/K = ± 0.01
δk/k = ± 0.02

REFERENCES:

J. Amer. Chem. Soc. 1951, 73, 3792.
COMPONENTS:
(1) Ethene or ethylene; C₂H₄; [74-85-1]
(2) Lanthanum chloride; LaCl₃; [10099-58-8]
(3) Water; H₂O; [7732-18-5]

ORIGINAL MEASUREMENTS:

VARIABLES:
T/K: 285.75 - 344.85
P/kPa: 101.325 (1 atm)

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>Temperature</th>
<th>Salt Effect Parameters</th>
</tr>
</thead>
<tbody>
<tr>
<td>t/°C</td>
<td>T/K</td>
</tr>
<tr>
<td>12.6</td>
<td>285.75</td>
</tr>
<tr>
<td>30.0</td>
<td>303.15</td>
</tr>
<tr>
<td>49.4</td>
<td>322.55</td>
</tr>
<tr>
<td>71.7</td>
<td>344.85</td>
</tr>
</tbody>
</table>

For the 1-3 electrolyte the compiler changed to m = c/3 for m₂/mol kg⁻¹ in the salt effect parameter.

The salt effect parameters were calculated from two measurements. The solubility of ethene in water, S°, and in the one molal salt solution, S. Only the solubility of the ethene in water, and the value of the salt effect parameter are given in the paper. The solubility values in the salt solution are not given.

The compiler calculated the values of the salt effect parameter using the mole fraction gas solubility ratio.

Note that the first salt effect parameter above uses the author's notation with c in gram equivalents per kg water. The author's c would be better represented as m₂((1/3)LaCl₃)/mol kg⁻¹ = 3 m₂(LaCl₃)/mol kg⁻¹, that is, it would have been better if the author had expressed the salt effect parameter in terms of moles of LaCl₃ per kg water rather than equivalents of LaCl₃ per kg water.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
The degassed solvent flows in a thin film down an absorption helix containing the ethene gas plus solvent vapor at a total pressure of one atmosphere. The volume of gas absorbed is measured in an attached buret system (1).

SOURCE AND PURITY OF MATERIALS:
(1) Ethene. Prepared from ethanol and phosphoric acid.
(2) Lanthanum chloride. "AnalaR" material.
(3) Water. No information given.

ESTIMATED ERROR:
δk/kg⁻¹ mol = 0.010

REFERENCES:
COMPONENTS:
(1) Ethene or ethylene; C₂H₄; [74-85-1]
(2) Lithium chloride; LiCl; [7447-41-8]
(3) Water; H₂O; [7732-18-5]

ORIGINAL MEASUREMENTS:
Morrison, T. J.; Billett, F.

VARIABLES:
T/K: 285.75 - 344.85
p/kPa: 101.325 (1 atm)

PREPARED BY:
H. L. Clever

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>Temperature</th>
<th>Salt Effect Parameters</th>
</tr>
</thead>
<tbody>
<tr>
<td>t/°C</td>
<td>T/K</td>
</tr>
<tr>
<td>12.6</td>
<td>285.75</td>
</tr>
<tr>
<td>30.0</td>
<td>303.15</td>
</tr>
<tr>
<td>49.4</td>
<td>322.55</td>
</tr>
<tr>
<td>71.7</td>
<td>344.85</td>
</tr>
</tbody>
</table>

¹ The authors used (l/c)log(S°/S) with c defined as g eq salt per kg of water. For the 1-1 electrolyte the compiler changed the c to an m for m₂/mol kg⁻¹. The ethene solubility S is cm³(STP) kg⁻¹.

The salt effect parameters were calculated from two measurements. The solubility of ethene in water, S°, and in the one molal salt solution, S. Only the solubility of the ethene in water, and the value of the salt effect parameter are given in the paper. The solubility values in the salt solution are not given.

The compiler calculated the values of the salt effect parameter using the mole fraction gas solubility ratio.

AUXILIARY INFORMATION

METHOD/AppARATUS/PROCEDURE:
The degassed solvent flows in a thin film down an absorption helix containing the ethene gas plus solvent vapor at a total pressure of one atmosphere. The volume of gas absorbed is measured in an attached buret system (1).

SOURCE AND PURITY OF MATERIALS:
(1) Ethene. Prepared from ethanol and phosphoric acid.
(2) Lithium chloride. "AnalaR" material.
(3) Water. No information given.

ESTIMATED ERROR:
δk/kg⁻¹ mol = 0.010

REFERENCES:
1. Morrison, T. J.; Billett, F.
COMPONENTS:
1. Ethene, (Ethylene); C2H4; [74-85-1]
2. Sodium chloride; NaCl; [7647-14-5]
3. Water; H2O; [7732-18-5]

ORIGINAL MEASUREMENTS:

VARIABLES:
\[ T/K = 298.15 \]
\[ P/kPa = 101.3 \]

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>Conc. of salt / mol 1(^{-1})</th>
<th>Bunsen coefficient, (a)</th>
</tr>
</thead>
<tbody>
<tr>
<td>298.15</td>
<td>0.524</td>
<td>0.0925</td>
</tr>
<tr>
<td>1.123</td>
<td>0.0759</td>
<td></td>
</tr>
<tr>
<td>1.538</td>
<td>0.0674</td>
<td></td>
</tr>
<tr>
<td>2.170</td>
<td>0.0552</td>
<td></td>
</tr>
<tr>
<td>2.619</td>
<td>0.0467</td>
<td></td>
</tr>
<tr>
<td>3.805</td>
<td>0.0331</td>
<td></td>
</tr>
<tr>
<td>4.224</td>
<td>0.0284</td>
<td></td>
</tr>
</tbody>
</table>

Pressure = 1 atmosphere = 1.01325 x 10\(^5\)Pa.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
Solutions made up by weight and density measured but not reported in paper. Equilibrium established between a measured volume of gas and a measured amount of gas-free liquid in a cell fitted with a magnetic stirrer. Amount of gas absorbed estimated from change in volume of gas. Details in source.

SOURCE AND PURITY OF MATERIALS:
1. Commercial sample, minimum purity 99.6 mole per cent.
2. Analytical grade.
3. Distilled and degassed.

ESTIMATED ERROR:
\[ \delta T/K = \pm 0.2; \delta a = \pm 2\% \]
(estimated by compiler).

REFERENCES:
COMPONENTS:
(1) Ethene or ethylene; C$_2$H$_4$; [74-85-1]
(2) Sodium chloride; NaCl; [7647-14-5]
(3) Water; H$_2$O; [7732-18-5]

ORIGINAL MEASUREMENTS:
Morrison, T. J.; Billett, F.

VARIABLES:

<table>
<thead>
<tr>
<th>Temperature</th>
<th>Salt Effect Parameters</th>
</tr>
</thead>
<tbody>
<tr>
<td>t/$^\circ$C</td>
<td>T/K</td>
</tr>
<tr>
<td>12.6</td>
<td>285.75</td>
</tr>
<tr>
<td>30.0</td>
<td>303.15</td>
</tr>
<tr>
<td>49.4</td>
<td>322.55</td>
</tr>
<tr>
<td>71.7</td>
<td>344.85</td>
</tr>
</tbody>
</table>

1 The authors used (l/c)log(S°/S) with c defined as g eq salt per kg of water. For the 1-1 electrolyte the compiler changed the c to an m for m$_2$/mol kg$^{-1}$. The ethene solubility S is cm$^3$(STP) kg$^{-1}$.

The salt effect parameters were calculated from two measurements. The solubility of ethene in water, S°, and in the one molal salt solution, S. Only the solubility of the ethene in water, and the value of the salt effect parameter are given in the paper. The solubility values in the salt solution are not given.

The compiler calculated the values of the salt effect parameter using the mole fraction gas solubility ratio.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
The degassed solvent flows in a thin film down an absorption helix containing the ethene gas plus solvent vapor at a total pressure of one atmosphere. The volume of gas absorbed is measured in an attached buret system (1).

SOURCE AND PURITY OF MATERIALS:
(1) Ethene. Prepared from ethanol and phosphoric acid.
(2) Sodium chloride. "AnalaR" material.
(3) Water. No information given.

ESTIMATED ERROR:

$\delta k$/kg$^{-1}$ mol = 0.010

REFERENCES:
1. Morrison, T. J.; Billett, F.
COMPONENTS:  
1. Ethene; \( \text{C}_2\text{H}_4 \); [74-85-1]  
2. Lithium chloride, sodium chloride, sodium bromide or sodium sulfite  
3. Water; \( \text{H}_2\text{O} \); [7732-18-5]  

ORIGINAL MEASUREMENTS:  

VARIABLES:  

\[
\begin{align*}
T/K &= 298.15 \\
P/kPa &= 101.3
\end{align*}
\]  

PREPARED BY:  
C. L. Young  

EXPERIMENTAL VALUES:  

<table>
<thead>
<tr>
<th>Concentration of electrolyte ( /\text{mol L}^{-1})</th>
<th>Solubility of ethene ( /\text{mmol L}^{-1})</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Lithium chloride; ( \text{LiCl} ); [7447-41-8]</strong></td>
<td></td>
</tr>
<tr>
<td>0.000</td>
<td>4.83</td>
</tr>
<tr>
<td>0.500</td>
<td>4.29</td>
</tr>
<tr>
<td>1.000</td>
<td>3.75</td>
</tr>
<tr>
<td>1.500</td>
<td>3.20</td>
</tr>
<tr>
<td><strong>Sodium chloride; ( \text{NaCl} ); [7647-14-5]</strong></td>
<td></td>
</tr>
<tr>
<td>0.500</td>
<td>4.01</td>
</tr>
<tr>
<td>1.000</td>
<td>3.41</td>
</tr>
<tr>
<td>1.500</td>
<td>2.83</td>
</tr>
<tr>
<td><strong>Sodium bromide; ( \text{NaBr} ); [7647-15-6]</strong></td>
<td></td>
</tr>
<tr>
<td>0.500</td>
<td>4.19</td>
</tr>
<tr>
<td>1.000</td>
<td>3.57</td>
</tr>
<tr>
<td>1.500</td>
<td>3.07</td>
</tr>
<tr>
<td><strong>Sodium sulfite; ( \text{Na}_2\text{SO}_3 ); [7757-83-7]</strong></td>
<td></td>
</tr>
<tr>
<td>0.500</td>
<td>3.02</td>
</tr>
<tr>
<td>1.000</td>
<td>1.87</td>
</tr>
<tr>
<td>1.500</td>
<td>3.07</td>
</tr>
</tbody>
</table>

AUXILIARY INFORMATION  

METHOD/APPARATUS/PROCEDURE:  
Volumetric apparatus. Salt solution allowed to enter stirred absorption chamber. Pressure within absorption chamber adjusted to be as near atmospheric pressure as possible. Details in source and ref. 1.  

SOURCE AND PURITY OF MATERIALS:  
1. High purity sample, purity better than 99.5 mole per cent.  
2. Special grade.  
3. Distilled.  

ESTIMATED ERROR:  
Solubility = \( \pm 2\% \) (Compiler)  

REFERENCES:  
1. Yano, T.; Suetaka, T.; Umehara, T.  
*Nippon Kagaku Kaishi*  
1972, 11, 2194.
<table>
<thead>
<tr>
<th>COMPONENTS:</th>
<th>ORIGINAL MEASUREMENTS:</th>
</tr>
</thead>
<tbody>
<tr>
<td>2. Ammonium nitrate, sodium sulfite or sodium sulfate</td>
<td></td>
</tr>
<tr>
<td>3. Water; H₂O; [7732-18-5]</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>
<tr>
<td>P/kPa = 101.3</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>EXPERIMENTAL VALUES:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Concentration of salt /mol L⁻¹</td>
<td>Bunsen coefficient, α</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Nitric acid, ammonium salt (Ammonium nitrate); NH₄NO₃; [6484-52-2]</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>0.537</td>
<td>0.1050</td>
</tr>
<tr>
<td>1.937</td>
<td>0.0879</td>
</tr>
<tr>
<td>2.426</td>
<td>0.0839</td>
</tr>
<tr>
<td>2.793</td>
<td>0.0798</td>
</tr>
<tr>
<td>3.793</td>
<td>0.0713</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sulfurous acid, disodium salt (Sodium sulfite); Na₂S₀₃; [7757-83-7]</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>0.141</td>
<td>0.1011</td>
</tr>
<tr>
<td>0.267</td>
<td>0.0932</td>
</tr>
<tr>
<td>0.455</td>
<td>0.0770</td>
</tr>
<tr>
<td>0.747</td>
<td>0.0600</td>
</tr>
<tr>
<td>0.818</td>
<td>0.0592</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sulfuric acid, disodium salt (Sodium sulfate); Na₂S₀₄; [7757-82-6]</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>0.206</td>
<td>0.0916</td>
</tr>
<tr>
<td>0.448</td>
<td>0.0734</td>
</tr>
<tr>
<td>0.718</td>
<td>0.0587</td>
</tr>
<tr>
<td>0.944</td>
<td>0.0471</td>
</tr>
<tr>
<td>1.139</td>
<td>0.0392</td>
</tr>
</tbody>
</table>

**AUXILIARY INFORMATION**

**METHOD/APPARATUS/PROCEDURE:**

Solutions made up by weight and density measured but not reported in paper. Equilibrium established between a measured volume of gas and a measured amount of gas-free liquid in a cell fitted with a magnetic stirrer. Amount of gas absorbed estimated from change in volume of gas. Details in source.

**SOURCE AND PURITY OF MATERIALS:**

1. Commercial sample, minimum purity 99.6 mole per cent.
2. Analytical grade.
3. Distilled and degassed.

**ESTIMATED ERROR:**

δT/K = ±0.2; δα = ±2%.

*(estimated by compiler)*

**REFERENCES:**
COMPONENTS:
1. Ethene; C\textsubscript{2}H\textsubscript{4}; \[74-85-1]\n2. Potassium bromide, potassium chloride or copper chloride
3. Water; H\textsubscript{2}O; \[7732-18-5]\n
ORIGINAL MEASUREMENTS:
Kagaku Kogaku, 1974, 38, 320-323.

VARIABLES:
\[ T/K = 298.15 \]
\[ P/kPa = 101.3 \]

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>Concentration of electrolyte (mol L\textsuperscript{-1})</th>
<th>Solubility of ethene (mmol L\textsuperscript{-1})</th>
</tr>
</thead>
<tbody>
<tr>
<td>Potassium bromide; KBr; [7758-02-3]</td>
<td></td>
</tr>
<tr>
<td>0.000</td>
<td>4.83</td>
</tr>
<tr>
<td>0.500</td>
<td>4.24</td>
</tr>
<tr>
<td>1.000</td>
<td>3.71</td>
</tr>
<tr>
<td>1.500</td>
<td>3.21</td>
</tr>
<tr>
<td>Potassium chloride; KCl; [7747-40-7]</td>
<td></td>
</tr>
<tr>
<td>0.500</td>
<td>4.14</td>
</tr>
<tr>
<td>1.000</td>
<td>3.52</td>
</tr>
<tr>
<td>1.500</td>
<td>3.03</td>
</tr>
<tr>
<td>Copper chloride; CuCl\textsubscript{2}; [7477-39-4]</td>
<td></td>
</tr>
<tr>
<td>0.500</td>
<td>3.73</td>
</tr>
<tr>
<td>1.000</td>
<td>2.33</td>
</tr>
<tr>
<td>3.000</td>
<td>1.15</td>
</tr>
</tbody>
</table>

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
Volumetric apparatus. Salt solution allowed to enter stirred absorption chamber. Pressure within absorption chamber adjusted to be as near atmospheric pressure as possible. Details in source and ref. 1.

SOURCE AND PURITY OF MATERIALS:
1. High purity sample, purity better than 99.5 mole per cent.
2. Special grade.
3. Distilled.

ESTIMATED ERROR:
Solubility = ±2% (Compiler)

REFERENCES:
1. Yano, T.; Suetsaka, T.; Umehara, T.
   Nippon Kagaku Kaishi
   1972, 11, 2194.
**COMPONENTS:**

1. Ethene or ethylene; C\textsubscript{2}H\textsubscript{4}; [74-85-1]
2. Potassium iodide; KI; [7681-11-0]
3. Water; H\textsubscript{2}O; [7732-18-5]

**ORIGINAL MEASUREMENTS:**

Morrison, T. J.; Billett, F.


**VARIABLES:**

\[
\begin{align*}
T/\text{K} & : 285.75 - 344.85 \\
p/\text{kPa} & : 101.325 \text{ (1 atm)}
\end{align*}
\]

**EXPERIMENTAL VALUES:**

<table>
<thead>
<tr>
<th>Temperature (t/°C)</th>
<th>T/\text{K}</th>
<th>(1/(T/\text{K}))</th>
<th>(1/m\textsubscript{2})\log (S^0/S)\textsuperscript{1}</th>
<th>(1/m\textsubscript{2})\log (x^0/x)</th>
</tr>
</thead>
<tbody>
<tr>
<td>12.6</td>
<td>285.75</td>
<td>0.0035</td>
<td>0.070</td>
<td>0.085</td>
</tr>
<tr>
<td>30.0</td>
<td>303.15</td>
<td>0.0033</td>
<td>0.061</td>
<td>0.076</td>
</tr>
<tr>
<td>49.4</td>
<td>322.55</td>
<td>0.0031</td>
<td>0.050</td>
<td>0.065</td>
</tr>
<tr>
<td>71.7</td>
<td>344.85</td>
<td>0.0029</td>
<td>0.036</td>
<td>0.051</td>
</tr>
</tbody>
</table>

\textsuperscript{1} The authors used \((1/c)\log(S^0/S)\) with c defined as g eq salt per kg of water. For the 1-l electrolyte the compiler changed the c to an m for \(m_2/mol \text{ kg}^{-1}\). The ethene solubility \(S\) is \(\text{cm}^3\text{(STP)} \text{ kg}^{-1}\).

The salt effect parameters were calculated from two measurements. The solubility of ethene in water, \(S^0\), and in the one molal salt solution, \(S\). Only the solubility of the ethene in water, and the value of the salt effect parameter are given in the paper. The solubility values in the salt solution are not given.

The compiler calculated the values of the salt effect parameter using the mole fraction gas solubility ratio.

**METHOD/APPARATUS/PROCEDURE:**

The degassed solvent flows in a thin film down an absorption helix containing the ethene gas plus solvent vapor at a total pressure of one atmosphere. The volume of gas absorbed is measured in an attached buret system (1).

**SOURCE AND PURITY OF MATERIALS:**

1. Ethene. Prepared from ethanol and phosphoric acid.

**ESTIMATED ERROR:**

\[\delta k/\text{kg}^{-1} \text{ mol} = 0.010\]

**REFERENCES:**

1. Morrison, T. J.; Billett, F.

COMPONENTS:

1. Ethene; \( C_2H_4; \) [74-85-1]
2. Potassium nitrate; \( KNO_3; \) [7757-79-1]
3. Water; \( H_2O; \) [7732-18-5]

ORIGINAL MEASUREMENTS:

Clever, H. L.; Baker, E. R.; Hale, W. R.


VARIABLES:

\[ T/T = 303.15 \]
\[ P_1/kPa = 101.3 \]
\[ \sigma_2/mol dm^{-3} = 0 - 1.08 \]

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>Temperature ( t/°C )</th>
<th>Potassium Nitrate ( \sigma_0/\text{mol dm}^{-3} )</th>
<th>Ethene Solubility at 101.3 kPa</th>
<th>Solubility Ratio ( \sigma_0/\sigma_1 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>30.0</td>
<td>0</td>
<td>98.2 ± 0.5 (5)</td>
<td>4.41</td>
</tr>
<tr>
<td></td>
<td>0.0084</td>
<td>96.2 (1)</td>
<td>4.32</td>
</tr>
<tr>
<td></td>
<td>0.0173</td>
<td>92.7 ± 1.0 (2)</td>
<td>4.17</td>
</tr>
<tr>
<td></td>
<td>0.0280</td>
<td>89.6 ± 3.0 (2)</td>
<td>4.03</td>
</tr>
<tr>
<td></td>
<td>0.115</td>
<td>84.2 ± 2.5 (3)</td>
<td>3.79</td>
</tr>
<tr>
<td></td>
<td>0.525</td>
<td>73.0 ± 5.2 (4)</td>
<td>3.28</td>
</tr>
<tr>
<td></td>
<td>1.08</td>
<td>71.0 ± 1.6 (3)</td>
<td>3.19</td>
</tr>
</tbody>
</table>

\( \sigma_0/\text{mol dm}^{-3} = \) calculated by the compiler. Molar volume STP, \( V/cm^3 \text{ mol}^{-1} = 22,246. \)

The solubility ratios give salt effect parameters, \( k_{sox}/\text{dm}^3 \text{ mol}^{-1} = (1/(\sigma_2/\text{mol dm}^{-3})) \log (\sigma_0^2/\sigma_1) \), that range from 1.43 at low \( KNO_3 \) concentration to 0.13 at high \( KNO_3 \) concentration. The values at low \( KNO_3 \) concentrations should be used with caution.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The apparatus and method were similar to that described by Markham and Kobe (ref 1).

Aqueous solutions of potassium nitrate were prepared, degassed by refluxing under reduced pressure, and transferred to the solubility apparatus without contact with atmospheric gases. The solubility of ethene at a total pressure of one atm (101.3 kPa) was measured by observing the volume of gas, saturated with water vapor, absorbed by an 88.5 cm\(^3\) sample of degassed solution at 30 °C.

The solubilities were calculated for one atm partial pressure ethene assuming Henry's law.

SOURCE AND PURITY OF MATERIALS:

1. Ethene. Matheson Co., Inc. Stated to have 99.5 % minimum purity.


ESTIMATED ERROR:

\( \delta T/K = ± 0.05 \)
\( \delta \sigma_1/\sigma_1 = ± 0.01 \)

REFERENCES:

1. Markham, A. E.; Kobe, K. A.
**COMPONENTS:**

1. Ethene; \( C_2H_4; \) \{74-85-1\}
2. Silver nitrate; \( AgNO_3; \) \{7761-88-8\}
3. Water; \( H_2O; \) \{7732-18-5\}

**ORIGINAL MEASUREMENTS:**

Clever, H. L.; Baker, E. R.; Hale, W. R.


**VARIABLES:**

\[ T/K = 303.15 \]
\[ P_1/kPa = 95.75 \]
\[ \sigma_2/mol dm^{-3} = 0 - 0.0338 \]

**EXPERIMENTAL VALUES:**

<table>
<thead>
<tr>
<th>Temperature (^t)/°C</th>
<th>( T/K )</th>
<th>Silver Nitrate ( \sigma_2/mol dm^{-3} )</th>
<th>Ethene Solubility at 0.945 atm (95.75 kPa) ( \sigma_1/cm^3(STP) dm^{-3} )</th>
<th>( 10^3\sigma_1/mol dm^{-3} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>30.0 303.15 0</td>
<td>0.0001</td>
<td>92.8 ± 0.5 (5)</td>
<td>4.17</td>
<td></td>
</tr>
<tr>
<td>0.0028</td>
<td>0.0065</td>
<td>99.2 ± 0.2 (2)</td>
<td>4.46</td>
<td></td>
</tr>
<tr>
<td>149</td>
<td>0.0113</td>
<td>104 ± 0.0 (2)</td>
<td>4.68</td>
<td></td>
</tr>
<tr>
<td>0.0226</td>
<td>0.0338</td>
<td>119 ± 2.0 (2)</td>
<td>5.35</td>
<td></td>
</tr>
<tr>
<td>0.0338</td>
<td>0.0338</td>
<td>149 ± 2.0 (2)</td>
<td>6.06</td>
<td></td>
</tr>
<tr>
<td>0.0226</td>
<td>0.0226</td>
<td>200 ± 2.0 (2)</td>
<td>8.99</td>
<td></td>
</tr>
<tr>
<td>0.0001</td>
<td>0.0001</td>
<td>242 ± 0.0 (1)</td>
<td>10.88</td>
<td></td>
</tr>
</tbody>
</table>

\( \sigma_1/cm^3(STP) dm^{-3} \) \( = \frac{\sigma_1/mol dm^{-3}}{V/cm^3 mol^{-1}} \)

\( V/cm^3 mol^{-1} = 22,246 \)

*The numbers in ( ) are the number of determinations.*

Henry's constant for pure water is

\[ C_2H_4(aq, \sigma_1) + C_2H_4(g, P_1) \xrightleftharpoons{\Delta H} K_H \]

\[ K_H = (P_1/kPa)/(\sigma_1/mol dm^{-3}) = 23130 \]

**AUXILIARY INFORMATION**

**METHOD/APPARATUS/PROCEDURE:**

The apparatus and method were similar to that described by Markham and Kobe (ref 1).

Aqueous solutions of Silver nitrate were prepared, degassed by refluxing under vacuum, and transferred to the solubility apparatus without contact with atmospheric gases. The solubility of ethene at a partial pressure of 0.945 atm (95.75 kPa) was measured by observing the volume of gas, saturated with water vapor, absorbed by an 88.5 cm\(^3\) sample of degassed solution at 30.0 °C and a total pressure of 1 atm (101.3 kPa).

**SOURCE AND PURITY OF MATERIALS:**

1. Ethene. Matheson Co., Inc.
   Stated to have 99.5 % minimum purity.
2. Silver nitrate. Reagent grade.

**ESTIMATED ERROR:**

\[ \frac{\delta T}{T} = \pm 0.05 \]
\[ \frac{\delta \sigma_1}{\sigma_1} = \pm 0.01 \]

**REFERENCES:**

1. Markham, A. E.; Kobe, K. A.
COMPONENTS:
1. Ethene, (Ethylene); C₂H₄ [74-85-1]
2. Nitric acid; HNO₃ [7697-37-2]
3. Sodium chloride; NaCl [7647-14-5]

ORIGINAL MEASUREMENTS:

VARIABLES:
\[ T/K = 298.15 \]
\[ P/kPa = 101.3 \]

PREPARED BY:
C.L. Young

EXPERIMENTAL VALUES:
<table>
<thead>
<tr>
<th>( T/K )</th>
<th>( \text{Concentration}^+ ) of sodium chloride / mol l⁻¹</th>
<th>( \text{Concentration}^+ ) of nitric acid / mol l⁻¹</th>
<th>Ionic Strength / mol l⁻¹</th>
<th>Bunsen * co-efficient, ( \alpha )</th>
</tr>
</thead>
<tbody>
<tr>
<td>298.15</td>
<td>0.678</td>
<td>0.424</td>
<td>1.102</td>
<td>0.0903</td>
</tr>
<tr>
<td>0.875</td>
<td>0.546</td>
<td>0.744</td>
<td>1.421</td>
<td>0.0834</td>
</tr>
<tr>
<td>1.224</td>
<td>0.744</td>
<td>1.988</td>
<td>0.0754</td>
<td></td>
</tr>
<tr>
<td>1.421</td>
<td>0.807</td>
<td>2.308</td>
<td>0.0722</td>
<td></td>
</tr>
</tbody>
</table>

* quoted in original paper.
+ calculated from ionic strength and statement in paper that ratio of ionic strength of sodium chloride to total ionic strength was 1:0.6156.

Pressure = 1 atmosphere = 1.01325 x 10⁵Pa.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
Concentrated solution prepared by weighing, less concentrated solutions prepared by dilution. Equilibrium established between a measured volume of gas and a measured amount of gas-free liquid in a cell fitted with a magnetic stirrer. Amount of gas absorbed estimated from change in volume of gas. Details in source and ref.(1).

SOURCE AND PURITY OF MATERIALS:
1. Commercial sample, purity 99.6 mole per cent.
2. Analytical grade sample.
3. Analytical grade sample.
4. No information given.

ESTIMATED ERROR:
\[ \delta T/K = \pm 0.2; \delta \alpha = \pm 2\% \]
(estimated by compiler).

REFERENCES:
**COMPONENTS:**
1. Ethene, (Ethylene); C₂H₄; [74-85-1]
2. Carbonic acid, monosodium salt; (Sodium bicarbonate); NaHCO₃; [144-55-8]
3. Carbonic acid disodium salt; Na₂CO₃; [497-19-8]
4. Water; H₂O; [7732-18-5]

**ORIGINAL MEASUREMENTS:**

**VARIABLES:**
\[ T/K = 298.15 \]
\[ P/kPa = 101.3 \]

**PREPARED BY:**
C.L. Young.

**EXPERIMENTAL VALUES:**
\[
\begin{array}{cccc}
T/K & \text{Conc of + sodium bicarbonate} / \text{mol l}^{-1} & \text{Conc of + sodium carbonate} / \text{mol l}^{-1} & \text{Ionic strength}^* / \text{mol l}^{-1} & \text{Bunsen coefficient,}^* \\
298.15 & 0.248 & 0.018 & 0.302 & 0.0951 \\
 & 0.530 & 0.038 & 0.645 & 0.0824 \\
 & 0.657 & 0.047 & 0.799 & 0.0774 \\
\end{array}
\]

* quoted in original paper.
+ calculated from ionic strength and ratio of ionic strengths due to the two salts given in paper.

Pressure = 1 atmosphere = 1.01325 x 10⁵Pa.

**AUXILIARY INFORMATION**

**METHOD/APPARATUS/PROCEDURE:**
Concentrated solution prepared by weighing, less concentrated solutions prepared by subsequent dilution. Equilibrium established between a measured volume of gas and a measured amount of gas-free liquid in a cell fitted with a magnetic stirrer. Amount of gas absorbed estimated from change in volume of gas. Details in source and ref. (1).

**SOURCE AND PURITY OF MATERIALS:**
1. Commercial sample, purity 99.6 mole per cent.
2. Analytical grade sample.
3. Analytical grade sample.
4. No information given.

**ESTIMATED ERROR:**
\[ \delta T/K = \pm 0.2; \delta a = \pm 2\%. \]
(estimated by compiler).

**REFERENCES:**
COMPONENTS:
(1) Ethene; C₂H₄; [74-85-1]
(2) Sulfuric acid; H₂SO₄; [7664-93-9]
(3) Sodium sulfate; Na₂SO₄; [7757-82-6]
(4) Water; H₂O; [7732-18-5]

ORIGINAL MEASUREMENTS:
Kobe, K. A.; Kenton, F. H.

VARIABLES:
T/K: 298.15
P₁/kPa: 101.325 (1 atm)

PREPARED BY:
P. L. Long
H. L. Clever

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>Temperature t/°C</th>
<th>T/K</th>
<th>Solvent Volume V/cm³</th>
<th>Ethene Volume Absorbed v₁/cm</th>
<th>Bunsen Coefficient a/cm³(STP)cm⁻³atm⁻¹</th>
<th>Ostwald Coefficient L/cm³cm⁻³</th>
</tr>
</thead>
<tbody>
<tr>
<td>25</td>
<td>298.15</td>
<td>49.54</td>
<td>1.19</td>
<td>0.022</td>
<td>0.024</td>
</tr>
</tbody>
</table>

The solvent is a mixture of 800 g H₂O
200 g Na₂SO₄ (anhydrous)
40 ml H₂SO₄ (Conc., 36 normal)

Thus the molality of the solution is

\[ m₂/mol\text{ kg}^{-1} = 0.90 \text{ (H}_2\text{SO}_4) \]
\[ m₃/mol\text{ kg}^{-1} = 1.76 \text{ (Na}_2\text{SO}_4) \]

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
The apparatus is described in detail in an earlier paper (1). The apparatus consists of a gas buret, a pressure compensator, and a 200 cm³ absorption bulb and mercury leveling bulb. The absorption bulb is attached to a shaking mechanism.

The solvent and the gas are placed in the absorption bulb. The bulb is shaken until equilibrium is reached. The remaining gas is returned to the buret. The difference in the final and initial volumes is taken as the volume of gas absorbed.

SOURCE AND PURITY OF MATERIALS:
(1) Ethene. Source not given.
Purity stated to be 99+ per cent.
(2, 3) Sulfuric acid and sodium sulfate. Sources not given.
Analytical grade.

ESTIMATED ERROR:
\[ \delta a/cm³ = ±0.001 \text{ (authors)} \]

REFERENCES:
1. Kobe, K. A.; Williams, J. S.
COMPONENTS:
1. Ethene; \( \text{C}_2\text{H}_4 \); [74-85-1]
2. Sodium chloride, barium chloride or sodium sulfate
3. Nitric acid, ammonium salt (ammonium nitrate); \( \text{NH}_4\text{NO}_3 \); [6484-52-2]
4. Water; \( \text{H}_2\text{O} \); [7732-18-5]

VARIABLES:
\( T/K = 298.15 \)
\( P/kPa = 101.3 \)

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>Component 2: sodium chloride; NaCl; [7647-14-5]</th>
<th>Concentration of component 2 ( /\text{mol L}^{-1} )</th>
<th>Concentration of ammonium nitrate ( /\text{mol L}^{-1} )</th>
<th>Ionic strength ( /\text{mol L}^{-1} )</th>
<th>Bunsen coefficient, ( \alpha ) ( /\text{mol L}^{-1} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.298</td>
<td>0.193</td>
<td>0.600</td>
<td>0.0973</td>
<td></td>
</tr>
<tr>
<td>0.662</td>
<td>0.482</td>
<td>1.373</td>
<td>0.0824</td>
<td></td>
</tr>
<tr>
<td>0.777</td>
<td>0.834</td>
<td>1.611</td>
<td>0.0784</td>
<td></td>
</tr>
<tr>
<td>1.411</td>
<td>1.515</td>
<td>2.926</td>
<td>0.0603</td>
<td></td>
</tr>
<tr>
<td>1.777</td>
<td>1.909</td>
<td>3.686</td>
<td>0.0514</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Component 2: barium chloride; BaCl_2; [14832-99-6]</th>
<th>Concentration of component 2 ( /\text{mol L}^{-1} )</th>
<th>Concentration of ammonium nitrate ( /\text{mol L}^{-1} )</th>
<th>Ionic strength ( /\text{mol L}^{-1} )</th>
<th>Bunsen coefficient, ( \alpha ) ( /\text{mol L}^{-1} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.077</td>
<td>0.198</td>
<td>0.430</td>
<td>0.1046</td>
<td></td>
</tr>
<tr>
<td>0.124</td>
<td>0.318</td>
<td>0.691</td>
<td>0.0998</td>
<td></td>
</tr>
<tr>
<td>0.164</td>
<td>0.419</td>
<td>0.911</td>
<td>0.0948</td>
<td></td>
</tr>
<tr>
<td>0.195</td>
<td>0.500</td>
<td>1.086</td>
<td>0.0915</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Component 2: sodium sulfate; Na_2SO_4; [7757-82-6]</th>
<th>Concentration of component 2 ( /\text{mol L}^{-1} )</th>
<th>Concentration of ammonium nitrate ( /\text{mol L}^{-1} )</th>
<th>Ionic strength ( /\text{mol L}^{-1} )</th>
<th>Bunsen coefficient, ( \alpha ) ( /\text{mol L}^{-1} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.055</td>
<td>0.261</td>
<td>0.425</td>
<td>0.1020</td>
<td></td>
</tr>
<tr>
<td>0.105</td>
<td>0.502</td>
<td>0.818</td>
<td>0.0965</td>
<td></td>
</tr>
<tr>
<td>0.117</td>
<td>0.554</td>
<td>0.904</td>
<td>0.0926</td>
<td></td>
</tr>
<tr>
<td>0.118</td>
<td>0.561</td>
<td>0.915</td>
<td>0.0964</td>
<td></td>
</tr>
<tr>
<td>0.168</td>
<td>0.801</td>
<td>1.306</td>
<td>0.0894</td>
<td></td>
</tr>
<tr>
<td>0.226</td>
<td>1.072</td>
<td>1.749</td>
<td>0.0798</td>
<td></td>
</tr>
</tbody>
</table>

1 Calculated by compiler from ionic strength and ratio of ionic strength due to the two salts as given in paper.
2 Quoted in original paper.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
Concentrated solution prepared by weighing, less concentrated solutions prepared by dilution. Equilibrium established between a measured volume of gas and a measured amount of gas-free liquid in a cell fitted with a magnetic stirrer. Amount of gas absorbed estimated from change in volume of gas. Details in source and ref. [1].

SOURCE AND PURITY OF MATERIALS:
1. Commercial sample, purity 99.6 mole per cent.
2. Analytical grade sample.
3. Analytical grade sample.
4. No information given.

ESTIMATED ERROR:
\[ \delta T/K = \pm 0.2; \quad \delta \alpha = \pm 2\% . \] (estimated by compiler)

REFERENCES:
COMPONENTS:
1. Ethene, (Ethylene); C_2H_4; [74-85-1]
2. Carbonic acid, monopotassium salt, (Potassium bicarbonate); KHCO_3; [298-14-6]
3. Carbonic acid, dipotassium salt, (Potassium carbonate); K_2CO_3; [584-08-7]
4. Water; H_2O; [7732-18-5]

VARIABLES:
T/K = 298.15
P/kPa = 101.3

ORIGINAL MEASUREMENTS:

PREPARED BY:
C.L. Young.

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>Conc of + potassium bicarbonate / mol l(^{-1})</th>
<th>Conc of + potassium carbonate / mol l(^{-1})</th>
<th>Ionic strength* / mol l(^{-1})</th>
<th>Bunsen* coefficient α*</th>
</tr>
</thead>
<tbody>
<tr>
<td>298.15</td>
<td>0.239</td>
<td>0.016</td>
<td>0.286</td>
<td>0.0983</td>
</tr>
<tr>
<td></td>
<td>0.538</td>
<td>0.036</td>
<td>0.645</td>
<td>0.0805</td>
</tr>
<tr>
<td></td>
<td>0.587</td>
<td>0.039</td>
<td>0.704</td>
<td>0.0848</td>
</tr>
<tr>
<td></td>
<td>0.873</td>
<td>0.058</td>
<td>1.046</td>
<td>0.0709</td>
</tr>
<tr>
<td></td>
<td>1.084</td>
<td>0.072</td>
<td>1.299</td>
<td>0.0627</td>
</tr>
</tbody>
</table>

* quoted in original paper.
+ calculated from ionic strength and ratio of ionic strengths due to the two salts given in paper.

Pressure = 1 atmosphere = 1.01325 \times 10^5 Pa.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
Concentrated solution prepared by weighing, less concentrated solutions prepared by subsequent dilution. Equilibrium established between a measured volume of gas and a measured amount of gas-free liquid in a cell fitted with a magnetic stirrer. Amount of gas absorbed estimated from change in volume of gas. Details in source and ref. (1).

SOURCE AND PURITY OF MATERIALS:
1. Commercial sample, purity 99.6 mole per cent.
2. Analytical grade sample.
3. Analytical grade sample.
4. No information given.

ESTIMATED ERROR:
δT/K = ±0.2; δα = ±2%.
(estimated by compiler).

REFERENCES:
COMPONENTS:
1. Ethene, (Ethylene); C₂H₄; [74-85-1]
2. Sodium chloride; NaCl; [7647-14-5]
3. Barium chloride; BaCl₂; [14832-99-6]
4. Nitric acid, ammonium salt, (ammonium nitrate); NH₄NO₃; [6484-52-2]
5. Water; H₂O; [7732-18-5]

VARIABLES:
Composition

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>Concentration⁺</th>
<th>Concentration⁺</th>
<th>Concentration⁺</th>
<th>Ionic *</th>
<th>Bunsen *</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>of sodium</td>
<td>of barium</td>
<td>of ammonium</td>
<td>Strength</td>
<td>coefficient,</td>
</tr>
<tr>
<td></td>
<td>chloride</td>
<td>chloride</td>
<td>nitrate</td>
<td>α</td>
<td>/ mol l⁻¹</td>
</tr>
<tr>
<td></td>
<td>/ mol l⁻¹</td>
<td>/ mol l⁻¹</td>
<td>/ mol l⁻¹</td>
<td></td>
<td></td>
</tr>
<tr>
<td>298.15</td>
<td>0.195</td>
<td>0.065</td>
<td>0.195</td>
<td>0.584</td>
<td>0.0985</td>
</tr>
<tr>
<td></td>
<td>0.249</td>
<td>0.083</td>
<td>0.249</td>
<td>0.748</td>
<td>0.0955</td>
</tr>
<tr>
<td></td>
<td>0.317</td>
<td>0.106</td>
<td>0.317</td>
<td>0.952</td>
<td>0.0911</td>
</tr>
<tr>
<td></td>
<td>0.383</td>
<td>0.127</td>
<td>0.382</td>
<td>1.145</td>
<td>0.0881</td>
</tr>
</tbody>
</table>

* quoted in original paper.
+ calculated from ionic strength and statement in paper that the ratio of ionic strength of three salts was 1:1:1

Pressure = 1 atmosphere = 1.01325 x 10⁵Pa.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
Concentrated solution prepared by weighing, less concentrated solutions prepared by subsequent dilution. Equilibrium established between a measured volume of gas and a measured amount of gas-free liquid in a cell fitted with a magnetic stirrer. Amount of gas absorbed estimated from change in volume of gas. Details in source and ref. (1).

SOURCE AND PURITY OF MATERIALS:
1. Commercial sample, purity 99.6 mole per cent.
2. Analytical grade sample.
3. Analytical grade sample.
4. Analytical grade sample.
5. No information given.

ESTIMATED ERROR:
δT/K = ±0.2; δα = ±2%.
(estimated by compiler).

REFERENCES:
Seven papers report ethene solubility data in eleven aqueous organic nonelectrolyte solutions. Most of the data were collected at 298 K and 1 atm (101.3 kPa) partial pressure of ethene. Only one system has been studied by more than one laboratory. There is no reliable way to evaluate these data. They are classed as tentative until confirmed by further experimental work.

- Ethene + Methanol [57-56-1] + Water
- Ethene + Ethanol [64-17-1] + Water
- Ethene + 1-Propanol [71-23-8] + Water
- Ethene + 2-Butanone [74-18-5] + Water
- Ethene + 2-Amino-ethanol [141-43-5] + Water
- Ethene + 2,2',2"-Nitrilotris-ethanol [102-71-6] + Water
- Ethene + 1-Amino-2-propanol [78-96-6] + Water

Yano, Kidaka, Miyamoto and Murakami (3) measured the solubility of ethene in water, the pure alcohol and four mixtures of 0.2, 0.4, 0.6 and 0.8 mole fraction alcohol at 298.15 K by a volumetric method for each of the three systems. The solubility values in water and in the pure alcohols agree well with other data. The data sets are classed tentative.

Yorizane, Masuoka, Ida and Ieda (1) measured the solubility of ethene in both phases of the two phase liquid formed by mixing 2-butane, CH₃COCH₂CH₃ (methyl ethylketone), and water. The gas phase was stated to be greater than 99 percent ethene. Measurements are reported at five temperatures between 281 and 298 K and at ethene pressures between 1.013 and 5.238 MPa (10 - 51.7 atm). Ethene hydrates were observed to form at temperatures < 284 K and pressures > 1.175 MPa. The data are classed as tentative.

Sada and Kito (4) report the solubility of ethene in 0 to 3.83 mol L⁻¹ H₂NCH₂CH₂OH at 288.15 K and 0 to 5.70 mol L⁻¹ organic component at 298.15 K. The 2-amino-ethanol has little effect on the solubility of ethene in water. The Bunsen coefficient increases about 10 % as the organic component increases from 0 to 5.70 mol L⁻¹ at 298.15 K. The data are classed as tentative.

Sada et al. (5) (5) measured the solubility of ethene in 0 to 3.123 mol L⁻¹ (HOCH₂CH₂)₂NH at 298.15 K. The solubility (Bunsen coefficient) appears to go through a small maximum at 2.038 mol L⁻¹ amine, but the change is only a percent or two more than experimental error. The data are classed as tentative.

Sada et al. (6) measured the solubility of ethene in 0 to 3.240 mol L⁻¹ CH₂CHOHCH₂NH₂ at 298.15 K. The solubility (Bunsen coefficient) may go through a small maximum as the amine concentration increases, but the change is only about twice the magnitude of the estimated error of the measurement. The data are classed as tentative.
Ethene + 1,2-Ethanediamine [107-15-3] + Water

Sada et al. (5) measured the solubility of ethene in 0 to 3.683 mol L\(^{-1}\) \(\text{H}_2\text{NCH}_2\text{CHNH}_2\) at 298.15 K. The solubility (Bunsen coefficient) appears to go through a small but definite maximum as the amine concentration increases. The data are classed as tentative.

Ethene + 1,1'Iminobis-2-propanol [110-97-4] + Water

Sada et al. (6) measured the solubility of ethene in 0 to 2.982 mol L\(^{-1}\) \((\text{CH}_3\text{CHOHCH}_2)\text{NH}\) at 298.15 K. The solubility (Bunsen coefficient) appears to go through a small maximum as the amine concentration increases. The data are classed as tentative.


Shenderei and Ivanovskii (2) report ethene solubilities at 273, 278, 288 and 293 K and 13.3 - 101.3 kPa in mixed solvents of 0 to 0.557 mole fraction water. Wu, Zeck, Langhorst and Knapp (7) report ethene solubility at 298.15 K and 1 bar in mixed solvent of 0.083 to 0.960 mole fraction water. Limited comparison can be made between the Henry's constants calculated by the compiler in atm/mol fraction for the two studies. The results are of similar magnitude, but the Wu et al. Henry constants appears to be larger at 0.544-0.557 mole fraction water and smaller at 0.083-0.104 mole fraction water than expected from the trends shown by the Shenderei and Ivanovskii values. There is no way to say which data set is the more reliable, both data sets are classed as tentative.

REFERENCES

COMPONENTS:
1. Ethene; C$_2$H$_4$; [74-85-1]
2. Methanol; CH$_3$OH; [67-56-1]
3. Water; H$_2$O; [7732-18-5]

VARIABLES:

| T/K = 298.15 |
| P/kPa = 101.325 |
| Mole Fraction Alcohol, $x_2^1$ = 0-1 |

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>Mole Fraction Alcohol in Mixed Solvent/$x_2^1$</th>
<th>Ethene solubility, $x_2^1$, for $P_1 = 101.325$</th>
<th>2 Ostwald Coefficient $L/cm^3$gas($cm^3$ solvent)$^{-1}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0 (water)</td>
<td>0.0000876</td>
<td>0.0000904</td>
</tr>
<tr>
<td>0.2</td>
<td>0.000175</td>
<td>0.000186</td>
</tr>
<tr>
<td>0.4</td>
<td>0.000416</td>
<td>0.000454</td>
</tr>
<tr>
<td>0.6</td>
<td>0.000954</td>
<td>0.001074</td>
</tr>
<tr>
<td>0.8</td>
<td>0.00219</td>
<td>0.00254</td>
</tr>
<tr>
<td>1.0 (alcohol)</td>
<td>0.00408</td>
<td>0.00488</td>
</tr>
</tbody>
</table>

Although not specifically stated in the paper, it is assumed that the mole fraction solubility, $x$, is for a total pressure of 101.325 kPa.

The solubility corresponding to a gas partial pressure of 101.325 kPa was calculated by the compiler; Raoult's law was assumed to apply to the mixed solvent solution.

A glass apparatus was employed in which the uptake of gas by a known volume of solvent in a dissolution cell was volumetrically determined. The gas was displaced by mercury as the gas dissolved at constant pressure. A magnetically operated gas circulating pump and bubbling tip were provided for bubbling the gas through the solvent in the dissolution cell.

Sources and purities not given.

$\delta x_2^1/x_2^1 = \pm 0.03$ (Compiler)

REFERENCES:
**VARIABLES:**

- $T/K = 298.15$
- $P/kPa = 101.325$
- Mole Fraction Alcohol, $x_1 = 0-1$

**COMPONENTS:**

1. Ethene; $C_2H_4$; [74-85-1]
2. Ethanol; $C_2H_6O$; [64-17-1]
3. Water; $H_2O$; [7732-18-5]

**EXPERIMENTAL VALUES:**

<table>
<thead>
<tr>
<th>Temperature $t/\degree C$</th>
<th>Mole Fraction Alcohol in Mixed Solvent, $x_2$</th>
<th>Ethene solubility for: $P=101.325, x_1$</th>
<th>$\gamma$</th>
<th>$L/cm^3$ gas $cm^{-3}$ solvent</th>
</tr>
</thead>
<tbody>
<tr>
<td>25.0</td>
<td>0.0 (water) 0.0000876 0.0000904 0.122</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.2</td>
<td>0.000279 0.000291 0.270</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.4</td>
<td>0.000847 0.000892 0.633</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.6</td>
<td>0.00199 0.00212 1.22</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.8</td>
<td>0.00351 0.00373 2.15</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.0 (alcohol)</td>
<td>0.00558 0.00605 2.52</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1. Although not specifically stated in the paper, it is assumed that the mole fraction solubility, $x_1$, is for a total pressure of 101.325 kPa.

2. The solubility corresponding to a gas partial pressure of 101.325 kPa was calculated by the compiler; Raoult's law was assumed to apply to the mixed solvent solution.

**AUXILIARY INFORMATION**

**METHOD/APPARATUS/PROCEDURE:**

A glass apparatus was employed in which the uptake of gas by a known volume of solvent in a dissolution cell was volumetrically determined. The gas was displaced by mercury as the gas dissolved at constant pressure. A magnetically operated gas circulating pump and bubbling tip were provided for bubbling the gas through the solvent in the dissolution cell.

**SOURCE AND PURITY OF MATERIALS:**

Sources and purities not given.

**ESTIMATED ERROR:**

$\delta x_1/x_1 = \pm 0.03$ (Compiler)

**OFFICIAL MEASUREMENTS:**

Yano, T.; Kidaka, T.; Miyamoto, H.; Murakami, T.
**COMPONENTS:**

1. Ethene; C_2H_4; [74-85-1]
2. 1-Propanol; C_3H_8O; [71-23-8]
3. Water; H_2O; [7732-18-5]

**VARIABLES:**

\[ \frac{T}{K} = 298.15 \]
\[ P/kPa = 101.325 \]

Mole Fraction Alcohol, \( x_1 \) = 0-1

**EXPERIMENTAL VALUES:**

<table>
<thead>
<tr>
<th>Mole Fraction Alcohol in Mixed Solvent, ( x_2 )</th>
<th>Ethene solubility for: ( P = 101.325, x_2 )</th>
<th>( \frac{L}{cm^3 gas (cm^3 solvent)} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>25.0 (water) 0.0</td>
<td>0.00000876</td>
<td>0.0000904</td>
</tr>
<tr>
<td>0.2</td>
<td>0.000603</td>
<td>0.000622</td>
</tr>
<tr>
<td>0.4</td>
<td>0.00174</td>
<td>0.00179</td>
</tr>
<tr>
<td>0.6</td>
<td>0.00323</td>
<td>0.00333</td>
</tr>
<tr>
<td>0.8</td>
<td>0.00495</td>
<td>0.00509</td>
</tr>
<tr>
<td>1.0 (alcohol) 0.00</td>
<td>0.00697</td>
<td>0.00717</td>
</tr>
</tbody>
</table>

1Although not specifically stated in the paper, it is assumed that the mole fraction solubility, \( x_2 \), is for a total pressure of 101.325 kPa.

2The solubility corresponding to a gas partial pressure of 101.325 kPa was calculated by the compiler; Raoult's law was assumed to apply to the mixed solvent solution.

**AUXILIARY INFORMATION**

**METHOD/APPARATUS/PROCEDURE:**

A glass apparatus was employed in which the uptake of gas by a known volume of solvent in a dissolution cell was volumetrically determined. The gas was displaced by mercury as the gas dissolved at constant pressure. A magnetically operated gas circulating pump and bubbling tip were provided for bubbling the gas through the solvent in the dissolution cell.

**SOURCE AND PURITY OF MATERIALS:**

Sources and purities not given.

**ESTIMATED ERROR:**

\[ \delta \frac{x_1}{x_2} = \pm 0.03 \] (Compiler)

**REFERENCES:**
### COMPONENTS:

1. Ethene; $\text{C}_2\text{H}_4$; [74-85-1]
2. 2-Butanone (methyl ethylketone); $\text{C}_4\text{H}_8\text{O}$; [74-18-5]
3. Water; $\text{H}_2\text{O}$; [7732-18-5]

### ORIGINAL MEASUREMENTS:

Yorizane, M.; Masuoka, H.;
Ida, S.; Ideda, T.


### VARIABLES:

\[ T/K = 281.15 - 298.15 \]
\[ P/\text{MPa} = 1.013 - 5.238 \]

### EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>$t/\degree C$</th>
<th>281.15</th>
<th>283.05</th>
<th>283.95</th>
<th>283.95</th>
<th>287.95</th>
<th>287.95</th>
<th>287.95</th>
<th>287.95</th>
<th>288.15</th>
</tr>
</thead>
<tbody>
<tr>
<td>$T/K$</td>
<td>8.0</td>
<td>10.8</td>
<td>10.8</td>
<td>10.8</td>
<td>14.8</td>
<td>14.8</td>
<td>14.8</td>
<td>14.8</td>
<td>15.0</td>
</tr>
<tr>
<td>Pressure</td>
<td>15.0</td>
<td>10.0</td>
<td>20.0</td>
<td>48.5</td>
<td>10.0</td>
<td>20.0</td>
<td>30.0</td>
<td>35.0</td>
<td>51.0</td>
</tr>
<tr>
<td></td>
<td>1.520</td>
<td>1.013</td>
<td>2.026</td>
<td>4.914</td>
<td>1.013</td>
<td>2.026</td>
<td>3.040</td>
<td>3.546</td>
<td>5.168</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ethene</td>
<td>18.36</td>
<td>13.22</td>
<td>26.47</td>
<td>98.10</td>
<td>10.46</td>
<td>23.99</td>
<td>40.02</td>
<td>52.52</td>
<td>91.15</td>
</tr>
<tr>
<td>MEK</td>
<td>71.50</td>
<td>70.68</td>
<td>65.26</td>
<td>1.90</td>
<td>71.94</td>
<td>66.71</td>
<td>53.23</td>
<td>45.14</td>
<td>35.40</td>
</tr>
<tr>
<td>Water</td>
<td>10.14</td>
<td>16.10</td>
<td>8.27</td>
<td>0</td>
<td>17.60</td>
<td>9.30</td>
<td>6.75</td>
<td>2.34</td>
<td>1.99</td>
</tr>
<tr>
<td>Bottom Liquid Phase</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Ethene</td>
<td>0.22</td>
<td>0.21</td>
<td>0.30</td>
<td>0.26</td>
<td>0.20</td>
<td>0.26</td>
<td>0.30</td>
<td>0.21</td>
<td>0.47</td>
</tr>
<tr>
<td>MEK</td>
<td>7.05</td>
<td>7.22</td>
<td>5.82</td>
<td>2.62</td>
<td>7.87</td>
<td>6.00</td>
<td>4.26</td>
<td>3.72</td>
<td>3.59</td>
</tr>
<tr>
<td>Water</td>
<td>92.73</td>
<td>92.57</td>
<td>93.88</td>
<td>97.12</td>
<td>91.93</td>
<td>93.47</td>
<td>95.44</td>
<td>96.07</td>
<td>95.94</td>
</tr>
<tr>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\[ ^1 \text{This solubility is between a gas (ethene) phase, stated to be greater than 99\% ethene and two separate, immiscible liquid phases with the compositions expressed as mole percent.} \]

\[ ^2 \text{Calculated by compiler.} \]

### AUXILIARY INFORMATION

**METHOD/APPARATUS/PROCEDURE:**

The apparatus was described earlier (ref.1). The equilibrium cell was a Jerguson gauge of stainless steel with glass windows having an internal volume of 90 ml. Equilibrium was achieved by means of a gas recirculation pump. Samples of each phase were analyzed by means of a Shimadzu GC equipped with a peak integrator and a Porapack Q column. The concentrations of water vapor in the ethene were so low that they could not be detected.

At low temperatures (less than 11°C) and high pressures (greater than 11.6 atm) ethylene hydrates were observed to form.

**SOURCE AND PURITY OF MATERIALS:**

1. Ethene. Specified purity 99.95%.
2. 2-Butanone. Specified purity 99.6%.

**ESTIMATED ERROR:**

Accuracy: Not specified.

### REFERENCES:

1. Yorizane, M.; Yoshimura, S.; Masuoka, H.

**COMPONENTS:**

1. Ethene; $C_2H_4$; [74-85-1]
2. 2-Butanone (methyl ethyl ketone); $C_4H_8O$; [74-18-5]
3. Water; $H_2O$; [7732-18-5]

**ORIGINAL MEASUREMENTS:**


**VARIABLES:**

$T/K = 281.15 - 298.15$

$P/MPa = 1.013 - 5.238$

**EXPERIMENTAL VALUES: **

<table>
<thead>
<tr>
<th>$t/C$</th>
<th>$T/K$</th>
<th>Pressure</th>
<th>Ethene</th>
<th>MEK</th>
<th>Water</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>293.15</td>
<td>10</td>
<td>8.80</td>
<td>70.39</td>
<td>20.81</td>
</tr>
<tr>
<td>20</td>
<td>20</td>
<td>2.026</td>
<td>18.72</td>
<td>68.38</td>
<td>12.90</td>
</tr>
<tr>
<td>20</td>
<td>30</td>
<td>3.040</td>
<td>36.66</td>
<td>56.73</td>
<td>6.61</td>
</tr>
<tr>
<td>20</td>
<td>35</td>
<td>3.546</td>
<td>44.08</td>
<td>50.69</td>
<td>5.23</td>
</tr>
<tr>
<td>20</td>
<td>40</td>
<td>4.053</td>
<td>55.78</td>
<td>39.69</td>
<td>4.53</td>
</tr>
<tr>
<td>20</td>
<td>45</td>
<td>4.560</td>
<td>52.25</td>
<td>44.80</td>
<td>2.95</td>
</tr>
<tr>
<td>20</td>
<td>50</td>
<td>5.066</td>
<td>75.76</td>
<td>22.65</td>
<td>1.59</td>
</tr>
<tr>
<td>25</td>
<td>298.15</td>
<td>20</td>
<td>20.16</td>
<td>64.63</td>
<td>15.21</td>
</tr>
<tr>
<td>25</td>
<td>35</td>
<td>3.546</td>
<td>36.76</td>
<td>54.42</td>
<td>8.82</td>
</tr>
<tr>
<td>25</td>
<td>40</td>
<td>4.053</td>
<td>47.93</td>
<td>47.42</td>
<td>4.65</td>
</tr>
<tr>
<td>25</td>
<td>45</td>
<td>4.560</td>
<td>51.97</td>
<td>43.86</td>
<td>4.17</td>
</tr>
<tr>
<td>25</td>
<td>51.7</td>
<td>5.238</td>
<td>71.52</td>
<td>26.90</td>
<td>1.58</td>
</tr>
</tbody>
</table>

1. This solubility is between a gas (ethene) phase, stated to be greater than 99% ethene and two separate, immiscible liquid phases with the compositions expressed as mole percent.

2. Calculated by compiler.

**AUXILIARY INFORMATION**

**METHOD/APPARATUS/PROCEDURE:**

The apparatus was described earlier (ref.1). The equilibrium cell was a Jerguson gauge of stainless steel with glass windows having an internal volume of 90 ml. Equilibrium was achieved by means of a gas recirculation pump. Samples of each phase were analyzed by means of a Shimadzu GC equipped with a peak integrator and a Porapack Q column. The concentrations of water vapor in the ethene were so low that they could not be detected.

At low temperatures (less than 11°C) and high pressures (greater than 11.6 atm) ethylene hydrates were observed to form.

**SOURCE AND PURITY OF MATERIALS:**

1. Ethene. Specified purity 99.95%.
2. 2-Butanone. Specified purity 99.6%.

**ESTIMATED ERROR:**

Accuracy: Not specified.

**REFERENCES:**

1. Yorizane, M.; Yoshimura, S.; Masuoka, H.
**COMPONENTS:**

1. Ethene (Ethylene); \( \text{C}_2\text{H}_4 \);  
2. 2-Aminoethanol, (monoethanolamine); \( \text{C}_2\text{H}_7\text{NO} \); [141-43-5]  
3. Water; \( \text{H}_2\text{O} \); [7732-18-5]  

**VARIABLES:**

\[
\begin{align*}
T/K & = 288.15, 298.15 \\
P/kPa & = 101.3 
\end{align*}
\]

**EXPERIMENTAL VALUES:**

<table>
<thead>
<tr>
<th>( T/K )</th>
<th>Conc. of monoethanolamine / mol l(^{-1}) (soln.)</th>
<th>Bunsen coefficient,</th>
</tr>
</thead>
<tbody>
<tr>
<td>288.15</td>
<td>0.0</td>
<td>0.1432</td>
</tr>
<tr>
<td></td>
<td>0.9679</td>
<td>0.1450</td>
</tr>
<tr>
<td></td>
<td>2.2273</td>
<td>0.1432</td>
</tr>
<tr>
<td></td>
<td>2.8605</td>
<td>0.1437</td>
</tr>
<tr>
<td></td>
<td>3.8283</td>
<td>0.1408</td>
</tr>
<tr>
<td>298.15</td>
<td>0.0</td>
<td>0.1111</td>
</tr>
<tr>
<td></td>
<td>1.0049</td>
<td>0.1149</td>
</tr>
<tr>
<td></td>
<td>1.9091</td>
<td>0.1161</td>
</tr>
<tr>
<td></td>
<td>2.8337</td>
<td>0.1187</td>
</tr>
<tr>
<td></td>
<td>4.2082</td>
<td>0.1218</td>
</tr>
<tr>
<td></td>
<td>5.7019</td>
<td>0.1244</td>
</tr>
</tbody>
</table>

**AUXILIARY INFORMATION**

**METHOD APPARATUS PROCEDURE:**

Equilibrium established between measured volume of gas and a measured amount of gas-free liquid in a cell fitted with a magnetic stirrer. Amount of gas absorbed estimated from change in volume of gas. Concentration of amine determined by titration. Details in source and ref. (1).

**SOURCE AND PURITY OF MATERIALS:**

1. Purity 99.6 mole per cent.  
2/3. Of satisfactory purity.

**ESTIMATED ERROR:**

\[ \delta T/K = \pm 0.2; \; \delta a = \pm 2\%. \]

(estimated by compiler).

**REFERENCES:**

1. Onda, K.; Sada, E.; Kobayashi, T.  
COMPONENTS:
1. Ethene (Ethylene); C_2H_4; [74-85-1]
2. 1,2-Ethanedia~ine, (Ethyldiamine); C_2H_4N_2; [107-15-3]
3. Water; H_2O; [7732-18-5]

VARIABLES:
T/K = 293.15
P/KPa = 101.3

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>Conc. of amine / mol l^{-1}</th>
<th>Bunsen coefficient, a</th>
</tr>
</thead>
<tbody>
<tr>
<td>293.15</td>
<td>0.0</td>
<td>0.1111</td>
</tr>
<tr>
<td></td>
<td>0.561</td>
<td>0.1153</td>
</tr>
<tr>
<td></td>
<td>1.049</td>
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</tr>
<tr>
<td></td>
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</tr>
<tr>
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</tr>
<tr>
<td></td>
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<tr>
<td></td>
<td>2.890</td>
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</tr>
<tr>
<td></td>
<td>3.683</td>
<td>0.1124</td>
</tr>
</tbody>
</table>

Pressure = 1 atmosphere = 1.01325 x 10^5Pa.

METHOD/APPARATUS/PROCEDURE:
Equilibrium established between a measured volume of gas and a measured amount of gas-free liquid in a cell fitted with a magnetic stirrer. Amount of gas absorbed estimated from change in volume of gas. Concentration of amine determined by titration. Details in source and ref.(1).

SOURCE AND PURITY OF MATERIALS:
1. Commercial sample, minimum purity 99.8 mole per cent.
2. Reagent grade of guaranteed quality.
3. Distilled and degassed.

ESTIMATED ERROR:
\[ \delta T/K = \pm 0.2; \delta a = \pm 2\% \]
(estimated by compiler).

REFERENCES:
COMPONENTS:
1. Ethene (Ethylene); C₂H₄; [74-85-1]
2. Ethanol, 2,2'-iminobis-, (Diethanolamine); C₆H₁₁NO₂; [111-42-2]
3. Water; H₂O; [7732-18-5]

VARIABLES:
\[ T/K = 298.15 \]
\[ P/kPa = 101.3 \]

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>Conc. of amine / mol l⁻¹</th>
<th>Bunsen coefficient ( \alpha )</th>
</tr>
</thead>
<tbody>
<tr>
<td>298.15</td>
<td>0.00</td>
<td>0.1111</td>
</tr>
<tr>
<td></td>
<td>0.949</td>
<td>0.1131</td>
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<td>1.540</td>
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<td></td>
<td>2.442</td>
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<td>2.895</td>
<td>0.1121</td>
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</tr>
<tr>
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<td>3.123</td>
<td>0.1104</td>
</tr>
</tbody>
</table>

Pressure = 1 atmosphere = 1.01325 x 10⁵ Pa.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
Equilibrium established between a measured volume of gas and a measured amount of gas-free liquid in a cell fitted with a magnetic stirrer. Amount of gas absorbed estimated from change in volume of gas. Concentration of amine determined by titration. Details in source and ref. (1).

SOURCE AND PURITY OF MATERIALS:
1. Commercial sample, minimum purity 99.6 mole per cent.
2. Reagent grade of guaranteed quality.
3. Distilled and degassed.

ESTIMATED ERROR:
\[ \delta T/K = \pm 0.2; \delta \alpha = \pm 2\%. \]
(estimated by compiler).

REFERENCES:
COMPONENTS:
1. Ethene (Ethylene); C2H4; [74-85-1]
2. Ethanol, 2,2',2'''-nitrilotris-,(Triethanolamine); C6H15N03; [102-71-6]
3. Water; H2O; [7732-18-5]

ORIGINAL MEASUREMENTS:

VARIABLES:
\[ T/K = 298.15 \]
\[ P/kPa = 101.3 \]

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>( T/K )</th>
<th>Conc. of amine / mol l(^{-1} )</th>
<th>Bunsen coefficient, ( \alpha )</th>
</tr>
</thead>
<tbody>
<tr>
<td>298.15</td>
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<td>0.1111</td>
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<td>0.193</td>
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<td></td>
<td>2.624</td>
<td>0.1053</td>
</tr>
</tbody>
</table>

Pressure = 1 atmosphere = 1.01325 x 10\(^5\)Pa

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
Equilibrium established between a measured volume of gas and a measured amount of gas-free liquid in a cell fitted with a magnetic stirrer. Amount of gas absorbed estimated from change in volume of gas. Concentration of amine determined by titration. Details in source and ref.(1).

SOURCE AND PURITY OF MATERIALS:
1. Commercial sample, minimum purity 99.6 mole per cent.
2. Reagent grade of guaranteed quality.
3. Distilled and degassed.

ESTIMATED ERROR:
\[ \delta T/K = \pm 0.2; \delta \alpha = \pm 2\% \]
(estimated by compiler).

REFERENCES:
<table>
<thead>
<tr>
<th>COMPONENTS:</th>
<th>ORIGINAL MEASUREMENTS:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Ethene (Ethylene); C₂H₄; [74-85-1]</td>
<td>Sada, E.; Kumazawa, H.; Butt, M.A.</td>
</tr>
<tr>
<td>3. Water; H₂O; [7732-18-5]</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>
<tr>
<td>P/kPa = 101.3</td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>EXPERIMENTAL VALUES:</th>
</tr>
</thead>
<tbody>
<tr>
<td>T/K</td>
</tr>
<tr>
<td>-----</td>
</tr>
<tr>
<td>298.15</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
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<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

Pressure = 1 atmosphere = 1.01325 x 10⁵Pa.

**AUXILIARY INFORMATION**

**METHOD/APPARATUS/PROCEDURE:**
Equilibrium established between measured volume of gas and a measured amount of gas-free liquid in a cell fitted with a magnetic stirrer. Amount of gas absorbed estimated from change in volume of gas. Concentration of amine determined by titration. Details in source and refs. (1) and (2).

**SOURCE AND PURITY OF MATERIALS:**
1. Commercial sample, minimum purity 99.6 mole per cent.
2. Reagent grade of guaranteed quality.
3. Distilled and degassed.

**ESTIMATED ERROR:**
δT/K = ±0.2; δα = ±2%.
(estimated by compiler).

**REFERENCES:**
COMPONENTS:
1. Ethene (Ethylene); C\(_2\)H\(_4\); [74-85-1]
2. 2-Propanol, \(1,1^{\prime}\)-aminobis-(Diisopropanolamine); C\(_6\)H\(_{12}\)NO\(_2\); [110-97-4]
3. Water; H\(_2\)O; [7732-18-5]

ORIGINAL MEASUREMENTS:
Sada, E.; Kumazawa, H.; Butt, M.A.

VARIABLES:
\(T/\text{K} = 298.15\)
\(P/\text{kPa} = 101.3\)

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>(T/\text{K})</th>
<th>Conc. of amine / mol (1^{-1})</th>
<th>Bunsen coefficient, (a)</th>
</tr>
</thead>
<tbody>
<tr>
<td>298.15</td>
<td>0.0</td>
<td>0.1111</td>
</tr>
<tr>
<td></td>
<td>0.236</td>
<td>0.1131</td>
</tr>
<tr>
<td></td>
<td>0.290</td>
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</tr>
<tr>
<td></td>
<td>0.550</td>
<td>0.1120</td>
</tr>
<tr>
<td></td>
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<tr>
<td></td>
<td>1.467</td>
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</tr>
<tr>
<td></td>
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</tr>
<tr>
<td></td>
<td>2.982</td>
<td>0.1001</td>
</tr>
</tbody>
</table>

Pressure = 1 atmosphere = 1.01325 x 10\(^5\)Pa.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
Equilibrium established between measured volume of gas and a measured amount of gas-free liquid in a cell fitted with a magnetic stirrer. Amount of gas absorbed estimated from change in volume of gas. Concentration of amine determined by titration. Details in source and refs. (1) and (2).

SOURCE AND PURITY OF MATERIALS:
1. Commercial sample, minimum purity 99.6 mole per cent.
2. Reagent grade of guaranteed quality.
3. Distilled and degassed.

ESTIMATED ERROR:
\(\delta T/\text{K} = \pm 0.2\); \(\delta a = \pm 2\%\)
(estimated by compiler).

REFERENCES:
1. Sada, E.; Kumazawa, H.; Butt, M.A.
COMPONENTS:
1. Ethene; \(\text{C}_2\text{H}_4; [74-85-1]\)
2. 2-Pyrrolidinone, 1-methyl-, (N-methylpyrrolidinones); \(\text{C}_6\text{H}_{11}\text{NO}; [872-50-4]\)
3. Water; \(\text{H}_2\text{O}; [7732-18-5]\)

VARIABLES:
- \(T/K = 273-288\)
- \(P/kPa = 101.3\) (1 atm)
- Water conc./mole fraction = 0-0.56

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>(t/C)</th>
<th>(T/K)</th>
<th>water content in solvent, mole fraction</th>
<th>Henry's constant (K/mm) mercury</th>
<th>(H^1/\text{atm}) ((\text{mole fraction})^{-1}(\text{mole fraction})^{-1}) Ethene, (x_1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>273.15</td>
<td>0.104</td>
<td>93900</td>
<td>123.6</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.241</td>
<td>124000</td>
<td>163.2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.378</td>
<td>205000</td>
<td>269.7</td>
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<tr>
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<td></td>
<td>0.557</td>
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<td>5</td>
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<td></td>
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<td>0.241</td>
<td>134000</td>
<td>176.3</td>
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<tr>
<td></td>
<td></td>
<td>0.378</td>
<td>224000</td>
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<td>111000</td>
<td>146.1</td>
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<td></td>
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<td>0.241</td>
<td>147000</td>
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<td>0.378</td>
<td>240000</td>
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<td>0.557</td>
<td>393000</td>
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<tr>
<td>15</td>
<td>293.15</td>
<td>0.104</td>
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<td></td>
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<td>0.241</td>
<td>157200</td>
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<tr>
<td></td>
<td></td>
<td>0.378</td>
<td>262000</td>
<td>344.7</td>
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<tr>
<td></td>
<td></td>
<td>0.557</td>
<td>413000</td>
<td>543.4</td>
</tr>
</tbody>
</table>

\(^1\)Calculated by compiler; mole fraction ethene, \(x_1\), is for a partial pressure of 101.325 kPa.

METHOD/APPARATUS/PROCEDURE:
Glass equilibrium cell fitted with a magnetic stirrer. Pressure measured with a Bourdon gauge. Samples of liquid analyzed by stripping out ethene. The solubilities were measured at several pressures below atmospheric and Henry’s constant was determined. Details in ref. (1).

SOURCE AND PURITY OF MATERIALS:
1. Ethene source and purity not given.
2. N-Methylpyrrolidinone source and purity not given.
   Properties used by authors:
   Normal boiling point = 479.15 K
   Density at 20°C = 1.0220 g/cm³
   Refractive index \(n^2_\text{D}\) = 1.4700
3. Treatment not specified.

ESTIMATED ERROR:
\[\Delta K/K = \pm 0.02\]

REFERENCES:
   Gaz. Prom. 1958, 12, 36.
COMPONENTS:
1. Ethene; C₂H₄; [74-85-1]
2. 2-Pyrrolidinone, 1-methyl-, (N-methylpyrrolidinone); C₅H₈NO; [872-50-4]
3. Water; H₂O; [7732-18-5]

ORIGINAL MEASUREMENTS:
Wu, Z.; Zeck, S.; Langhorst, R.;
Knapp, H.
Proc. Int. Conf. Coal Gas and Air,
Beijing, China, 1985, 1, 209-229.

VARIABLES:
T/K = 298.15
P/kPa = 100 (1 bar)
Conc. water/x₁ = 0.08-0.96 mole fraction

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>Mole Fraction of Fraction</th>
<th>Solvent Gas</th>
<th>Henry's Constant</th>
<th>Ostwald</th>
<th>Mol/L</th>
<th>10⁻³x₃</th>
<th>10⁻³x₂</th>
<th>10⁻³x₁</th>
<th>10⁻³x₃10⁻³x₂/10⁻³x₃</th>
<th>10⁻³x₃10⁻³x₂/10⁻³x₁</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<td></td>
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</tr>
<tr>
<td>0.960</td>
<td>0.970</td>
<td>1.231</td>
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<td>0.421</td>
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<tr>
<td>0.371</td>
<td>0.992</td>
<td>33.01</td>
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<td>398.3</td>
<td>388.0</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.277</td>
<td>0.994</td>
<td>40.63</td>
<td>41.4</td>
<td>313.7</td>
<td>296.6</td>
<td>1.113</td>
<td></td>
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<tr>
<td>0.194</td>
<td>0.996</td>
<td>49.53</td>
<td>50.4</td>
<td>248.2</td>
<td>241.4</td>
<td>1.336</td>
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<tr>
<td>0.083</td>
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<td>63.9</td>
<td>202.7</td>
<td>198.5</td>
<td>1.502</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1 Values personally received from the first author for the gas and liquid phase compositions for a total pressure of 1 bar.
2 Solubility for a partial pressure of 101.325 kPa calculated by compiler.
3 The relationship between x₁ and x₁ is as follows:
x₁ + x₂ + x₃ = 1 ; x₁ + x₂ = 1 / (1-x₁) ; x₂ = x₃ / (1-x₃)

METHOD/APPARATUS/PROCEDURE:
Ethylene gas was stored in a glass burette equipped with an accurate manometer for measuring pressure and situated in a constant temperature air bath. A known quantity of completely degassed solvent was charged into an equilibrium cell immersed in a liquid bath. The volume of gas absorbed was measured after the gas was admitted into the cell. The solubility was determined from the quantities of gas and solvent used. The apparatus and procedure are described in detail in reference 1.

SOURCE AND PURITY OF MATERIALS:
1. Ethene purity was 99.9 vol. percent.
2. Solvent was provided by Merck with a minimum purity of 99.0% (GC). After treatment with molecular sieve drying agent the purity was analyzed to be 99.9%.
3. Water was bidistilled and had a conductivity of 2 micromhos/cm.

ESTIMATED ERROR:
δP/kPa = ± 0.05
δT/K = ± 0.01
δL/L = ± 0.01

REFERENCES:
1. Zeck, S.
CRITICAL EVALUATION:

Critical Evaluation of Ethene Solubility in Alkanes, Neohexane and Squalane for Pressures up to 101.3 kPa

Data for solubilities of ethene have been reported by ten groups of researchers (1-10) for some of the alkane solvents from pentane to docosane as well as in the branch-chained solvents, 2,2 dimethylbutane (neohexane) and squalane, for pressures to 101.3 kPa and temperatures ranging from 213.2 K to 473.2 K. One group (10) measured ethene solubilities in a two-component solvent solution. Four groups of researchers, Jadot (1), Lenoir et al. (7), Ng et al. (8) and Simon and Lukacs (9), utilized gas chromatographic techniques which involve equilibrium at low gas partial pressures so that the values obtained are not always dependable when extrapolated to a partial pressure of 101.3 kPa. The data of McDaniel, obtained some 81 years ago, have often been questioned because of the technique used which tends to yield low values of solubility.

There are too few reliable data to define a relationship between the solubility at 298.15 K and the number of carbons in the alkane solvents \( C_n \). It is noted that the alkanes of carbon number greater than \( C_{16} \) are solids at this temperature. The paucity of solubility data for this class of solvents is particularly apparent; the data consist mainly of single measurements or those supplied by just one research group for any one solvent. Solubility data are available from two or more independent sources only for the solvents hexane and heptane.

Solubilities for the individual solvents are now discussed. Equations for interpolating consistent data and the applicable temperature ranges are included where possible.

Pentane; \( C_5H_{12} \); \([109-66-0]\)
Hexane; \( C_6H_{14} \); \([110-54-3]\)
2,2-Dimethylbutane (neohexane); \( C_{10}H_{22} \); \([75-83-2]\)

Jadot (1) reported the solubility of ethene in pentane and in hexane at 298.15 K in the form of Henry's constants. The single value for the solubility in pentane is classified as tentative. Sahgal et al. (2) measured the solubility of ethene in hexane at 298.15 K. Waters et al. (3) provided data for the ethene in hexane at four temperatures in the range of 263.15 K to 293.15 K, and at pressures between 26.7 kPa and 85.8 kPa. Tilquin et al. (4) provided a single value at 288.15 K, while McDaniel (5) furnished solubility values at four temperatures, from 295.15 K to 318.15 K. All five sets of data were plotted in the form of \( \log x \) versus \( 1/T \). The data of McDaniel (5) and the single value of Jadot (1) are about 30% lower than other comparable data, and are consequently rejected. The value of Waters et al. at 293.15 K is about 10% higher than the other data; hence, it too is rejected. Although the graph of these data is not shown, the equation of the line that best fit the data is:

\[
\log x_1 = -3.349 + 498.07/(T/K) \quad \text{for} \quad 298 > T/K > 263 \] (1)

Equation 1 has a coefficient of correlation of 0.9954 and the maximum deviation of the data points from the line is 3.3%, while the average deviation is 1.3%. The remaining data and Equation 1 are classified as tentative.

Tilquin et al. (4) reported a single value for the solubility of ethene in neohexane at 288.15 K. Their result is classified as tentative.
Ethene solubilities in heptane were reported by four groups of researchers (1,2,5,6). Three values each were provided by Sahgal et al. (2) at temperatures from 273.15 K to 323.15 K, and by Leites and Ivanovskii (6) for temperatures from 213.15 K to 253.15 K. Four solubilities were reported by McDaniel (5) at temperatures from 295.55 K to 312.15 K, while Jadot (1) reported a single value at 298.15 K. All four sets of data were plotted in the form of log x versus 1/T, and all points were colinear except for the single value of Jadot (1) which deviated by about 16% (see Fig. 1). Omitting this point, the equation of the line which best fit the data is:

$$\log x_1 = -3.512 + \frac{542.46}{(T/K)}$$

for $323 > T/K > 213$ (2)

Figure 1 Mole fraction solubility of ethene in n-heptane at 298.15 K and 101.3 kPa gas partial pressure.
COMPONENTS:
1. Ethene; C₂H₄; [74-85-1]
2. Alkanes, neohexane and squalane

EVALUATOR:
Walter Hayduk
Department of Chemical Engineering
University of Ottawa
Ottawa, ON
Canada K1N 6N5
September, 1992

CRITICAL EVALUATION:

Equation 2 has a correlation coefficient of 0.9988, and the average deviation of the data points from the regression line is 2.7%, while the maximum deviation is 6.0%. Equation 2 may be used to estimate ethene solubilities in heptane at temperatures between 213.15 K and 323.15 K and is classified as tentative along with the data on which it is based.

Ethene solubilities in octane, nonane and decane were reported by Jadot (1). All were single values at 298.15 K. The solubilities showed a definite increase with an increase in the chain length of the alkane. These values are classified as tentative.

Dodecane; C₁₂H₂₆; [112-40-3]
Hexadecane; C₁₆H₃₄; [544-76-3]
Heptadecane; C₁₇H₃₈; [629-78-7]

Sahgal et al. (2) measured ethene solubilities in dodecane at 101.3 kPa pressure and at four temperatures ranging from 263.95 K to 339.15 K. The equation representing these data with deviations of less than 2.5% is:

$$\log x_1 = -3.6096 + \frac{582.79}{T/K}$$ for $339 > T/K > 263$  (3)

The data for dodecane are classified as tentative. Lenoir et al. (7) furnished single values for the solubility of ethene in hexadecane as well as heptadecane at 298.15 K, and 323.15 K, respectively. Both values are classified as tentative.

Ethene solubilities in octadecane, eicosane and docosane were measured by Ng et al. (8) at 101.3 kPa pressure and at temperatures from 308.2 K to 473.2 K. The three equations which best represent the data are:

For octadecane: \( \log x_1 = -3.2173 + 489.06/(T/K) \) for $423 > T/K > 308$  (4)

For eicosane: \( \log x_1 = -3.1861 + 479.10/(T/K) \) for $413 > T/K > 323$  (5)

For docosane: \( \log x_1 = -3.1820 + 484.71/(T/K) \) for $483 > T/K > 333$  (6)

All three sets of data are classified as tentative.

Ethene solubilities in squalane were reported by Simon and Lukacs (9) for temperatures between 293.15 K and 333.15 K. It is noted that this C₃₀ hydrocarbon is a liquid at ambient conditions because of its branched structure. The solubilities were significantly higher than those measured by Ng et al. (8) for the C₁₈ - C₂₂ alkanes. The data of Simon and Lukacs (9) are classified as tentative.
COMPONENTS:
1. Ethene; C$_2$H$_4$; [74-85-1]
2. Alkanes, neohexane and squalane

CRITICAL EVALUATION:
Hexane and dodecane solvent solutions:
C$_6$H$_{14}$; [110-54-3]; C$_{12}$H$_{26}$; [112-40-3]

Sahgal and Hayduk (10) reported ethene solubilities in mixtures of hexane and dodecane at 298.15 K. The solubility of ethene was essentially insensitive to the amount of dodecane in the mixture until the mole fraction of dodecane exceeded 0.72. Thereafter, a small increase in solubility was observed. These data are classified as tentative.

References
COMPONENTS:
1. Ethene; C\(_2\)H\(_4\); [74-85-1]
2. Pentane; C\(_5\)H\(_{12}\); [109-66-0] or Hexane; C\(_6\)H\(_{14}\); [110-54-3]

VARIABLES:
- \( T/K = 298.15 \)
- \( P/kPa = 101.3 \)

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>( T/K )</th>
<th>Henry's Law Constant, ( H/\text{atm} )</th>
<th>Mole fraction(^+) at partial pressure of 101.3 kPa, ( x_{C_2H_4} )</th>
<th>#( \Delta H^\circ ) /cal mol(^-1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>298.15</td>
<td>65.45</td>
<td>0.01528</td>
<td>-</td>
</tr>
<tr>
<td>298.15</td>
<td>62.82</td>
<td>0.01592</td>
<td>256 (1071)</td>
</tr>
</tbody>
</table>

\( \) Calculated by compiler assuming \( x_{C_2H_4} = 1/H. \)

\( \) Excess partial molar enthalpy of solution at infinite dilution.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
The conventional gas chromatographic technique 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 no allowance was made for surface adsorption.

SOURCE AND PURITY OF MATERIALS:
No details given.

ESTIMATED ERROR:
- \( \delta T/K = \pm 0.05 \)
- \( \delta H = \pm 2\% \)

REFERENCES:
COMPONENTS:
1. Ethene; C₂H₄; [74-85-1]
2. Hexane; C₆H₁₄; [110-54-3]

ORIGINAL MEASUREMENTS:
Sahgal, A.; La, H.M.; Hayduk, W.

VARIABLES:
T/K = 298.15
P/kPa = 101.325

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>t/C</th>
<th>T/K</th>
<th>Mole Fraction Ethene, x₁</th>
<th>Ostwald Coefficient L/(cm³ gas /cm³ solvent)</th>
</tr>
</thead>
<tbody>
<tr>
<td>25.0</td>
<td>298.15</td>
<td>0.0207</td>
<td>3.91</td>
</tr>
</tbody>
</table>

Mole fraction ethene, x₁, is for a gas partial pressure of 101.325 kPa.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
A glass apparatus equipped with a gas storage burette, a spiral tube for gas absorption, a miniature internal manometer and a solution storage burette was used. Degassed solvent was injected at a constant rate into the absorption spiral by means of a syringe-pump while the gas was displaced by mercury using a mechanical elevating device for a mercury bottle, at a rate required to keep the gas pressure constant. Readings of the volume of vapor-free gas consumed and volume of solvent required to achieve saturation were obtained from which the solubility was calculated. Constant temperature fluid was circulated through a jacket enclosing the burettes and absorption spiral.

SOURCE AND PURITY OF MATERIALS:
1. Ethene was CP grade from Matheson, 99.5 mole % minimum purity.
2. Hexane was from Fisher Chemicals, 99.0 mole % minimum purity.

ESTIMATED ERROR:

\[
\frac{\Delta x_1}{x_1} = \pm 2\%
\]
\[
\frac{\Delta T}{K} = \pm 0.05
\]

REFERENCES:
COMPONENTS:
1. Ethene; \( \text{C}_2\text{H}_4 \); [74-85-1]
2. Hexane; \( \text{C}_6\text{H}_{14} \); [110-54-3]

VARIABLES:
\( T/\text{K} = 263-293 \)
\( P/\text{kPa} = 101.325 \)

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>( t/\text{C} )</th>
<th>( ^1 T/\text{K} )</th>
<th>( P/\text{mm} )</th>
<th>( ^2 \text{Bunsen Coefficient} )</th>
<th>( ^3 \text{Solubility} )</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>( \text{mercury} )</td>
<td>( \text{a/cm}^3 \text{gas (NTP)}/\text{cm}^3\text{solvent} )</td>
<td>( \text{Mole/litre} )</td>
</tr>
<tr>
<td>-10</td>
<td>263.15</td>
<td>200.4</td>
<td>6.53</td>
<td>0.291</td>
</tr>
<tr>
<td></td>
<td>346.9</td>
<td>6.35</td>
<td></td>
<td>0.284</td>
</tr>
<tr>
<td></td>
<td>465.9</td>
<td>6.33</td>
<td></td>
<td>0.283</td>
</tr>
<tr>
<td>0</td>
<td>273.15</td>
<td>507.0</td>
<td>5.42</td>
<td>0.242</td>
</tr>
<tr>
<td></td>
<td>571.4</td>
<td>5.34</td>
<td></td>
<td>0.239</td>
</tr>
<tr>
<td>10</td>
<td>283.15</td>
<td>543.3</td>
<td>4.77</td>
<td>0.213</td>
</tr>
<tr>
<td></td>
<td>611.9</td>
<td>4.70</td>
<td></td>
<td>0.210</td>
</tr>
<tr>
<td>20</td>
<td>293.15</td>
<td>570.2</td>
<td>4.35</td>
<td>0.149</td>
</tr>
<tr>
<td></td>
<td>643.7</td>
<td>4.27</td>
<td></td>
<td>0.190</td>
</tr>
</tbody>
</table>

\(^1\) Calculated by compiler.

\(^2\) Although not specified in paper, compiler confirms that \( a \) as given is the Bunsen coefficient.

\(^3\) Solubility, \( s \) and \( x_1 \), are calculated for a gas partial pressure of 101.325 kPa.

AUXILIARY INFORMATION

METHOD APPARATUS/PROCEDURE:
The method involved measuring the pressure change in a gas reservoir of known volume. Two glass bulbs were connected by tubing fitted with a pressure transducer, gas supply and vacuum lines. The solvent (100 cm\(^3\)) was degassed in one of the bulbs equipped with a stirrer using liquid nitrogen. Gas was charged to a higher pressure in the second bulb and quantitatively charged into the first bulb at the appropriate temperature. The final pressure in the equilibrium flask was measured.

SOURCE AND PURITY OF MATERIALS:
1. Ethene, Monsanto polymerization grade, purity 99.85%.
2. Hexane was from Phillips Petroleum, purity 99.0%.

ESTIMATED ERROR:
\( \delta T/\text{K} = \pm 0.01 \)
\( \delta s/s = \pm 2\% \)

REFERENCES:
### COMPONENTS:
1. Ethene or ethylene; $C_2H_4$; [74-85-1]
2. Hexane; $C_6H_{14}$; [110-54-3]

### ORIGINAL MEASUREMENTS:
McDaniel, A. S.

### VARIABLES:
- $T/K = 295.15 - 318.15$
- $P_1/kPa = 101.3$ (1 atm)

### PREPARED BY:
H. L. Clever

### EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>Temperature $t/°C$</th>
<th>Mol Fraction $x_1$</th>
<th>Bunsen Coefficient $a$</th>
<th>Ostwald Coefficient $b$</th>
</tr>
</thead>
<tbody>
<tr>
<td>22.0</td>
<td>1.62</td>
<td>2.8141</td>
<td>3.0382</td>
</tr>
<tr>
<td>25.0</td>
<td>1.58</td>
<td>2.7309</td>
<td>2.9896$^c$</td>
</tr>
<tr>
<td>35.0</td>
<td>1.47</td>
<td>2.5050</td>
<td>2.8265</td>
</tr>
<tr>
<td>45.0</td>
<td>1.32</td>
<td>2.2190</td>
<td>2.5863</td>
</tr>
</tbody>
</table>

- $a$ Bunsen coefficient, $a/cm^3(STP) cm^{-3} atm^{-1}$.
- $b$ Listed as absorption coefficient in the original paper. Interpreted to be equivalent to Ostwald coefficient by compiler.
- $c$ Ostwald coefficient (absorption coefficient) estimated as 298.15 K value by author.
- $d$ Mole fraction and Bunsen coefficient values calculated by compiler assuming ideal gas behavior.

**EVALUATOR'S COMMENT:** McDaniel's data should be used with caution. His values are often 20 percent or more too small when compared with more reliable data.

### AUXILIARY INFORMATION

**METHOD/APPARATUS/PROCEDURE:**
The apparatus is all glass. It consists of a gas buret connected to a contacting vessel. The solvent is degassed by boiling under reduced pressure. Gas pressure or volume is adjusted using mercury displacement. Equilibration is achieved at atm pressure by hand shaking, and incrementally adding gas to the contacting chamber. Solubility measured by obtaining total uptake of gas by known volume of the solvent.

**SOURCE AND PURITY OF MATERIALS:**
1. Ethene. Prepared by reaction of 1,2-dibromoethane with zinc-copper.
2. Hexane. No details given.

**ESTIMATED ERROR:**
$$\delta \frac{L}{L} \geq -0.20$$

**REFERENCES:**
### COMPONENTS:

1. Ethene; $C_2H_4$; [74-85-1]
2. Hexane; $C_6H_{14}$; [110-54-3]

### ORIGINAL MEASUREMENTS:

Tilquin, B.; Decannière, L.;
Fontaine, R.; Claes, P.
*Ann. Soc. Sc. Bruxelles (Belgium)*
1967, 81, 191-199.

### VARIABLES:

<table>
<thead>
<tr>
<th>$T/K$</th>
<th>$P/kPa$</th>
</tr>
</thead>
<tbody>
<tr>
<td>288.15</td>
<td>4.11-8.13</td>
</tr>
</tbody>
</table>

### EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>$t/C$</th>
<th>$T/K$</th>
<th>Ostwald coefficient, $a$</th>
<th>Mole fraction, $b$</th>
<th>Henry's constant, $b$</th>
</tr>
</thead>
<tbody>
<tr>
<td>15.0</td>
<td>288.15</td>
<td>4.445</td>
<td>0.0238</td>
<td>42.0</td>
</tr>
</tbody>
</table>

- $a$ Original data at low pressure reported as distribution coefficient; but if Henry's law and ideal gas law apply, distribution coefficient is equivalent to Ostwald coefficient as shown here.
- $b$ Calculated by compiler for a gas partial pressure of 101.325 kPa assuming that Henry's law and ideal gas law apply.

### METHOD/APPARATUS/PROCEDURE:

All glass apparatus used at very low gas partial pressures, containing a replaceable degassed solvent ampule equipped with a breakable point which could be broken by means of a magnetically activated plunger. Quantity of gas fed into system determined by measuring the pressure change in a known volume. Quantity of liquid measured by weight. Pressure change observed after solvent released. Experimental details described by Rzad and Claes, ref. (1).

### SOURCE AND PURITY OF MATERIALS:

1. Source not given; minimum purity specified as 99.0 mole per cent.
2. Fluka pure grade; minimum purity specified as 99.0 mole per cent.

### ESTIMATED ERROR:

\[ \delta T/K = 0.05; \delta x_1/x_1 = 0.01 \]

(estimated by compiler).

### REFERENCES:

1. Rzad, S.; Claes, P.
*Bull. Soc. Chim. Belgès*
1964, 73, 689.
COMPONENTS:
1. Ethene; C\textsubscript{2}H\textsubscript{4}; [74-85-1]
2. 2,2'-Dimethylbutane (Neo-hexane); C\textsubscript{6}H\textsubscript{14}; [75-83-2]

ORIGINAL MEASUREMENTS:
Tilquin, B.; Decannière, L.; Fontaine, R.; Claes, P.

VARIABLES:
\begin{align*}
T/K & : 288.15 \\
P/kPa & : 2.05-2.11
\end{align*}

PREPARED BY:
C. L. Young

EXPERIMENTAL VALUES:
\begin{tabular}{|c|c|c|c|}
\hline
\textit{t}/C & \textit{T}/K & \textit{L}/K & \textit{x}_1 & \textit{H}/atm \\
\hline
15.0 & 288.15 & 14.56 & 0.07506 & 13.32 \\
\hline
\end{tabular}

\textit{a} Original data at low pressure reported as distribution coefficient; but if Henry's law and ideal gas law apply, distribution coefficient is equivalent to Ostwald coefficient as shown here.

\textit{b} Calculated by compiler for a gas partial pressure of 101.325 kPa assuming that Henry's law and ideal gas law apply.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
All glass apparatus used at very low gas partial pressures, containing a replaceable degassed solvent ampule equipped with a breakable point which could be broken by means of a magnetically activated plunger. Quantity of gas fed into system determined by measuring the pressure change in a known volume. Quantity of liquid measured by weight. Pressure change observed after solvent released. Experimental details described by Rzad and Claes, ref. (1).

SOURCE AND PURITY OF MATERIALS:
1. Source not given; minimum purity specified as 99.0 mole per cent.
2. Fluka pure grade; minimum purity specified as 99.0 mole per cent.

ESTIMATED ERROR:
\begin{align*}
\delta \textit{T}/K &= 0.05; \delta \textit{x}_1/\textit{x}_1 &= 0.01 \\
& \quad (\text{estimated by compiler}).
\end{align*}

REFERENCES:
1. Rzad, S.; Claes, P.
COMPONENTS:
1. Ethene; \( \text{C}_2\text{H}_4; [74-85-1] \)
2. Heptane; \( \text{C}_7\text{H}_{16}; [142-82-5] \)

ORIGINL MEASUREMENTS:
Sahgal, A.; La, H.M.; Hayduk, W.

VARIABLES:
\( T/K = 273-323 \)
\( P/kPa = 101.325 \)

PREPARED BY:
W. Hayduk

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>( t/\degree C )</th>
<th>( T/K )</th>
<th>Ethene, ( x_1 )</th>
<th>Mole Fraction</th>
<th>Ostwald Coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>273.15</td>
<td>0.0284</td>
<td></td>
<td>4.56</td>
</tr>
<tr>
<td>25</td>
<td>298.15</td>
<td>0.0198</td>
<td></td>
<td>3.35</td>
</tr>
<tr>
<td>50</td>
<td>323.15</td>
<td>0.0143</td>
<td></td>
<td>2.51</td>
</tr>
</tbody>
</table>

Mole fraction ethene, \( x_1 \), is for a gas partial pressure of 101.325 kPa.

AUXILIARY INFORMATION

METHOD APPARATUS/PROCEDURE:
A glass apparatus equipped with a gas storage burette, a spiral tube for gas absorption, a miniature internal manometer and a solution storage burette was used. Degassed solvent was injected at a constant rate into the absorption spiral by means of a syringe-pump while the gas was displaced by mercury using a mechanical elevating device for a mercury bottle, at a rate required to keep the gas pressure constant. Readings of the volume of vapor-free gas consumed and volume of solvent required to achieve saturation were obtained from which the solubility was calculated. Constant temperature fluid was circulated through a jacket enclosing the burettes and absorption spiral.

SOURCE AND PURITY OF MATERIALS:
1. Ethene was CP grade from Matheson, 99.5 mole % minimum purity.
2. Heptane was chromatography grade from Matheson Coleman and Bell, 99.0 mole % minimum purity.

ESTIMATED ERROR:
\( \delta x_1/x_1 = \pm 2\% \)
\( \delta T/K = \pm 0.05 \)

REFERENCES:
**COMPONENTS:**

1. Ethene; \( \text{C}_2\text{H}_4; [74-85-1] \)
2. Heptane; \( \text{C}_7\text{H}_{16}; [142-82-5] \)

**ORIGINAL MEASUREMENTS:**

Leites, I.L.; Ivanovskii, F.P.


**VARIABLES:**

\[

t / ^{\circ} \text{C} \\
T / \text{K} \\
P_i / \text{kPa} = 101.325
\]

\[

213.15 - 253.15
\]

**PREPARED BY:**

W. Hayduk

**EXPERIMENTAL VALUES:**

<table>
<thead>
<tr>
<th>( t / ^{\circ} \text{C} )</th>
<th>( T / \text{K} )</th>
<th>( \log_{10} H' ), H'/mm Hg</th>
<th>( 2 \text{Henry's Constant}, \frac{H'}{\text{atm (mole fraction)}} )</th>
<th>( 2 \text{Mole Fraction} ) Ethene, ( x_1 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>-60</td>
<td>213.15</td>
<td>3.841</td>
<td>9.12</td>
<td>0.1096</td>
</tr>
<tr>
<td>-50</td>
<td>223.15</td>
<td>3.965</td>
<td>12.14</td>
<td>0.0824</td>
</tr>
<tr>
<td>-20</td>
<td>253.15</td>
<td>4.243</td>
<td>23.02</td>
<td>0.0434</td>
</tr>
</tbody>
</table>

These results were part of a study for the behavior of solubilities in two-component solvent solutions.

1 Only graphical results were available in this paper; values of \( \log_{10} \) Henry's constant (\( H' \)) were read from enlarged graphs by the compiler.

2 Values of Henry's constant (\( H \)) and mole fraction solubility (\( x_1 \)) were calculated by the compiler based on the graphical results.

**AUXILIARY INFORMATION**

**METHOD/APPARATUS/PROCEDURE:**

A metal cryostat was cooled with dry-ice and acetone and controlled to a temperature to \( \pm 0.05 \) K. The equilibrium cell was mounted in the cryostat. The solvent was purified by fractional distillation and analyzed by chromatography. Details were not given.

**SOURCE AND PURITY OF MATERIALS:**

1. Ethene purity was stated to be 99.9%.
2. Heptane was distilled and analyzed by chromatography. Actual purity not given.

**ESTIMATED ERROR:**

\[

t / K = \pm 0.05
\]

\[

\delta x_1 / x_1 = \pm 0.01 \text{ (Authors)}
\]

**REFERENCES:**
COMPONENTS:
(1) Ethene or ethylene; C\textsubscript{2}H\textsubscript{4}; [74-85-1]
(2) Heptane; C\textsubscript{7}H\textsubscript{16}; [142-82-5]

ORIGINAL MEASUREMENTS:
McDaniel, A. S.

VARIABLES:
\[ T/K = 295.55 - 312.15 \]
\[ p_f/kPa = 101.3 \text{ (1 atm)} \]

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>Temperature (°C)</th>
<th>Mol Fraction</th>
<th>Bunsen Coefficient\textsuperscript{a}</th>
<th>Ostwald Coefficient\textsuperscript{b}</th>
</tr>
</thead>
<tbody>
<tr>
<td>22.4</td>
<td>295.55</td>
<td>2.06</td>
<td>3.2071</td>
</tr>
<tr>
<td>25.0</td>
<td>298.15</td>
<td>2.01</td>
<td>3.1205</td>
</tr>
<tr>
<td>35.0</td>
<td>308.15</td>
<td>1.85</td>
<td>3.1860</td>
</tr>
<tr>
<td>39.0</td>
<td>312.15</td>
<td>1.79</td>
<td>3.1100</td>
</tr>
</tbody>
</table>

\textsuperscript{a} Bunsen coefficient, a/cm\textsuperscript{3}(STP) cm\textsuperscript{-3} atm\textsuperscript{-1}.

\textsuperscript{b} Listed as absorption coefficient in the original paper. Interpreted to be equivalent to Ostwald coefficient by compiler.

\textsuperscript{c} Ostwald coefficient (absorption coefficient) estimated as 298.15 K value by author.

\textsuperscript{d} Mole fraction and Bunsen coefficient values calculated by compiler assuming ideal gas behavior.

EVALUATOR'S COMMENT: McDaniel's data should be used with caution. His values are often 20 percent or more too small when compared with more reliable data.

AUXILIARY INFORMATION
METHOD/APPARATUS/PROCEDURE:
The apparatus is all glass. It consists of a gas buret connected to a contacting vessel. The solvent is degassed by boiling under reduced pressure. Gas pressure or volume is adjusted using mercury displacement. Equilibration is achieved at atm pressure by hand shaking, and incrementally adding gas to the contacting chamber. Solubility measured by obtaining total uptake of gas by known volume of the solvent.

SOURCE AND PURITY OF MATERIALS:
(1) Ethene. Prepared by reaction of 1,2-dibromoethane with zinc-copper.
(2) Heptane. No details given.

ESTIMATED ERROR:
\[ \delta L/L \geq -0.20 \]
**COMPONENTS:**
1. Ethene; C$_2$H$_4$; [74-85-]
2. Heptane; C$_7$H$_{16}$; [142-82-5]
   or Octane; C$_8$H$_{18}$; [111-65-9]

**ORIGINAL MEASUREMENTS:**
Jadot, R.

**VARIABLES:**
- $T/K = 298.15$
- $P/kPa = 101.3$

**EXPERIMENTAL VALUES:**

<table>
<thead>
<tr>
<th>$T/K$</th>
<th>Henry's Law Constant, $H$/atm</th>
<th>Mole fraction$^+$ at partial pressure of 101.3 kPa, $x_{C_2H_4}$</th>
<th>$#\Delta H = \Delta H^E$/cal mol$^{-1}$</th>
<th>$\Delta H = \Delta H^E$/J mol$^{-1}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>298.15</td>
<td>57.88</td>
<td>0.01728</td>
<td>316 (1322)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Heptane; C$<em>7$H$</em>{16}$; [142-82-5]</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>298.15</td>
<td>54.26</td>
<td>0.01843</td>
<td>420 (1757)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Octane; C$<em>8$H$</em>{18}$; [111-65-9]</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

$^+$ Calculated by compiler assuming $x_{C_2H_4} = 1/H$.

$\#\Delta H^E$ Excess partial molar enthalpy of solution at infinite dilution.

**METHOD/APPARATUS/PROCEDURE:**
The conventional gas chromatographic technique 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 no allowance was made for surface adsorption.

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

**ESTIMATED ERROR:**
$\delta T/K = \pm 0.05$; $\delta H = \pm 2\%$

**REFERENCES:**
**COMPONENTS:**
1. Ethene; C\(_2\)H\(_4\); [74-85-1]
2. Nonane; C\(_9\)H\(_{20}\); [111-84-2]
or
Decane; C\(_{10}\)H\(_{22}\); [124-18-5]

**ORIGINAL MEASUREMENTS:**
Jadot, R.

**VARIABLES:**
\[ T/K = 298.15 \]
\[ P/kPa = 101.3 \]

**PREPARED BY:**
C.L. Young

**EXPERIMENTAL VALUES:**

<table>
<thead>
<tr>
<th>T/K</th>
<th>Henry's Law Constant, ( H/\text{atm} )</th>
<th>Mole fraction(^+) at partial pressure of 101.3 kPa, ( x_{\text{C}_2\text{H}_4} )</th>
<th>#( \Delta H^\circ ) (( \text{cal mol}^{-1} ))</th>
</tr>
</thead>
<tbody>
<tr>
<td>298.15</td>
<td>50.97</td>
<td>0.01962</td>
<td>490 (2050)</td>
</tr>
</tbody>
</table>

Nonane; C\(_9\)H\(_{20}\); [111-84-2]

<table>
<thead>
<tr>
<th>T/K</th>
<th>Henry's Law Constant, ( H/\text{atm} )</th>
<th>Mole fraction(^+) at partial pressure of 101.3 kPa, ( x_{\text{C}_2\text{H}_4} )</th>
<th>#( \Delta H^\circ ) (( \text{cal mol}^{-1} ))</th>
</tr>
</thead>
<tbody>
<tr>
<td>298.15</td>
<td>47.36</td>
<td>0.02111</td>
<td>540 (2259)</td>
</tr>
</tbody>
</table>

Decane; C\(_{10}\)H\(_{22}\); [124-18-5]

\( +\) Calculated by compiler assuming \( x_{\text{C}_2\text{H}_4} = 1/H. \)

\( \#\) Excess partial molar enthalpy of solution at infinite dilution.

**AUXILIARY INFORMATION**

**METHOD/APPARATUS/PROCEDURE:**
The conventional gas chromatographic technique 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 no allowance was made for surface adsorption.

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

**ESTIMATED ERROR:**
\[ \delta T/K = \pm 0.05; \delta H = \pm 2\% \]

**REFERENCES:**
COMPONENTS:
1. Ethene; C₂H₄; [74-85-1]
2. Dodecane; C₁₂H₂₆; [112-40-3]

VARIABLES: 
T/K = 264-339
P/kPa = 101.325

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>t/C</th>
<th>T/K</th>
<th>Ethene, x₁</th>
<th>Ostwald Coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>-9.2</td>
<td>263.95</td>
<td>0.0402</td>
<td>4.08</td>
</tr>
<tr>
<td>25</td>
<td>298.15</td>
<td>0.0216</td>
<td>2.35</td>
</tr>
<tr>
<td>48</td>
<td>321.15</td>
<td>0.0159</td>
<td>1.81</td>
</tr>
<tr>
<td>66</td>
<td>339.15</td>
<td>0.0131</td>
<td>1.55</td>
</tr>
</tbody>
</table>

Mole fraction ethene, x₁, is for a gas partial pressure of 101.325 kPa.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
A glass apparatus equipped with a gas storage burette, a spiral tube for gas absorption, a miniature internal manometer and a solution storage burette was used. Degassed solvent was injected at a constant rate into the absorption spiral by means of a syringe-pump while the gas was displaced by mercury using a mechanical elevating device for a mercury bottle, at a rate required to keep the gas pressure constant. Readings of the volume of vapor-free gas consumed and volume of solvent required to achieve saturation were obtained from which the solubility was calculated. Constant temperature fluid was circulated through a jacket enclosing the burettes and absorption spiral.

SOURCE AND PURITY OF MATERIALS:

1. Ethene was CP grade from Matheson, 99.5 mole % minimum purity.
2. Dodecane was research grade from Phillips Petroleum of 99.0 mole % minimum purity.

ESTIMATED ERROR:
δx₁/x₁ = ± 2%
δT/K = ± 0.05

REFERENCES:
PREPARED BY: W. Hayduk
**COMPONENTS:**

1. Ethene (Ethylene); C₂H₄; [74-85-1]
2. Hexadecane; C₁₆H₃₄; [544-76-3] or Heptadecane; C₁₇H₃₆; [629-78-7]

**ORIGINAL MEASUREMENTS:**

Lenoir, J-Y.; Renault, P.; Renon, H.

**VARIABLES:**

T/K = 298.15, 323.15
P/kPa = 101.3

**PREPARED BY:**

C.L. Young

**EXPERIMENTAL VALUES:**

<table>
<thead>
<tr>
<th>T/K</th>
<th>Henry's constant $H_{C₂H₄}$/atm</th>
<th>Mole fraction at 1 atm* $x_{C₂H₄}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hexadecane</td>
<td>298.15 42.8</td>
<td>0.0234</td>
</tr>
<tr>
<td>Heptadecane</td>
<td>323.15 52.0</td>
<td>0.0192</td>
</tr>
</tbody>
</table>

* Calculated by compiler assuming a linear function of $H_{C₂H₄}$ vs $x_{C₂H₄}$, i.e. $x_{C₂H₄}$ (1 atm) = 1/$H_{C₂H₄}$.

**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. Ethene; C₂H₄; [74-85-1]
2. Octadecane; C₁₈H₃₆; [593-45-3], Eicosane; C₂₀H₄₂; [112-95-8], or Docosane; C₂₂H₄₆; [629-97-0]

ORIGINAL MEASUREMENTS:
Ng. S.; Harris, H.G.; Prausnitz, J.M.
J. Chem. Eng. Data
1969, 14, 482-3.

VARIABLES:

\[ T/K = 308.2 \text{ - } 473.2 \]
\[ P/kPa = 101.3 \]

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>Henry's constant, ( H )/atm</th>
<th>Mole fraction ethene, ( x_1 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>308.2</td>
<td>42.5</td>
<td>0.0235</td>
</tr>
<tr>
<td>323.2</td>
<td>50.6</td>
<td>0.0198</td>
</tr>
<tr>
<td>343.2</td>
<td>61.8</td>
<td>0.0162</td>
</tr>
<tr>
<td>363.2</td>
<td>74.4</td>
<td>0.0134</td>
</tr>
<tr>
<td>373.2</td>
<td>81.8</td>
<td>0.0122</td>
</tr>
<tr>
<td>423.2</td>
<td>114</td>
<td>0.00877</td>
</tr>
<tr>
<td>323.2</td>
<td>50.5</td>
<td>0.0198</td>
</tr>
<tr>
<td>343.2</td>
<td>61.9</td>
<td>0.0162</td>
</tr>
<tr>
<td>373.2</td>
<td>79.8</td>
<td>0.0125</td>
</tr>
<tr>
<td>393.2</td>
<td>92.6</td>
<td>0.0108</td>
</tr>
<tr>
<td>413.2</td>
<td>106.4</td>
<td>0.00940</td>
</tr>
<tr>
<td>333.2</td>
<td>53.6</td>
<td>0.0187</td>
</tr>
<tr>
<td>383.2</td>
<td>82.6</td>
<td>0.0121</td>
</tr>
<tr>
<td>408.2</td>
<td>99.6</td>
<td>0.0100</td>
</tr>
<tr>
<td>433.2</td>
<td>112.7</td>
<td>0.00887</td>
</tr>
<tr>
<td>453.2</td>
<td>128</td>
<td>0.00781</td>
</tr>
<tr>
<td>473.2</td>
<td>147</td>
<td>0.00680</td>
</tr>
</tbody>
</table>

Calculated by compiler for a partial pressure of 101.3 kPa assuming a mole fraction equal to 1/\( H \).

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
Gas chromatographic method. Solvent supported on Chromosorb P in 6m column. Gas injected as sample, helium used as carrier gas. Henry's law constant calculated from knowledge of retention time and flow rate.

SOURCE AND PURITY OF MATERIALS:

1. Matheson sample, purity greater than 99 mole per cent.
2. Matheson, Coleman and Bell sample, m.p.t.:
   - Octadecane 27-28.5 °C
   - Eicosane 35-36.5 °C
   - Docosane 43-45 °C

ESTIMATED ERROR:
\[ \delta T/K = \pm 0.1; \quad \delta H/\text{atm} = \pm 5\% \]

REFERENCES:
COMPONENTS:
1. Ethene; C₂H₄; [74-85-1]
2. Tetracosane, 2,6,10,15,19,23-hexamethyl (squalane); C₂₀H₄₂; [110-01-3]

ORIGINAL MEASUREMENTS:
Simon, P.; Lukacs, J.
Magy. Asvanyolaj-Poldaz. Intesz.
Kozl. (Hungary) 1977, 18, 57-66.

VARIABLES:
\( T/K = 293.15 \text{ - } 333.15 \)
\( p_1/kPa = 101.325 \)

PREPARED BY:
W. Hayduk

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>( i/C )</th>
<th>( T/K )</th>
<th>( 1 \text{Bunsen Coefficient} \ K_B/\text{cm}^3\text{gas at NTP} )</th>
<th>( 2 \text{Ostwald Coefficient} \ L/\text{cm}^3\text{gas cm}^{-3}\text{solvent} )</th>
<th>( 2 \text{Mole Fraction} \ Ethene, x_1 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>293.15</td>
<td>1.66</td>
<td>1.78</td>
<td>0.0373</td>
</tr>
<tr>
<td>40</td>
<td>313.15</td>
<td>1.25</td>
<td>1.43</td>
<td>0.0289</td>
</tr>
<tr>
<td>50</td>
<td>323.15</td>
<td>1.09</td>
<td>1.30</td>
<td>0.0257</td>
</tr>
<tr>
<td>60</td>
<td>333.15</td>
<td>0.970</td>
<td>1.18</td>
<td>0.0230</td>
</tr>
</tbody>
</table>

1 The solubility results were in the form of two equations, the first describing the temperature effect at 101.3 kPa pressure and the second the effect of pressure, to 405.2 kPa, at 313.15 K:

\[
\log K_B = 568.0378 \ (T/K)^{-1} - 1.7185 \quad \text{correlation coeff. } = 0.9985
\]

\[
K_B = 0.0101 \ \text{p/atm} + 1.2241 \quad \text{correlation coeff. } = 0.3171 \ (\text{low})
\]

2 The Ostwald coefficient and mole fraction solubility at 101.3 kPa were calculated by the compiler. The solvent densities were extrapolated.

Also available in the paper were ethene Bunsen coefficients in four transformer oils, the properties of which were not specified.

METHOD/APPARATUS/PROCEDURE:
The gas solubility was determined using gas chromatography and employing helium as a carrier gas. Based on the retention times and column characteristics, the Bunsen coefficient was calculated.

SOURCE AND PURITY OF MATERIALS:
Sources and purities of gas and solvent not specified.

ESTIMATED ERROR:
\[
\delta T/K = \pm 0.1
\]
\[
\delta p_1/kPa = 2.0
\]
\[
\delta K_B = \pm 6-8\% \ (\text{authors})
\]

REFERENCES:
COMPONENTS:
1. Ethene; \( C_2 H_4 \); [74-85-1]
2. Hexane; \( C_6 H_{14} \); [110-54-3]
3. Dodecane; \( C_{12} H_{26} \); [112-40-3]

VARIABLES:
\[ T/K = 298.15 \]
\[ P/kPa = 101.325 \]
\[ \xi_i / \text{Mole Fraction} = 0-1.0 \]

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>( t/\degree C )</th>
<th>( T/K )</th>
<th>( \xi_i ), Volume Fraction ( i )</th>
<th>( \xi_i ), Mole Fraction ( i )</th>
<th>Mole Fraction Ethene, ( \xi_i )</th>
<th>Ethene Solubility ( L/(cm^3 \text{gas/cm}^3 \text{solvent}) )</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Hexane)</td>
<td>298.15</td>
<td>0.241</td>
<td>0.155</td>
<td>0.0207</td>
<td>3.91</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.380</td>
<td>0.261</td>
<td>0.0206</td>
<td>3.72</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.422</td>
<td>0.290</td>
<td>0.0205</td>
<td>3.17</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.502</td>
<td>0.367</td>
<td>0.0206</td>
<td>3.06</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.578</td>
<td>0.442</td>
<td>0.0205</td>
<td>2.92</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.821</td>
<td>0.722</td>
<td>0.0207</td>
<td>2.564</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.922</td>
<td>0.871</td>
<td>0.0214</td>
<td>2.470</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.0</td>
<td>1.000</td>
<td>0.0216</td>
<td>2.352</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>( t/\degree C )</th>
<th>( T/K )</th>
<th>( \xi_i ), Volume Fraction ( i )</th>
<th>( \xi_i ), Mole Fraction ( i )</th>
<th>Mole Fraction Ethene, ( \xi_i )</th>
<th>Ethene Solubility ( L/(cm^3 \text{gas/cm}^3 \text{solvent}) )</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Dodecane)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\(^1\)Volume fraction is based on volumes of two liquid components before mixing.

\(^2\)Mole fraction is shown on a gas-free basis.

Values for pure solvents were previously given (in reference 1).

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
The apparatus utilized a continuous flow of deaerated solvent injected into a glass absorption spiral tube by means of a calibrated syringe pump. The mixed solvent was prepared volumetrically then deaerated and a sample analyzed by a density measurement. A mercury lift device was used for continuously adjusting the residual volume at constant pressure in a gas storage burette. Solvent injection and gas consumption rates were used to calculate solubilities. This paper also includes solution densities and refractive indices as well as ethene molecular diffusivities in the solutions.

SOURCE AND PURITY OF MATERIALS:
1. Ethene was CP grade from Matheson with minimum purity of 99.5 mole %. Molar volume used at 298.15 K and 101.325 kPa was 24,326 cm\(^3\)/mole.
2. Hexane was from Fisher; purity 99.0 mole %.
3. Dodecane was research grade from Phillips Petroleum, 99.0 mole % purity.

ESTIMATED ERROR:
\[ T/K = \pm 0.05 \]
\[ \delta P/P = \pm 0.01 \]
\[ \delta \xi_i = \pm 0.001 \]

REFERENCES:
1. Sahgal, A.; La, H.M.; Hayduk, W.
Critical Evaluation of Ethene Solubility in Propene and in Ten Alkanes
from Propane (C3) to Hexatriacontane (C36), for pressures exceeding 0.2 MPa

There are surprisingly few data for solubilities of ethene in alkane solvents at higher pressures and for some of these data it is not possible to accurately determine the gas partial pressures.

Ethene solubilities in individual solvents are now discussed:

Propane; C3H8; [74-98-6]
Propene; C3H6; [115-07-1]

Elshayal and Lu (1) reported ethene solubilities in propane for total pressures from 0.14 MPa to 3.92 MPa and for temperatures ranging from 199.8 K to 273.2 K. To check for consistency, the data were plotted as log x versus log p. Data for each isotherm were essentially linear over the whole range of partial pressures.

Although propene is not an alkane, the data for this solvent are included here because it is the only alkene for which data are available. The data of Rozhnov and Dorochinskaya (2) for 303.15 K and 323.15 K are reported only as Henry's constants.

Both of the above data are classified as tentative.

2-Methylpropane (isobutane); C4H10; [75-28-5]

The most extensive solubilities of ethene in 2-methylpropane solvent are those of Naumova and Tyvina (3) which span a temperature range from 293.15 K to 393.15 K and a pressure range from 0.30 MPa to 6.08 MPa. For constant temperatures all the data are essentially linear on a log x versus log p graph. There is a minimum solubility at a temperature of approximately 360 K. This is consistent with data for other gases of low solubility. The results of Kozorozov and Lisin (4) are consistent with those of Naumova and Tyvina at 333.15 K.

Both of the above data are classified as tentative.

Hexane; C6H14; [110-54-3]
Heptane; C7H16; [142-82-5]

Konobeev and Lyapin (5) reported solubilities for ethene in both n-hexane and n-heptane at temperatures from 293.15 K to 333.15 K and total pressures from 0.29 MPa to 3.2 MPa. However, the corresponding ethene partial pressures or gas phase compositions were not given. As expected, the solubilities in hexane and heptane are very similar in magnitude for the same temperatures and pressures. These data are classified as tentative.

Paratella (7) reported ethene solubilities in n-heptane for high temperatures, from 373.15 K to 473 K, and high total pressures, from 4.05 MPa to 10.13 MPa. Whereas these data appear self-consistent, no other comparable results are available. The data of Paratella are classified as tentative.
**Components:**

1. Ethene; \( \text{C}_2\text{H}_4 \); [74-85-1]
2. Propene and Alkanes from \( \text{C}_3 \) to \( \text{C}_{36} \); for pressures greater than 0.2 MPa (2 atm)

**Evaluator:**

Walter Hayduk  
Department of Chemical Engineering  
University of Ottawa  
Ottawa, ON  
Canada K1N 6N5  
June, 1993

**Critical Evaluation:**

Ethene solubilities in n-heptane were reported by Shenderei and Ivanovskii (8) for relatively low temperatures from 228.15 K to 248.15 K and for total pressures from 0.55 MPa to 1.66 MPa. Henry’s constants were also given which permitted extrapolation of these data to solubilities corresponding to a pressure of 101.32 kPa. A comparison of the extrapolated Shenderei and Ivanovskii data with that obtained at low pressure (101.32 kPa) is very favorable, probably because both data were products of the same laboratory. These data are classified as tentative.

Octane; \( \text{C}_8\text{H}_{18} \); [111-65-9]  
Nonane; \( \text{C}_9\text{H}_{20} \); [111-84-2]  
Dodecane; \( \text{C}_{12}\text{H}_{26} \); [112-40-3]

Data reported by Shenderei and Ivanovski (8) for ethene solubilities in n-octane are for the three temperatures 248.15 K, 238.15 K and 228.15 K and for pressures ranging from 0.25 MPa to 1.48 MPa. These low temperature data are entirely self-consistent.

Solubilities for ethene in n-nonane as reported by Konobeev and Lyapin (6) are for the temperatures 293.15 K, 313.15 K and 333.15 K and for total pressures ranging from 0.29 to 3.2 MPa. These data are entirely self-consistent.

The data for ethene solubilities in n-dodecane reported by Ribeiro et al. (10) are for relatively large temperature and pressure ranges, from 283.15 K to 348.15 K and from 0.51 MPa to 9.1 MPa. These data are also entirely self-consistent and are approximately consistent (within 8%) with the low pressure solubilities in n-dodecane.

The above data for n-octane, n-nonane and n-dodecane are classified as tentative.

Eicosane; \( \text{C}_{20}\text{H}_{42} \); [112-95-8]  
Octacosane; \( \text{C}_{28}\text{H}_{56} \); [630-02-4]  
Hexatriacontane; \( \text{C}_{36}\text{H}_{74} \); [630-06-8]

Only the work of Chou and Chao (11) is available for the three wax-like paraffinic solvents at the relatively high temperatures from 373 K to 573 K and total pressures from 0.51 MPa to 9.12 MPa. These data are consistent with those of lower molecular weight alkane solvents and are classified as tentative.

**References**

COMPONENTS:
1. Ethene; C\textsubscript{2}H\textsubscript{4}; [74-85-1]
2. Propene and Alkanes from C\textsubscript{3} to C\textsubscript{36}; for pressures greater than 0.2 MPa (2 atm)

EVALUATOR:
Walter Hayduk
Department of Chemical Engineering
University of Ottawa
Ottawa, ON
Canada K1N 6N5
June, 1993

CRITICAL EVALUATION:
COMPONENTS:
1. Ethene; C₂H₄; [74-85-1]
2. Propene, C₃H₆; [115-07-1]

ORIGINAL MEASUREMENTS:
Rozhnov, M.S.; Dorochinskaya, G.S.
1969, 140-146.

VARIABLES:
\[ T/K = 303.15, 323.15 \]
\[ P/MPa = \text{to } 4.05 \]

PREPARED BY: W. Hayduk

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>t/C</th>
<th>T/K</th>
<th>(^1) Henry's Constant, ( K/\text{atm (mol fraction)}^{-1} )</th>
<th>(^2) Mole Fraction Ethene, ( x_1 )</th>
<th>(^3) Vapor-liquid Equilibrium Constant, ( a )</th>
</tr>
</thead>
<tbody>
<tr>
<td>30</td>
<td>303.15</td>
<td>62.36</td>
<td>0.01604</td>
<td>2.55</td>
</tr>
<tr>
<td>50</td>
<td>323.15</td>
<td>83.33</td>
<td>0.01200</td>
<td>2.67</td>
</tr>
</tbody>
</table>

\(^1\) Actual data were shown in the form of a graph only; Henry's constants were listed in the paper.

\(^2\) The mole fraction solubility was calculated by the compiler for an ethene partial pressure of 101.3 kPa. Henry's law was shown by the authors to apply to 4.05 MPa (40 atm) total pressure.

\(^3\) The authors showed that the vapor-liquid equilibrium compositions were described by the following equation:

\[ x_1 + y_1 = a \log \left( \frac{P}{P_2} \right) \]

For: \( a = \) Vapor-liquid equilibrium constant

\( x_1, y_1 = \) Ethene mole fraction in liquid and gas phases, respectively

\( P = \) Total pressure

\( P_2 = \) Propene vapor pressure

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
The gas-liquid equilibrium compositions for the binary system were analyzed by chromatography. A membrane pressure gauge was used for measuring pressure. The equilibrium vessel of 110 cm³ in volume, was placed in a constant temperature bath. A magnetic mixer was used.

SOURCE AND PURITY OF MATERIALS:
1. Ethene source and purity not given.
2. Propene purity measured by chromatography to be 99.95% pure.

ESTIMATED ERROR:
\[ \delta T/K = \pm 0.1 \] (authors)
\[ \delta x_1/x_1 = \pm 2\% \] (compiler)

REFERENCES:
COMPONENTS:
1. Ethene; C₂H₄; [74-85-1]
2. Propane; C₃H₈; [74-98-6]

ORIGINAL MEASUREMENTS:
Elshayal, I.M.; Lu, B.C-Y.

VARIABLES:

\[
\begin{align*}
T/K &= 200-273 \\
P/MPa &= 0.14-3.92, \text{ (1.4-39 atm)}
\end{align*}
\]

PREPARED BY:
W. Hayduk

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>P/atm</th>
<th>P/MPa</th>
<th>p液/MPa</th>
<th>p气/MPa</th>
<th>liquid x₁</th>
<th>vapor y₁</th>
</tr>
</thead>
<tbody>
<tr>
<td>199.83</td>
<td>1.41</td>
<td>0.1429</td>
<td>0.1270</td>
<td>0.2505</td>
<td>0.8890</td>
<td></td>
</tr>
<tr>
<td>199.83</td>
<td>1.64</td>
<td>0.1662</td>
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<td></td>
</tr>
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<td>0.3469</td>
<td>0.9233</td>
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</tr>
<tr>
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<td>2.56</td>
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<td>0.522</td>
<td>0.9567</td>
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<td>0.3708</td>
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</tr>
<tr>
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<td>0.9224</td>
<td></td>
</tr>
<tr>
<td>227.9</td>
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<td>0.1856</td>
<td>0.7444</td>
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</tr>
<tr>
<td>227.9</td>
<td>4.00</td>
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<td>0.3334</td>
<td>0.2755</td>
<td>0.8226</td>
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</tr>
<tr>
<td>227.9</td>
<td>5.43</td>
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<td>0.8858</td>
<td></td>
</tr>
<tr>
<td>227.9</td>
<td>7.07</td>
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<td>0.6651</td>
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<td></td>
</tr>
<tr>
<td>227.9</td>
<td>9.15</td>
<td>0.9271</td>
<td>0.8934</td>
<td>0.7485</td>
<td>0.9636</td>
<td></td>
</tr>
<tr>
<td>227.9</td>
<td>11.34</td>
<td>1.149</td>
<td>1.139</td>
<td>0.9355</td>
<td>0.9909</td>
<td></td>
</tr>
<tr>
<td>255.38</td>
<td>3.77</td>
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</tr>
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*Calculated by compiler. continued...*

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
The equilibrium cell was a chamber drilled into a copper rod. The cell was equipped with viewing windows, with gauges for pressure measurement and temperature measurement using two thermocouples for the liquid and gas phases. The low temperatures were achieved by immersing the copper extension of the cell in liquid nitrogen provided with a pressure controller and utilizing an intermediate electric heater. The cell itself was surrounded by a steel vacuum jacket for insulation. An electromagnetic plunger-type stirrer was used. In most of the experiments only the liquid phase was analyzed and that by GC.

SOURCE AND PURITY OF MATERIALS:
1. Ethene from Matheson of purity 99.9 mole %.
2. Propane from Matheson of purity 99.9 mole %.

ESTIMATED ERROR:
\[ \delta x_1 / x_1 = \pm 1\% \quad \delta T/K = 0.02 \]
\[ \delta P / P = \pm 0.5\% \]

REFERENCES:
**COMPONENTS:**

1. Ethene: C₂H₄; [74-85-1]
2. Propane: C₃H₈; [74-98-6]

**ORIGINAL MEASUREMENTS:**
Elshayal, I.M.; Lu, B.C-Y.

**VARIABLES:**

\[ T/K = 200-273 \]
\[ P/\text{MPa} = 0.14-3.92, (1.4-39 \text{ atm}) \]

**EXPERIMENTAL VALUES:** ...continued

<table>
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<tr>
<th>( T/K )</th>
<th>( P/\text{atm} )</th>
<th>( P/\text{MPa} )</th>
<th>( P_1/\text{MPa} )</th>
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</table>

*Calculated by compiler.*

**AUXILIARY INFORMATION**

**METHOD/APPARATUS/PROCEDURE:**
The equilibrium cell was a chamber drilled into a copper rod. The cell was equipped with viewing windows, with gauges for pressure measurement and temperature measurement using two thermocouples for the liquid and gas phases. The low temperatures were achieved by immersing the copper extension of the cell in liquid nitrogen provided with a pressure controller and utilizing an intermediate electric heater. The cell itself was surrounded by a steel vacuum jacket for insulation. An electromagnetic plunger-type stirrer was used. In most of the experiments only the liquid phase was analyzed and that by GC.

**SOURCE AND PURITY OF MATERIALS:**

1. Ethene from Matheson of purity 99.9 mole %.
2. Propane from Matheson of purity 99.9 mole %.

**ESTIMATED ERROR:**
\[ \delta x_i / x_i = \pm 1\% \quad \delta T/K = 0.02 \]
\[ \delta P/P = \pm 0.5\% \]

**REFERENCES:**
COMPONENTS:
1. Ethene; C₂H₄; [74-85-1]
2. 2-Methylpropane (isobutane); C₄H₁₀; [75-28-5]

ORIGINAL MEASUREMENTS:
Naumova, A.A.; Tyvina, T.N.

VARIABLES:
\[ T/K = 293.15-393.15 \]
\[ P/MPa = 0.30-6.08, (3-60 \text{ atm}) \]

PREPARED BY:
W. Hayduk

EXPERIMENTAL VALUES:

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<thead>
<tr>
<th>( t/°C )</th>
<th>( T/K )</th>
<th>( P/10^3 \text{ hPa} )</th>
<th>( \text{Partial Pressure} P_i/\text{MPa} )</th>
<th>( 1 \text{ Ethene} ) Partial Pressure</th>
<th>( \text{Mole Fraction} ) Liquid, ( x_i )</th>
<th>( \text{Gas,} y_i )</th>
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</table>

\(^1\text{Calculated by compiler.}

...continued

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
A static type of solubility equipment was used.

SOURCE AND PURITY OF MATERIALS:
1. Ethene source and purity not given.
2. 2-Methylpropane source and purity not given.

ESTIMATED ERROR:
\[ \delta T/K = \pm 0.5 \]
\[ \delta x_i/x_i = \pm 0.02 \]
(compiler)

REFERENCES:
COMPONENTS:
1. Ethene; C₂H₄; [74-85-1]
2. 2-Methylpropane (isobutane); C₄H₁₀; [75-28-5]

ORIGINAL MEASUREMENTS:
Naumova, A.A.; Tyvina, T.N.

VARIABLES: T/K = 293.15-393.15
P/MPa = 0.30-6.08, (3-60 atm)

EXPERIMENTAL VALUES: ...

---

<table>
<thead>
<tr>
<th>t/C</th>
<th>T/K</th>
<th>Total Pressure P/10³ hPa</th>
<th>Partial Pressure p₁/MPa</th>
<th>Ethene Mole Fraction</th>
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<tbody>
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<td></td>
<td></td>
<td></td>
<td>Liquid x₁</td>
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<tr>
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<td></td>
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---

1Calculated by compiler.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
A static type of solubility equipment was used.

SOURCE AND PURITY OF MATERIALS:
1. Ethene source and purity not given.
2. 2-Methylpropane source and purity not given.

ESTIMATED ERROR:
δT/K = ± 0.5
δx₁ / x₁ = ± 0.02
(compiler)

REFERENCES:
COMPONENTS:
1. Ethene; C\textsubscript{2}H\textsubscript{4}; [74-85-1]
2. 2-Methylpropane (isobutane); C\textsubscript{4}H\textsubscript{10}; [75-28-5]

ORIGINAL MEASUREMENTS:
Benedict, M.; Solomon, E.;
Rubin, L.C.

VARIABLES: T/K = 310.93, 344.26
P/MPa = 3.447 (34.02 atm)

PREPARED BY:
W. Hayduk

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>t/C</th>
<th>T/K</th>
<th>Total Pressure P/ atm</th>
<th>Partial Pressure p/MPa</th>
<th>Ethene Liquid, x\textsubscript{l}</th>
<th>Ethene Gas, y\textsubscript{1}</th>
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</tbody>
</table>

\( ^1 \)Calculated by compiler; the partial pressure is based on the gas phase composition.

This paper contains a listing of three-component phase equilibria for methane, ethene and 2-methylpropane at several temperatures and pressures. These have been compiled and may be found in the Methane volume. The data here are all that are available for the two-component system.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
A steel cell is used for the solubility measurements. The solvent floats on mercury. The mercury is in contact with a free-piston and weights for pressure measurement. Equilibration is aided by rocking the cell and contents. As the gas is slowly sampled, mercury flows into the cell to keep the pressure constant. When only liquid remains, the pressure is increased and a liquid sample is obtained. The gas phase densities and olefin content are determined for the samples at low pressure.

SOURCE AND PURITY OF MATERIALS:
1. Ethene, anesthesia grade, was obtained from Ohio Chemical. It was purified by flash distillation and estimated to have 0.5 mole % ethane.

2. 2-Methylpropane of the CP grade was from Phillips Petroleum with a purity of 99.2%.

ESTIMATED ERROR:
\( \delta T/K = \pm 0.02 \)
\( \delta P/P = \pm 0.001 \)
\( \delta x\textsubscript{l}/x\textsubscript{l} = \pm 0.02 \)
(compiler)

REFERENCES:
COMPONENTS:
1. Ethene; \( \text{C}_2\text{H}_4; [74-85-1] \)
2. Propane, 2-methyl (isobutane); \( \text{C}_4\text{H}_{10}; [75-28-5] \)

ORIGINAL MEASUREMENTS:
Kozorezov, Yu.I.; Lisin, V.E.

VARIABLES:
\( T/\text{K} = 293-333 \)
\( P/\text{MPa} = 0.097-0.782 \)

EXPERIMENTAL VALUES:

<table>
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<tr>
<th>( t/\text{C} )</th>
<th>( T/\text{K} )</th>
<th>( p_1/\text{atm} )</th>
<th>( p_1/\text{MPa} )</th>
<th>( s/\text{cm}^3 ) (NTP) (g(^{-1}))</th>
<th>( x_1, \text{mole fraction} )</th>
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</table>

*Calculated by compiler.*

Although Henry's law constants were calculated by authors, they are not listed here because data obey Henry's law only very approximately.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
A 650 cm\(^3\) vessel kept at constant temperature was charged with 400-450 cm\(^3\) of liquid isobutane. The vessel was provided with a mixer for equilibration. The isobutane was saturated at constant pressure with gas. A sample of the saturated solution was withdrawn for chromatographic analysis. Method for determining gas partial pressure was not given in paper.

SOURCE AND PURITY OF MATERIALS:
1. Ethene purity 99.6%.
2. Isobutane purity 99.3%.

ESTIMATED ERROR:
\( \delta s/s = \pm 3\% \)

REFERENCES:
### COMPONENTS:
1. Ethene; C\textsubscript{2}H\textsubscript{4}; [74-85-1]
2. Heptane; C\textsubscript{7}H\textsubscript{16}; [142-82-5]

### ORIGINAL MEASUREMENTS:
Konobeev, B.I.; Lyapin, V.V.

### VARIABLES:
\[ T/K = 293.15 - 333.15 \]
\[ P/MPa = 0.28 - 3.2 \]

### EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>P/10\textsuperscript{5}Pa</th>
<th>Mole fraction of ethene in liquid ( x_{C_2H_4} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>293.15</td>
<td>3.090</td>
<td>0.060</td>
</tr>
<tr>
<td></td>
<td>8.106</td>
<td>0.156</td>
</tr>
<tr>
<td></td>
<td>15.60</td>
<td>0.291</td>
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<tr>
<td></td>
<td>32.12</td>
<td>0.576</td>
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<tr>
<td>313.15</td>
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<td>0.040</td>
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<tr>
<td></td>
<td>8.248</td>
<td>0.123</td>
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<tr>
<td></td>
<td>17.43</td>
<td>0.266</td>
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<tr>
<td></td>
<td>32.42</td>
<td>0.471</td>
</tr>
<tr>
<td>333.15</td>
<td>2.847</td>
<td>0.031</td>
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<td>8.278</td>
<td>0.100</td>
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<td>32.53</td>
<td>0.396</td>
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</table>

### AUXILIARY INFORMATION

**METHOD/APPARATUS/PROCEDURE:**
Static equilibrium cell fitted with magnetic stirrer. Samples analysed by gas chromatography. Details in source.

**SOURCE AND PURITY OF MATERIALS:**
1. Purity better than 99.6 mole per cent.
2. No details given.

**ESTIMATED ERROR:**
\( \delta T/K = \pm 0.1; \delta P = \pm 0.5\%; \delta x_{C_2H_4} = \pm 0.002 \) (estimated by compiler)

**REFERENCES:**
COMPONENTS:
1. Ethene; C₂H₄; [74-85-1]
2. Hexane; C₆H₁₄; [110-54-3]

ORIGINAL MEASUREMENTS:
Konobeev, B.I.; Lyapin, V.V.

VARIABLES:
\[ T/K = 293.15 - 333.15 \]
\[ P/\text{MPa} = 0.29 - 3.2 \]

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>P/10⁵Pa</th>
<th>( x_{C₂H₄} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>293.15</td>
<td>3.090</td>
<td>0.056</td>
</tr>
<tr>
<td></td>
<td>8.106</td>
<td>0.153</td>
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<tr>
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<td></td>
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<td></td>
<td>32.42</td>
<td>0.364</td>
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</table>

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
Static equilibrium cell fitted with magnetic stirrer. Samples analysed by gas chromatography. Details in source.

REFERENCE AND PURITY OF MATERIALS:
1. Purity better than 99.6 mole per cent.
2. No details given.

ESTIMATED ERROR:
\[ \delta T/K = \pm 0.1; \delta P = \pm 0.5\%; \delta x_{C₂H₄} = \pm 0.002 \]
(estimated by compiler)

REFERENCES:
COMPONENTS:
1. Ethene; \( \text{C}_2\text{H}_4 \); [74-85-1]
2. Heptane; \( \text{C}_7\text{H}_{16} \); [142-82-5]

ORIGINAL MEASUREMENTS:
Shenderei, E.R.; Ivanovskii, F.P.

VARIABLES:
\[ T/K = 228.15 - 248.15 \]
\[ P/\text{MPa} = 0.552 - 1.663 \]

PREPARED BY:
W. Hayduk

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>( t/C )</th>
<th>( \frac{1}{T/K} )</th>
<th>( P/\text{Atm} )</th>
<th>( \frac{1}{P/\text{MPa}} )</th>
<th>Mole fraction ( \text{et}hene, \ z_1 )</th>
<th>Solubility ( \text{cm}^3 \text{(STP)}/\text{g} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>-25</td>
<td>248.15</td>
<td>5.45</td>
<td>0.552</td>
<td>0.2376</td>
<td>69.06</td>
</tr>
<tr>
<td></td>
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<td>5.49</td>
<td>0.556</td>
<td>0.2561</td>
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<td>8.65</td>
<td>0.876</td>
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<td>0.902</td>
<td>0.4091</td>
<td>153.44</td>
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<td></td>
<td>10.19</td>
<td>1.033</td>
<td>0.4686</td>
<td>195.37</td>
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<td>0.6169</td>
<td>356.80</td>
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<td>1.493</td>
<td>0.6834</td>
<td>478.25</td>
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<td>0.7196</td>
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<td>16.41</td>
<td>1.663</td>
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<tr>
<td>-35</td>
<td>238.15</td>
<td>5.44</td>
<td>0.551</td>
<td>0.3085</td>
<td>98.84</td>
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<td>0.867</td>
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<td></td>
<td>12.88</td>
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<td>12.92</td>
<td>1.309</td>
<td>0.7649</td>
<td>721.04</td>
</tr>
</tbody>
</table>

\(^1\)Calculated by compiler.
Henry's constant determined for pressures below atmospheric. Graphs given for low pressure range showing that Henry's law is obeyed.

\[ \frac{T}{K} \quad \frac{H}{\text{Atm(mole fraction)}} \]
\begin{align*}
228.15 & \quad 13.5 \\
238.15 & \quad 17.2 \\
248.15 & \quad 20.9 \\
\end{align*}

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
The apparatus utilized an absorption tube with a magnetic stirrer. The temperature controlled bath had two compartments, one containing methanol solution, the other containing solid dry ice in acetone. The walls of the vessels served as the heat transfer medium. Capillary tubing connected the absorber to pressure devices, gas and solvent vessels and a vacuum system. A known amount of solvent was charged into the absorber and the quantity of gas was determined by pressure difference in the gas supply vessel.

SOURCE AND PURITY OF MATERIALS:
1. Purified and analyzed by GC. Actual purity not given.
2. Not given.

ESTIMATED ERROR:
\[ \delta \frac{T}{K} = \pm 0.1 \]
\[ \delta \frac{z_1}{z_1} = \pm 2\% \text{ (compiler)} \]

REFERENCES:
### Components:

1. Ethene; \( \text{C}_2\text{H}_4; [74-85-1] \)
2. Heptane; \( \text{C}_7\text{H}_{16}; [142-82-5] \)

### Original Measurements:

Shenderei, E.R.; Ivanovskii, F.P.


### Variables:

\[
\begin{align*}
T/K &= 228.15 - 248.15 \\
P/\text{MPa} &= 0.552 - 1.663
\end{align*}
\]

### Prepared By:

W. Hayduk

### Experimental Values:  

<table>
<thead>
<tr>
<th>( t/\degree \text{C} )</th>
<th>( T/K )</th>
<th>( P/\text{Atm} )</th>
<th>( f/P/\text{MPa} )</th>
<th>Mole fraction ethene, ( x_1 )</th>
<th>Solubility cm(^3) (STP)/g</th>
</tr>
</thead>
<tbody>
<tr>
<td>-35</td>
<td>238.15</td>
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<td>1.425</td>
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<tr>
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<td>228.15</td>
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<td>0.496</td>
<td>0.3636</td>
<td>126.58</td>
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<td>6.21</td>
<td>0.528</td>
<td>0.3765</td>
<td>136.80</td>
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<td>7.53</td>
<td>0.571</td>
<td>0.3742</td>
<td>132.50</td>
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<td>0.794</td>
<td>0.5929</td>
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<td>7.87</td>
<td>0.797</td>
<td>0.5962</td>
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<td>1.033</td>
<td>0.8161</td>
<td>981.15</td>
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<tr>
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<td>10.29</td>
<td>1.043</td>
<td>0.8218</td>
<td>1022.30</td>
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<td></td>
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<td>1.069</td>
<td>0.8413</td>
<td>1176.70</td>
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<tr>
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<td></td>
<td>10.96</td>
<td>1.111</td>
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<td>1806.70</td>
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<td>11.17</td>
<td>1.132</td>
<td>0.9012</td>
<td>2024.69</td>
</tr>
</tbody>
</table>

\(^{1}\text{Calculated by compiler.}\)

Henry's constant determined for pressures below atmospheric. Graphs given for low pressure range showing that Henry's law is obeyed.

<table>
<thead>
<tr>
<th>( T/K )</th>
<th>( H/\text{Atm(mole fraction)}^{-1} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>228.15</td>
<td>13.5</td>
</tr>
<tr>
<td>238.15</td>
<td>17.2</td>
</tr>
<tr>
<td>248.15</td>
<td>20.9</td>
</tr>
</tbody>
</table>

### Auxiliary Information

**Method/Apparatus/Procedure:**

The apparatus utilized an absorption tube with a magnetic stirrer. The temperature controlled bath had two compartments, one containing methanol solution, the other containing solid dry ice in acetone. The walls of the vessels served as the heat transfer medium. Capillary tubing connected the absorber to pressure devices, gas and solvent vessels and a vacuum system. A known amount of solvent was charged into the absorber and the quantity of gas was determined by pressure difference in the gas supply vessel.

### Source and Purity of Materials:

1. Purified and analyzed by GC. Actual purity not given.
2. Not given.

### Estimated Error:

\[
\delta T/K = \pm 0.1 \\
\delta x_1 / x_1 = \pm 2\% \text{ (compiler)}
\]

### References:


COMPONENTS:
1. Ethene; C₂H₄ [74-85-1]
2. Heptane; C₇H₁₆ [142-82-5]

VARIABLES:
$T/K = 373.15 - 473.15$
$p/MPa = 4.05 - 10.13$

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>Temperature $t/°C$</th>
<th>Total Pressure $P/atm$</th>
<th>Ethene $K₁=y₁/x₁$</th>
<th>Heptane $K₂=y₂/x₂$</th>
<th>$₂$Ethene Mole Fraction</th>
<th>Vapor, $y_1$ Liquid, $x_1$</th>
</tr>
</thead>
<tbody>
<tr>
<td>100 373.15</td>
<td>40 4.05</td>
<td>2.95</td>
<td>0.144</td>
<td>0.900</td>
<td>0.306</td>
</tr>
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<td>2.04</td>
<td>0.148</td>
<td>0.919</td>
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<tr>
<td></td>
<td>80 8.11</td>
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<td>0.237</td>
<td>0.905</td>
<td>0.599</td>
</tr>
<tr>
<td></td>
<td>100 10.13</td>
<td>1.08</td>
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<td>150 423.15</td>
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<td>0.925</td>
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<tr>
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<td>200 473.15</td>
<td>40 4.05</td>
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<td>0.586</td>
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<td>80 8.11</td>
<td>1.39</td>
<td>0.702</td>
<td>0.602</td>
<td>0.433</td>
</tr>
</tbody>
</table>

1Calculated by Compiler.

2Liquid and vapor compositions were calculated by the Compiler to satisfy the Equilibrium Constants; these were not given in the paper although they were shown in a graph.

AUXILIARY INFORMATION

METHOD APPARATUS PROCEDURE:
A high pressure apparatus employing a glass capillary tube immersed in mercury was used. Agitation was by means of a magnetically-operated agitation system. A cathetometer was used to determine the quantity of solvent charged and a microburette was used to measure the volumes of gas dissolved.

SOURCE AND PURITY OF MATERIALS:
1. Ethene was prepared by reaction of Zn with dibromoethane in an alcohol solution. The purity was determined at 99.5%.
2. Heptane was from Phillips Petroleum of the highest purity grade (unspecified).

ESTIMATED ERROR:

$ΔT/K = ± 0.1$
$ΔP/atm = ± 0.5$
$δx_1 = ± 0.02$

REFERENCES:
COMPONENTS: ORIGINAL MEASUREMENTS:

1. Ethene; C₂H₄; [74-85-1]
2. Heptane; C₇H₁₆; [142-82-5]

Kay, W.B.

VARIABLES:

\[\frac{T}{K} = 211.5 - 522.0\]
\[P/\text{MPa} = 0.677 - 19.15\]

PREPARED BY:
W. Hayduk

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>Fraction Ethene</th>
<th>Temperature in Liquid</th>
<th>¹Equilibrium Constant</th>
<th>Total Pressure</th>
</tr>
</thead>
<tbody>
<tr>
<td>(T/K)</td>
<td>(P/\text{psia})</td>
<td>(K = y_1/x_1)</td>
<td>(P/\text{MPa})</td>
</tr>
<tr>
<td>0.0208</td>
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<td>468.0</td>
<td>515.37</td>
</tr>
</tbody>
</table>

¹Calculated by compiler. Raoult's law was used to calculate the vapor composition and K, both being approximations. continued...

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Heptane was charged into the high pressure cell, degassed, and its quantity determined by volume. A measured volume of ethene gas was added from a storage bomb at constant temperature to give a known liquid composition by a material balance. The liquid composition was considered to remain constant for the changes in temperature and pressure involved in each series of experiments because of the small gas volume used. Densities and critical properties of the solutions were also given at high pressure. Details of experimental method given in reference 1.

Vapor-liquid equilibria for eight ethene compositions are reported. The results for four of the compositions, in which the mole fractions are less than 0.5, may be considered solubility equilibria and are listed here.

SOURCE AND PURITY OF MATERIALS:

1. Commercial high purity ethene was fractionated then degassed by repeated freezing, evacuation and melting. Actual purity not indicated.

2. Heptane purity not specified.

ESTIMATED ERROR:

\[\frac{\Delta T}{T} = \pm 0.02\]
\[\frac{\Delta P}{P} = \pm 0.005\]
\[\frac{\Delta x_1}{x_1} = \pm 0.03\] (Compiler)

REFERENCES:

1. Kay, W.B.
COMPONENTS:
1. Ethene; C\textsubscript{2}H\textsubscript{4}; [74-85-1]
2. Heptane; C\textsubscript{7}H\textsubscript{16}; [142-82-5]

ORIGINAL MEASUREMENTS:
Kay, W.B.

VARIABLES:
\[ \frac{T}{K} = 211.5 - 522.0 \]
\[ \frac{P}{MPa} = 0.677 - 19.15 \]

PREPARED BY:
W. Hayduk

EXPERIMENTAL VALUES: ...continued

<table>
<thead>
<tr>
<th>Fraction Ethene in Liquid</th>
<th>Temperature for Ethene</th>
<th>Equilibrium Constant</th>
<th>Total Pressure</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>( w, \text{mass} \times_1, \text{mol} )</td>
<td>( t/\text{°F} \times 1/\text{T/K} )</td>
<td>( K = y_1/x_1 )</td>
</tr>
<tr>
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</tr>
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</table>

1 Calculated by compiler. Raoult's law was used to calculate the vapor composition and \( K \), both being approximations.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Heptane was charged into the high pressure cell, degassed, and its quantity determined by volume. A measured volume of ethene gas was added from a storage bomb at constant temperature to give a known liquid composition by a material balance. The liquid composition was considered to remain constant for the changes in temperature and pressure involved in each series of experiments because of the small gas volume used. Densities and critical properties of the solutions were also given at high pressure. Details of experimental method given in reference 1. Vapor-liquid equilibria for eight ethene compositions are reported. The results for four of the compositions, in which the mole fractions are less than 0.5, may be considered solubility equilibria and are listed here.

SOURCE AND PURITY OF MATERIALS:

1. Commercial high purity ethene was fractionated then degassed by repeated freezing, evacuation and melting. Actual purity not indicated.

2. Heptane purity not specified.

ESTIMATED ERROR:

\[
\delta T/K = \pm 0.02 \\
\delta P/P = \pm 0.005 \\
\delta x_1/x_1 = \pm 0.03 \text{ (Compiler)}
\]

REFERENCES:

1. Kay, W.B.

COMPONENTS:
1. Ethene; C₂H₄; [74-85-1]
2. Heptane; C₇H₁₆; [142-82-5]

ORIGINAL MEASUREMENTS:
Kay, W.B.

VARIABLES:

<table>
<thead>
<tr>
<th>θ/T/K</th>
<th>p/MPa</th>
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</thead>
<tbody>
<tr>
<td>211.5 - 522.0</td>
<td>0.677 - 19.15</td>
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</tbody>
</table>

EXPERIMENTAL VALUES: ...continued

<table>
<thead>
<tr>
<th>Fraction Ethene in Liquid</th>
<th>Temperature T/K</th>
<th>Equilibrium Constant K = y₁/x₁</th>
<th>Total Pressure p/psia</th>
<th>Total Pressure p/MPa</th>
</tr>
</thead>
<tbody>
<tr>
<td>x₁, mol</td>
<td>t/°F</td>
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<td></td>
<td></td>
</tr>
<tr>
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<tr>
<td>0.2105 0.4725</td>
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<td>343.0 445.93</td>
<td>2.031 1150 7.929</td>
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<td></td>
</tr>
</tbody>
</table>

*Calculated by compiler. Raoult's law was used to calculate the vapor composition and K, both being approximations.*

METHOD/APPARATUS/PROCEDURE:
Heptane was charged into the high pressure cell, degassed, and its quantity determined by volume. A measured volume of ethene gas was added from a storage bomb at constant temperature to give a known liquid composition by a material balance. The liquid composition was considered to remain constant for the changes in temperature and pressure involved in each series of experiments because of the small gas volume used. Densities and critical properties of the solutions were also given at high pressure. Details of experimental method given in reference 1. Vapor-liquid equilibria for eight ethene compositions are reported. The results for four of the compositions, in which the mole fractions are less than 0.5, may be considered solubility equilibria and are listed here.

SOURCE AND PURITY OF MATERIALS:
1. Commercial high purity ethene was fractionated then degassed by repeated freezing, evacuation and melting. Actual purity not indicated.
2. Heptane purity not specified.

ESTIMATED ERROR:

<table>
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<tr>
<th>δT/K</th>
<th>δP/P</th>
<th>δx₁/x₁</th>
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</thead>
<tbody>
<tr>
<td>± 0.02</td>
<td>± 0.005</td>
<td>± 0.03 (Compiler)</td>
</tr>
</tbody>
</table>

REFERENCES:
1. Kay, W.B.
**COMPONENTS:**

1. Ethene; C₂H₄; [74-85-1]
2. Octane; C₈H₁₈; [111-65-9]

**ORIGINAL MEASUREMENTS:**

Shenderei, E.R.; Ivanovskii, F.P.


**VARIABLES:**

\[ T/K = 228.15 - 248.15 \]

\[ P/MPa = 0.285 - 1.48 \]

**PREPARED BY:**

W. Hayduk

**EXPERIMENTAL VALUES:**

<table>
<thead>
<tr>
<th>t/C</th>
<th>( T/K )</th>
<th>( P/\text{atm} )</th>
<th>( P/\text{MPa} )</th>
<th>Mole fraction ethene, ( x_1 )</th>
<th>Solubility ( \text{cm}^3(\text{STP})/\text{g} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>-25</td>
<td>248.15</td>
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<td>0.536</td>
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<td>0.5937</td>
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</table>

1'Calculated by compiler.

Henry's constant determined for pressures below atmospheric. Graphs given for low pressure range showing that Henry's law is obeyed.

\[
\frac{T}{K} \quad H/\text{Atm(mole fraction)}^{-1}
\]

\[
228.15 \quad 14.2
238.15 \quad 17.0
248.15 \quad 20.2
\]

continued...

**METHOD/APPARATUS/PROCEDURE:**

The apparatus utilized an absorption tube with a magnetic stirrer. The temperature controlled bath had two compartments, one containing methanol solution, the other containing solid dry ice in acetone. The walls of the vessels served as the heat transfer medium. Capillary tubing connected the absorber to pressure devices, gas and solvent vessels and a vacuum system. A known amount of solvent was charged into the absorber and the quantity of gas was determined by pressure difference in the gas supply vessel.

**SOURCE AND PURITY OF MATERIALS:**

1. Purified and analyzed by GC. Actual purity not given.

2. Not given.

**ESTIMATED ERROR:**

\[
\delta T/K = \pm 0.1
\]

\[
\delta x_1/x_1 = \pm 2\% \text{ (compiler)}
\]

**REFERENCES:**


COMPONENTS:
1. Ethene; C\(_2\)H\(_4\); [74-85-1]
2. Octane; C\(_8\)H\(_{18}\); [111-65-9]

ORIGINAL MEASUREMENTS:
Shenderei, E.R.; Ivanovskii, F.P.

VARIABLES:
\( T/K = 228.15 - 248.15 \)
\( P/MPa = 0.253 - 1.048 \)

PREPARED BY:
W. Hayduk

EXPERIMENTAL VALUES: ....continued

<table>
<thead>
<tr>
<th>Temperature (°C)</th>
<th>( T/K )</th>
<th>Pressure (atm)</th>
<th>( P/MPa )</th>
<th>Mole fraction ethene, ( x_1 )</th>
<th>Solubility (cm(^3)(STP)/g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>-45</td>
<td>228.15</td>
<td>2.50</td>
<td>0.253</td>
<td>0.1715</td>
<td>40.23</td>
</tr>
<tr>
<td>2.85</td>
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<td>0.1950</td>
<td>47.09</td>
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<td>0.2583</td>
<td>67.66</td>
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<tr>
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<td>0.4032</td>
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</table>

* Calculated by compiler.

Henry's constant determined for pressures below atmospheric. Graphs given for low pressure range showing that Henry's law is obeyed.

\[
\begin{array}{c|c|c|c}
T/K & H/Atm(mole fraction)\(^{-1}\) & 228.15 & 238.15 & 248.15 \\
\hline
228.15 & 14.2 & 20.2 \\
238.15 & 17.0 & & \\
248.15 & & & \\
\end{array}
\]

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
The apparatus utilized an absorption tube with a magnetic stirrer. The temperature controlled bath had two compartments, one containing methanol solution, the other containing solid dry ice in acetone. The walls of the vessels served as the heat transfer medium. Capillary tubing connected the absorber to pressure devices, gas and solvent vessels and a vacuum system. A known amount of solvent was charged into the absorber and the quantity of gas was determined by pressure difference in the gas supply vessel.

SOURCE AND PURITY OF MATERIALS:
1. Purified and analyzed by GC. Actual purity not given.
2. Not given.

ESTIMATED ERROR:
\[ \delta T/K = \pm 0.1 \]
\[ \delta x_1/x_1 = \pm 2\% \text{ (compiler)} \]

REFERENCES:
COMPONENTS:
1. Ethene; C\(_2\)H\(_4\); [74-85-1]
2. Nonane; C\(_9\)H\(_{20}\); [111-84-2]

VARIABLES:

\[ T/K = 293.15 - 333.15 \]
\[ P/\text{MPa} = 0.29 - 3.19 \]

EXPERIMENTAL VALUES:

<table>
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<tr>
<th>( T/K )</th>
<th>( P/\text{MPa} \times 10^5 )</th>
<th>( x_{C_2H_4} )</th>
</tr>
</thead>
<tbody>
<tr>
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AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
Static equilibrium cell fitted with magnetic stirrer. Samples analysed by gas chromatography. Details in source.

SOURCE AND PURITY OF MATERIALS:
1. Purity better than 99.6 mole per cent.
2. No details given.

ESTIMATED ERROR:
\[ \delta T/K = \pm 0.1; \delta P = \pm 0.5\% ; \delta x_{C_2H_4} = \pm 0.002 \]
(estimated by compiler)

REFERENCES:
### COMPONENTS:
1. Ethene: C\textsubscript{2}H\textsubscript{4}: [74-85-1]
2. Dodecane: C\textsubscript{12}H\textsubscript{26}: [112-40-3]

### VARIABLES:
- \( T/K = 283-348 \)
- \( P/\text{MPa} = 0.51-9.12 \)

### EXPERIMENTAL VALUES:

<table>
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<tr>
<th>( t/\degree C )</th>
<th>( T/K )</th>
<th>Total Pressure ( P/\text{atm} )</th>
<th>Ethene in liquid Mole Fraction, ( x_1 )</th>
<th>Liquid Solution Molar Volume ( V_L/\text{cm}^3(\text{mole})^{-1} )</th>
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</thead>
<tbody>
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\( x_1 \) Calculated by compiler.

### AUXILIARY INFORMATION

**METHOD/APPARATUS/PROCEDURE:**

A 10-cm\textsuperscript{3} borosilicate glass equilibrium cell containing a known mass of degassed solvent was mounted in a constant temperature bath. Gas was quantitatively (+ 0.006 cm\textsuperscript{3}) charged from a reservoir, kept at constant pressure, by mercury displacement. Pressure gauges mounted on the cell and the reservoir were accurate to 0.07 atm. Liquid volumes inside the cell could be read using calibration marks on the cell wall. Agitation was by using a magnetically activated stainless steel ball. The solubility was determined from the volume of gas consumed. Saturated solution volumes were read from the observed volumes in the cell. Additional details in reference 1. The dodecane vapor pressure was considered negligible even at 75°C when it corresponded to 4.2 mm mercury.

**SOURCE AND PURITY OF MATERIALS:**

1. Ethene was CP grade from Matheson; minimum purity 99.5%. Gas critical temperature and pressure measured as 9.34°C at 50.09 atm.
2. Dodecane was from Humphrey-Wilkinson; 99.0% minimum purity. Freezing point: -9.57°C.

**ESTIMATED ERROR:**

\[ \delta x_1 / x_1 = \pm 0.01 \quad T/K = \pm 0.02 \]
\[ \delta P/P = \pm 0.01 \]

**REFERENCES:**

1. Lee, K.H.; Kohn, J.P.
### Components:

1. Ethene; \( \text{C}_2\text{H}_4 \); [74-85-1]
2. Dodecane; \( \text{C}_{12}\text{H}_{26} \); [112-40-3]

### Variables:

- \( T/K = 283-348 \)
- \( P/\text{MPa} = 0.51-9.12 \)

### Experimental Values:

<table>
<thead>
<tr>
<th>( T/K )</th>
<th>( P/\text{atm} )</th>
<th>( \delta P/P )</th>
<th>( M_{\text{L}}/\text{cm}^3 \text{(mole)}^{-1} )</th>
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<td>0.850</td>
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Calculated by compiler.

### Method/Apparatus/Procedure:

A 10-cm³ borosilicate glass equilibrium cell containing a known mass of degassed solvent was mounted in a constant temperature bath. Gas was quantitatively (±0.006 cm³) charged from a reservoir, kept at constant pressure, by mercury displacement. Pressure gauges mounted on the cell and the reservoir were accurate to 0.07 atm. Liquid volumes inside the cell could be read using calibration marks on the cell wall. Agitation was by using a magnetically activated stainless steel ball. The solubility was determined from the volume of gas consumed. Saturated solution volumes were read from the observed volumes in the cell. Additional details in reference 1. The dodecane vapor pressure was considered negligible even at 75°C when it corresponded to 4.2 mm mercury.

### Auxiliary Information

**Source and Purity of Materials:**

1. Ethene was CP grade from Matheson; minimum purity 99.5%. Gas critical temperature and pressure measured as 9.34°C at 50.09 atm.
2. Dodecane was from Humphrey-Wilkinson; 99.0% minimum purity. Freezing point: -9.57°C.

### Estimated Error:

\[ \delta x_1/x_1 = \pm 0.01 \quad T/K = \pm 0.02 \]
\[ \delta P/P = \pm 0.01 \]

### References:

1. Lee, K.H.; Kohn, J.P.  
COMPONENTS:
1. Ethene; \( \text{C}_2\text{H}_4 \); [74-85-1]
2. Dodecane; \( \text{C}_{12}\text{H}_{26} \); [112-40-3]

VARIABLES:
\( T/\text{K} = 283-348 \)
\( P/\text{MPa} = 0.51-9.12 \)

EXPERIMENTAL VALUES: ...continued

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<th>( T/\text{K} )</th>
<th>( P/\text{atm} )</th>
<th>( P/\text{MPa} )</th>
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\( ^1 \)Calculated by compiler.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
A 10-cm\(^3\) borosilicate glass equilibrium cell containing a known mass of degassed solvent was mounted in a constant temperature bath. Gas was quantitatively (\( \pm 0.006 \text{ cm}^3 \)) charged from a reservoir, kept at constant pressure, by mercury displacement. Pressure gauges mounted on the cell and the reservoir were accurate to 0.07 atm. Liquid volumes inside the cell could be read using calibration marks on the cell wall. Agitation was by using a magnetically activated stainless steel ball. The solubility was determined from the volume of gas consumed. Saturated solution volumes were read from the observed volumes in the cell. Additional details in reference 1. The dodecane vapor pressure was considered negligible even at 75°C when it corresponded to 4.2 mm mercury.

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2. Dodecane was from Humphrey-Wilkinson; 99.0% minimum purity. Freezing point: -9.57°C.

ESTIMATED ERROR:
\( \delta x_1/x_1 = \pm 0.01 \)
\( \delta T/\text{K} = \pm 0.02 \)
\( \delta P/\text{MPa} = \pm 0.01 \)

REFERENCES:
1. Lee, K.H.; Kohn, J.P. 
## COMPONENTS:
1. Ethene; \( \text{C}_2\text{H}_4; [74-85-1] \)
2. Eicosane (n-Eicosane); \( \text{C}_{20}\text{H}_{42}; [112-95-8] \)

## ORIGINAL MEASUREMENTS:
Chou, J.S.; Chao, K. C.

## VARIABLES:
- \( T / \text{K} = 373.25 - 573.15 \)
- \( P / \text{MPa} = 1.01 - 5.06 \)

## PREPARED BY:
W. Hayduk

## EXPERIMENTAL VALUES:

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<th>( t / ^\circ \text{C} )</th>
<th>( T / \text{K} )</th>
<th>( P / \text{atm} )</th>
<th>( \text{Mole Fraction, Ethene, } x_1 )</th>
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</table>

1 Calculated by Compiler.
2 Estimated by Compiler.

## AUXILIARY INFORMATION

**METHOD/APPARATUS/PROCEDURE**
Ethene is bubbled through a presaturator and then through the equilibrium cell, both being filled with the molten solvent. The cell is thermostated in a nitrogen bath. After saturation, a (molten) liquid sample is withdrawn into an evacuated trap connected to a gas handling system. The solvent solidifies, and the volume of the gas released is measured in a burette over water at a known temperature and pressure. The mass of the solid solvent is determined. Further details are in Ref. 1.

**SOURCE AND PURITY OF MATERIALS:**
1. Ethene was from Matheson Gas Products at a specified purity of 99.5%.
2. Eicosane was from Sigma Chemicals at a specified purity of 99.0%.

**ESTIMATED ERROR:**
- \( \delta T / \text{K} = 0.1 \)
- \( \delta P / \text{atm} = 0.05 \)
- \( \delta x / x = 0.02 \) (Compiler)

**REFERENCES:**
1. Huang, S.H.; Lin, H.M.; Chao, K.C.
   *Fluid Phase Equil.* 1987, 36, 141.
COMPONENTS:
1. Ethene; C₂H₄; [74-85-1]
2. Octacosane; C₂₈H₅₆; [630-02-4]

ORIGINAL MEASUREMENTS:
Chou, J.S.; Chao, K. C.

VARIABLES: \( T/K = 373.05 - 573.05 \)
\( P/MPa = 1.01 - 5.06 \)

PREPARED BY: W. Hayduk

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>( T/K )</th>
<th>( P/MPa )</th>
<th>Mole Fraction, Ethene, ( x_I )</th>
</tr>
</thead>
</table>
| 373.05 | 1.013 | 0.0146
| 30.02 | 2.033 | 0.255
| 39.98 | 4.051 | 0.422
| 49.94 | 5.060 | 0.488
| 473.05 | 1.016 | 0.0979
| 30.02 | 2.026 | 0.181
| 39.99 | 4.052 | 0.311
| 49.89 | 5.055 | 0.369
| 573.05 | 1.012 | 0.0804
| 30.01 | 2.034 | 0.151
| 40.00 | 4.053 | 0.273
| 49.98 | 5.064 | 0.321

\( 1T/K = \) Calculated by Compiler.
\( 2P/MPa = \) Estimated by Compiler.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
Ethene is bubbled through a presaturator and then through the equilibrium cell, both being filled with the molten solvent. The cell is thermostated in a nitrogen bath. After saturation, a (molten) liquid sample is withdrawn into an evacuated trap connected to a gas handling system. The solvent solidifies, and the volume of the gas released is measured in a burette over water at a known temperature and pressure. The mass of the solid solvent is determined. Further details are in Ref. 1.

SOURCE AND PURITY OF MATERIALS:
1. Ethene was from Matheson Gas Products at a specified purity of 99.5%.
2. Octacosane was from the Aldrich Chemical Company at a specified purity of 99.0%.

ESTIMATED ERROR:
\( \Delta T/K = 0.1 \)
\( \Delta P/MPa = 0.05 \)
\( \Delta x/x = 0.02 \) (Compiler)

REFERENCES:
1. Huang, S.H.; Lin, H.M.; Chao, K.C.
Fluid Phase Equil. 1987, 36, 141.
COMPONENTS:
1. Ethene; \( \text{C}_2\text{H}_4; \) [74-85-1]
2. Hexatriacontane; \( \text{C}_{36}\text{H}_{74}; \) [630-06-8]

ORIGINAL MEASUREMENTS:
Chou, J.S.; Chao, K.C.

VARIABLES:
\( T/K = 373.25 - 573.25 \)
\( P/\text{MPa} = 1.02 - 5.06 \)

PREPARED BY:
W. Hayduk

EXPERIMENTAL VALUES:

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<th>( P/\text{atm} )</th>
<th>( P/\text{MPa} )</th>
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¹Calculated by Compiler.
²Estimated by Compiler.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
Ethene is bubbled through a presaturator and then through the equilibrium cell, both being filled with the molten solvent. The cell is thermostated in a nitrogen bath. After saturation, a (molten) liquid sample is withdrawn into an evacuated trap connected to a gas handling system. The solvent solidifies, and the volume of the gas released is measured in a burette over water at a known temperature and pressure. The mass of the solid solvent is determined. Further details are in Ref. 1.

SOURCE AND PURITY OF MATERIALS:
1. Ethene was from Matheson Gas Products at a specified purity of 99.5%.
2. Hexatriacontane was from the Aldrich Chemical Company at a specified purity of 99.9%.

ESTIMATED ERROR:
\( \delta T/K = 0.1 \)
\( \delta P/\text{atm} = 0.05 \)
\( \delta x/x = 0.02 \) (Compiler)

REFERENCES:
1. Huang, S.H.; Lin, H.M.; Chao, K.C.
*Fluid Phase Equil.* 1987, 36, 141.
The solubilities of ethene in aromatic, cyclic and alicyclic compounds for a pressure of essentially 101.3 kPa were reported by some ten groups of researchers (1-10). Three groups of researchers reported their results in the form of graphs or correlations only (4,7,8) and from these solubility values were determined or calculated for comparison with other data.

For the solvents composed of carbon-ring structures, some general observations can be made concerning their solvating ability for ethene. It is observed that the ethene solubility is increased when the number of methyl side groups on a carbon ring compound is increased. The solubility is also increased when the degree of saturation of an unsaturated carbon-ring compound is increased. Finally, solvents having a ring structure all appear to have similar temperature coefficients of solubility for ethene. These observations are based on the fact that at the same temperatures the solubility in decahydronaphthalene is higher than in tetrahydronaphthalene, in methylbenzene it is higher than in benzene, and in turn in dimethyl benzene it is higher still than in methylbenzene. Finally, the solubilities in methycyclohexane, when extrapolated, appear higher than those in cyclohexane solvent for the same temperatures.

Solubilities in individual solvents are now discussed in more detail below.

Benzene; C₆H₆; [71-43-2]

Horiuti (1) reported solubility data for ethene in benzene at low pressures for temperatures ranging from 278.15 K to 323.15 K. In spite of the date of the publication (1931/1932), Horiuti's data are known to be of high accuracy. Narasimhan and Nageshwar (2), and Jadot (3) reported ethene solubilities at 293.15 K, and at 298.15 K, respectively. Krauss and Gestrich (4) reported their results as a correlation utilizing an enthalpy of solution which permitted the calculation of solubilities in the temperature range from 293.15 to 313.15 K. The early results of McDaniel (5), while of historical interest, have been usually found to be significantly lower than those of more recent researchers as in this case, and are rejected. When compared with the other data, the result of Jadot is also rejected because it is approximately 9% lower than comparable data. The single value of Narasimhan and Nageshwar (2) is 4% higher than those of the remaining two research groups and is also rejected.

The remaining data are well represented by the following equation applicable for a temperature range from 278.15 K to 323.15 K and having a correlation coefficient of 0.9995:

\[
\ln x_1 = -8.0954 + 1103.8/(T/K)
\] (1)

Equation (1) has a maximum deviation from the experimental data of 0.9%. This equation and the data on which it is based are classified as tentative. It is noted that while both constants of Equation (1) are different than those listed in the compilation of the Horiuti data (1), the calculated values are virtually identical, differing by a maximum of only one figure in the fourth significant place.
CRITICAL EVALUATION:

The mole fraction solubilities for ethene in benzene at 101.3 kPa pressure as calculated by means of Equation (1) are tabulated below:

<table>
<thead>
<tr>
<th>T/K</th>
<th>10² x₁</th>
<th>T/K</th>
<th>10² x₁</th>
</tr>
</thead>
<tbody>
<tr>
<td>278.15</td>
<td>1.606</td>
<td>303.15</td>
<td>1.158</td>
</tr>
<tr>
<td>283.15</td>
<td>1.518</td>
<td>308.15</td>
<td>1.093</td>
</tr>
<tr>
<td>288.15</td>
<td>1.398</td>
<td>313.15</td>
<td>1.036</td>
</tr>
<tr>
<td>293.15</td>
<td>1.327</td>
<td>318.15</td>
<td>0.9828</td>
</tr>
<tr>
<td>298.15</td>
<td>1.229</td>
<td>323.15</td>
<td>0.9327</td>
</tr>
</tbody>
</table>

Methylbenzene (toluene); C₇H₈; [108-88-3]

Solubilities of ethene in methylbenzene at low pressure of four groups of researchers (4, 6, 7, 8) are available over a wide temperature range, from 213.15 K (-60°C) to 313.15 K (40°C). The data of Waters et al. (6) were obtained using three different methods; hence, it is unlikely that systematic errors occurred. The data of Krauss and Gestrich (4) as well as of Hannaert et al. (7) were presented only as correlations. Values of the latter two groups were calculated for the temperature ranges for which the measurements were made. Leites and Ivanovskii (8) reported solubilities at low temperatures. A consistency test indicated that there is a good correlation for the temperature range from 243.15 K to 313.15 K, provided that the low temperature data of Leites and Ivanovskii are omitted. The equation obtained for the temperature range from 243.15 K to 313.15 K, having a correlation coefficient of 0.9980, an average deviation of 1.2% and a maximum deviation of 3.2% is:

\[
\ln x_1 = -8.1440 + 1161.47/(T/K)
\]  

The data on which it is based and Equation (2) are classified as tentative. The value of Leites and Ivanovskii (8) is about 6% higher than the correlation of Hannaert et al. at 243.15 K. The low temperature data are also significantly higher, by about 10%, than Equation (2). It is, however, impossible to ascertain whether the data are too high or there is a curvature in the solubility-temperature relation. Until additional solubilities become available, the data of Leites and Ivanovskii are classified as tentative.

The mole fraction solubilities for ethene in methylbenzene at 101.3 kPa pressure were calculated by means of Equation (2) and are tabulated below:

<table>
<thead>
<tr>
<th>T/K</th>
<th>10² x₁</th>
<th>T/K</th>
<th>10² x₁</th>
</tr>
</thead>
<tbody>
<tr>
<td>243.15</td>
<td>3.449</td>
<td>293.15</td>
<td>1.527</td>
</tr>
<tr>
<td>253.15</td>
<td>2.856</td>
<td>398.15</td>
<td>1.429</td>
</tr>
<tr>
<td>263.15</td>
<td>2.399</td>
<td>303.15</td>
<td>1.340</td>
</tr>
<tr>
<td>273.15</td>
<td>2.041</td>
<td>318.15</td>
<td>1.186</td>
</tr>
<tr>
<td>283.15</td>
<td>1.756</td>
<td>323.15</td>
<td>1.093</td>
</tr>
</tbody>
</table>

Dimethylbenzenes (xylene); C₈H₁₀; [108-38-3]

Two research groups reported ethene solubilities in dimethylbenzene. Krauss and Gestrich (4) and Hannaert et al. (7), both reported their results as correlations only, but for different temperature ranges. Four values of solubility were calculated from each correlation and together were found to be very consistent. The correlating line representing data from both sources is:
COMPONENTS:
1. Ethene; C₂H₄; [74-85-1]
2. Aromatic, cyclic and alicyclic compounds for pressures less than 0.2 MPa (2 atm)

CRITICAL EVALUATION:

\[
\ln x_1 = -8.19193 + \frac{1186.94}{(T/K)} \tag{3}
\]

Equation (3) covers temperatures from 243.15 K to 313.15 K, has a correlation coefficient of \( r = 0.9992 \) and maximum and average deviations from the equation of 2.4%, and 1.1%, respectively. Attention is drawn to the fact that the solvent used by Hannaert et al. (7) contained only 90% dimethylbenzene of an unspecified isomer, with the remaining components being methylbenzene and ethylbenzene. Similarly, the solvent purity and isomer type used by Krauss and Gestrich (4) likewise were not specified. Hence, it is not possible to determine in which isomer the solubilities were obtained. However, because there is a relatively small difference in ethene solubilities in methylbenzene and in dimethylbenzene, it appears likely that the solubilities in all three dimethylbenzene isomers are similar. Equation (3) and the data on which it is based are classified as tentative.

Cyclohexane; C₆H₁₂; [110-82-7] and methylcyclohexane; C₇H₁₄; [108-87-2]

Only the results of Krauss and Gestrich (4), expressed as a correlation, are available for the solubilities of ethene in cyclohexane. The temperature range is from 293.15 K to 313.15 K. Only the results of Leites and Ivanovskil at low temperature (8) are available for solubilities in methylcyclohexane. These data are both classified as tentative.

Tetrahydronaphthalene; C₁₀H₁₂; [119-64-2] and decahydronaphthalene; C₁₀H₁₈; [91-17-8]

Only the results of Krauss and Gestrich (4) for the temperature range from 293.15 to 313.15 K are available for the solubility of ethene in tetrahydronaphthalene. Again, only the results of Lenoir et al. (9) are available at two temperatures for the solubility in decahydronaphthalene. These data are both classified as tentative.

(R)-1-Methyl-4-(1-methyleneylecyl)cylohexene, (Limonene); C₁₀H₁₆; [5989-27-5]

The result of McDaniel (5) is the only solubility of ethene available in limonene. As with most of McDaniel's results, a caution is expressed because his results have been found to be more than 20% too low. Hence, this result is considered to be of qualitative value only, and is rejected.

1,1'-Methylenebis(methylbenzene) or ditolylmethane; C₁₅H₁₆; [1335-47-3]

Glazunova et al. (10) reported ethene solubilities in 1,1'-methylenebis(methylbenzene) at temperatures to 413.15 K. These solubilities appear consistent and no other source of data is available for this solvent. These data are classified as tentative.

Two component solvent solutions composed of n-heptane; C₇H₁₆; [142-82-5] and methylbenzene; C₇H₈; [108-88-3], as well as of methylcyclohexane; C₇H₁₄; [108-87-2] and methylbenzene.

The solubilities of ethene in the mixed solvent solutions were reported for both solvent solutions for the low temperatures of 223.15 K and 213.15 K by Leites and Ivanovskil (8). These results were shown only graphically as Henry's constants and were recalculated as mole fraction solute. There is a maximum mole fraction solubility of ethene in
COMPONENTS:
1. Ethene; C₂H₄; [74-85-1]
2. Aromatic, cyclic and alicyclic compounds for pressures less than 0.2 MPa (2 atm)

EVALUATOR:
Walter Hayduk
Department of Chemical Engineering
University of Ottawa
Ottawa, ON
Canada K1N 6N5
October, 1993

CRITICAL EVALUATION:
methylcyclohexane-methylbenzene solutions at about 25% methylbenzene, whereas, the solubility in n-heptane-methylbenzene solutions increases with increasing heptane concentrations. These results appear consistent and are classified as tentative.

References
COMPONENTS:
(1) Ethene or ethylene; C₂H₄; [74-85-1]
(2) Benzene; C₆H₆; [71-43-2]

ORIGINAL MEASUREMENTS:
Horiuti, J.

VARIABLES:
T/K: 278.15 - 323.15
P₁/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>278.15</td>
<td>1.605</td>
<td>4.191</td>
<td>4.268</td>
</tr>
<tr>
<td>283.15</td>
<td>1.518</td>
<td>3.875</td>
<td>4.017</td>
</tr>
<tr>
<td>288.15</td>
<td>1.398</td>
<td>3.598</td>
<td>3.796</td>
</tr>
<tr>
<td>293.15</td>
<td>1.327</td>
<td>3.346</td>
<td>3.591</td>
</tr>
<tr>
<td>298.15</td>
<td>1.229</td>
<td>3.118</td>
<td>3.403</td>
</tr>
<tr>
<td>303.15</td>
<td>1.158</td>
<td>2.920</td>
<td>3.241</td>
</tr>
<tr>
<td>308.15</td>
<td>1.093</td>
<td>2.736</td>
<td>3.087</td>
</tr>
<tr>
<td>313.15</td>
<td>1.035</td>
<td>2.579</td>
<td>2.955</td>
</tr>
<tr>
<td>318.15</td>
<td>0.9528</td>
<td>2.428</td>
<td>2.828</td>
</tr>
<tr>
<td>323.15</td>
<td>0.8937</td>
<td>2.289</td>
<td>2.708</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.

Smoothed Data: For use between 278.15 and 323.15 K.

\[ \ln x₁ = -8.0797 + 10.9921/(T/100K) \]

The standard error about the regression line is 8.15 x 10⁻⁵.

AUXILIARY INFORMATION

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) Ethene. Prepared by dropping ethanol into orthophosphoric acid. The gas was cooled, passed through several wash solutions, dried, and fractionated from liquid air several times.
(2) Benzene. Merck. Extra pure and free of sulfur. Refluxed with sodium amalgam, distilled. Boiling point (760 mmHg) 80.18°C.

ESTIMATED ERROR:
\[ \delta T/K = 0.05 \]
\[ \delta x₁/x₁ = 0.01 \]

REFERENCES:
COMPONENTS:
1. Ethene; C₂H₄; [74-85-1]
2. Benzene; C₆H₆; [71-43-2]

ORIGINAL MEASUREMENTS:
Narasimhan, S.; Nageshwar, G.W.
Chem. Petro-Chem. J. (India)

VARIABLES:
\[ T/K = 293.15 \]
\[ P/kPa = 101.325 \text{ kPa} \]

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>( t/°C )</th>
<th>( T/K )</th>
<th>( x_1 )</th>
<th>( L/\text{cm}^3 \text{ gas(\text{cm}^3 \text{ solvent})}^{-1} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>293.15</td>
<td>0.01235</td>
<td>0.01369 3.737</td>
</tr>
</tbody>
</table>

Although not specifically stated in the paper, it is assumed that the mole fraction solubility is for a total pressure of 101.325 kPa.

Calculated by compiler; a gas molar volume of 23910 cm³/mole was used at 293.15 K and 101.325 kPa for the calculation of \( L \), and Henry's law was assumed to apply for the calculation of \( x_1 \).

It was confirmed by personal communication that the solubilities were measured at atmospheric pressure.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
The solvent was held in a jacketed burette. Constant temperature water was circulated through the jacket. Gas was bubbled through the solvent until saturated. The dissolved gas content was determined by an electrometric dead-stop titration technique which yielded the bromine number. The electrometric titrator was based on a design given in reference 1.

SOURCE AND PURITY OF MATERIALS:
1. Ethene prepared by catalytic dehydration of ethanol over activated alumina at 350-400°C and analyzed by chromatography. Purity not given.
2. Benzene was distilled twice in a laboratory packed column.

ESTIMATED ERROR:
\[ \delta x_1 / x_1 = \pm 3\% \text{ (Estimated by compiler)} \]

REFERENCES:
1. Dubois, H.D.; Skoog, D.A.
COMPONENTS:

1. Ethene; C₂H₄; [74-85-1]
2. Benzene; C₆H₆; [71-43-2]

ORIGINAL MEASUREMENTS:

Krauss, V.W.; Gestrich, W.
Khemie - Technik 1977, 6, 513-516.

VARIABLES:

\[ T/K = 293.15 - 313.15 \]

\[ p_1/kPa = 101.32 \]

PREPARED BY:

W. Hayduk

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>( t/C )</th>
<th>( T/K )</th>
<th>Mole Fraction Ethene, ( x_1 )</th>
<th>( ^{10} ) Ostwald Coefficient ( L/cm^3 ) gas ( (cm^3 ) solvent(^{-1} )</th>
<th>( ^{1} ) Bunsen Coefficient ( \alpha/cm^2 ) (STP)cm (^{-1} ) atm (^{-1} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>293.15</td>
<td>0.0132</td>
<td>3.60</td>
<td>3.36</td>
</tr>
<tr>
<td>25</td>
<td>298.15</td>
<td>0.0124</td>
<td>3.41</td>
<td>3.12</td>
</tr>
<tr>
<td>30</td>
<td>303.15</td>
<td>0.0116</td>
<td>3.23</td>
<td>2.91</td>
</tr>
<tr>
<td>40</td>
<td>313.15</td>
<td>0.0103</td>
<td>2.92</td>
<td>2.54</td>
</tr>
</tbody>
</table>

There were no direct results, only a correlation. The results were calculated by the compiler for a gas partial pressure of 101.325 kPa using equations given in the paper for the applicable temperature range as follows:

\[ H = H_o \exp(-\Delta H_L / fR); \quad C = H \]

\( C \) = Solubility, mol/l; \( P \) = Pressure, bar

\( H \) = Henry's constant, mol/l.bar

\( H_o \) = A constant, 0.00195, mol/l.bar

\( -\Delta H_L \) = Enthalpy of solution, 10544, W s/mol

\( R \) = Gas constant, 1.bar/mol.K

\( fR \) = Conversion factor, 8.324, W s.1.bar (mol\(^3\).K\(^{-1}\))\(^{-1} \) (determined by compiler from graphs of \( H \) versus \( T^{-1} \))

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The absorption vessel whose volume was 160 ml, containing a thermometer and stirring bar, was mounted in a constant temperature bath. A volume of about 100 ml of solvent was degassed then pressurized with ethene to a pressure not exceeding 2 bar in the absorption vessel. After equilibrium was achieved, the gas was slowly released into an evacuated gas expansion system connected to a mercury manometer. Any solvent vapor present in the gas was condensed in a low temperature coil. By material balance, considering the volumes of gas in the system, it was possible to calculate solubilities as Henry's constants.

SOURCE AND PURITY OF MATERIALS:

Sources and purities not specified.

ESTIMATED ERROR:

\( \delta x_1/x_1 = \pm 3\% \) (compiler)

REFERENCES:
COMPONENTS:
1. Ethene; C₂H₄; [74-85-1]
2. Benzene; C₆H₆; [71-43-2]

ORIGINAL MEASUREMENTS:
Jadot, R.

VARIABLES:
T/K = 298.15
P/kPa = 101.3

PREPARED BY:
C.L. Young

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>Henry's Law Constant, H/atm</th>
<th>Mole fraction+ at partial pressure of 101.3 kPa, X C₂H₄</th>
<th>#ΔH°#</th>
</tr>
</thead>
<tbody>
<tr>
<td>298.15</td>
<td>89.46</td>
<td>0.01118</td>
<td>625 (2615)</td>
</tr>
</tbody>
</table>

+ Calculated by compiler assuming X C₂H₄ = 1/H.

# Excess partial molar enthalpy of solution at infinite dilution.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
The conventional gas chromatographic technique 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 no allowance was made for surface adsorption.

SOURCE AND PURITY OF MATERIALS:
No details given.

ESTIMATED ERROR:
δ T/K = ±0.05; δH = ±2%

REFERENCES:
COMPONENTS:
(1) Ethene or ethylene; C₂H₄; [74-85-1]
(2) Benzene; C₆H₆; [71-43-2]

ORIGINAL MEASUREMENTS:
McDaniel, A. S.

VARIABLES:
\[ T/K = 295.15 - 323.15 \]
\[ P_j/kPa = 101.3 \text{ (1 atm)} \]

PREPARED BY:
H. L. Clever

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>Temperature (°C)</th>
<th>Mol Fraction</th>
<th>Bunsen Coefficient ( a )</th>
<th>Ostwald Coefficient ( b )</th>
</tr>
</thead>
<tbody>
<tr>
<td>22.0</td>
<td>295.15</td>
<td>1.10</td>
<td>2.7865</td>
</tr>
<tr>
<td>25.0</td>
<td>298.15</td>
<td>1.06</td>
<td>2.6826</td>
</tr>
<tr>
<td>35.0</td>
<td>308.15</td>
<td>0.94</td>
<td>2.3530</td>
</tr>
<tr>
<td>50.0</td>
<td>323.15</td>
<td>0.86</td>
<td>2.1000</td>
</tr>
</tbody>
</table>

\( a \) Bunsen coefficient, \( a/cm³\text{(STP)} \text{ cm}^{-3} \text{ atm}^{-1} \).

\( b \) Listed as absorption coefficient in the original paper. Interpreted to be equivalent to Ostwald coefficient by compiler.

\( c \) Ostwald coefficient (absorption coefficient) estimated as 298.15 K value by author.

\( d \) Mole fraction and Bunsen coefficient values calculated by compiler assuming ideal gas behavior.

EVALUATOR'S COMMENT: McDaniel's data should be used with caution. His values are often 20 percent or more too small when compared with more reliable data.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
The apparatus is all glass. It consists of a gas buret connected to a contacting vessel. The solvent is degassed by boiling under reduced pressure. Gas pressure or volume is adjusted using mercury displacement. Equilibration is achieved at atm pressure by hand shaking, and incrementally adding gas to the contacting chamber. Solubility measured by obtaining total uptake of gas by known volume of the solvent.

SOURCE AND PURITY OF MATERIALS:
(1) Ethene. Prepared by reaction of 1,2-dibromoethane with zinc-copper.
(2) Benzene.

ESTIMATED ERROR:
\[ \delta \frac{L}{L} \geq -0.20 \]

REFERENCES:
**COMPONENTS:**

1. Ethene; $\text{C}_2\text{H}_4$; [74-85-1]
2. Methylbenzene (toluene); $\text{C}_7\text{H}_8$; [108-88-3]

**ORIGINAL MEASUREMENTS:**
Leites, I.L.; Ivanovskii, F.P.

**VARIABLES:**

\[ \frac{T}{K} = 213.15 - 243.15 \]
\[ p_1/kPa = 101.325 \]

**PREPARED BY:**
W. Hayduk

---

**EXPERIMENTAL VALUES:**

<table>
<thead>
<tr>
<th>$t$/°C</th>
<th>$\frac{T}{K}$</th>
<th>$\log_1 H'$, H'/mm Hg</th>
<th>$\text{Henry's Constant, } H/\text{atm (mole fraction)}$</th>
<th>$\text{Mole Fraction Ethene, } x_1$</th>
</tr>
</thead>
<tbody>
<tr>
<td>-60</td>
<td>213.15</td>
<td>3.998</td>
<td>13.10</td>
<td>0.0764</td>
</tr>
<tr>
<td>-50</td>
<td>223.15</td>
<td>4.119</td>
<td>17.31</td>
<td>0.0578</td>
</tr>
<tr>
<td>-30</td>
<td>243.15</td>
<td>4.304</td>
<td>26.50</td>
<td>0.0377</td>
</tr>
</tbody>
</table>

These results were part of a study for the behavior of solubilities in two-component solvent solutions.

1. Only graphical results were available in this paper; values of log of Henry's constant ($H'$) were read from enlarged graphs by the compiler.

2. Values of Henry's constant ($H$) and mole fraction solubility ($x_1$) were calculated by the compiler based on the graphical results.

---

**AUXILIARY INFORMATION**

**METHOD/APPARATUS/PROCEDURE:**
A metal cryostat was cooled with dry-ice and acetone and controlled to a temperature to ± 0.05 K. The equilibrium cell was mounted in the cryostat. The solvent was purified by fractional distillation and analyzed by chromatography. Details were not given.

**SOURCE AND PURITY OF MATERIALS:**

1. Ethene purity was stated to be 99.9%.
2. Methylbenzene was distilled and analyzed by chromatography. Actual purity not given.

**ESTIMATED ERROR:**

\[ \delta T/K = \pm 0.05 \]
\[ \delta x_1/x_1 = \pm 0.01 \text{ (Authors)} \]

**REFERENCES:**
COMPONENTS:
1. Ethene; C₂H₄; [74-85-1]
2. Methylbenzene (toluene); C₇H₈; [108-88-3]

ORIGINAL MEASUREMENTS:
Waters, J.A.; Mortimer, G.A.; Clements, H.E.

VARIABLES:
T/K = 250-295
P/kPa = 101.325

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>t/C</th>
<th>¹T/K</th>
<th>P/mm mercury</th>
<th>²Bunsen Coefficient (cm³ gas NTP (cm³ solvent)-¹</th>
<th>³Solubility Mole/litre</th>
<th>³Average Mole Fraction, x₁</th>
</tr>
</thead>
<tbody>
<tr>
<td>-23</td>
<td>250.15</td>
<td>760.0</td>
<td>6.894</td>
<td>0.311B</td>
<td>0.0306</td>
</tr>
<tr>
<td>-20</td>
<td>253.15</td>
<td>760.0</td>
<td>6.320</td>
<td>0.283B</td>
<td>0.0280</td>
</tr>
<tr>
<td>-10</td>
<td>263.15</td>
<td>222.6</td>
<td>5.310</td>
<td>0.237A</td>
<td>0.0236</td>
</tr>
<tr>
<td></td>
<td></td>
<td>359.9</td>
<td>5.240</td>
<td>0.234A</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>475.6</td>
<td>5.270</td>
<td>0.235A</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>520.1</td>
<td>4.400</td>
<td>0.196A</td>
<td>0.0201</td>
</tr>
<tr>
<td></td>
<td></td>
<td>594.5</td>
<td>4.410</td>
<td>0.196A</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>765.0</td>
<td>4.412</td>
<td>0.197B</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>765.0</td>
<td>4.444</td>
<td>0.199C</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>283.15</td>
<td>260.9</td>
<td>3.850</td>
<td>0.172A</td>
<td>0.0176</td>
</tr>
<tr>
<td>20</td>
<td>293.15</td>
<td>275.4</td>
<td>3.420</td>
<td>0.153A</td>
<td>0.0159</td>
</tr>
<tr>
<td>22</td>
<td>295.15</td>
<td>445.6</td>
<td>3.360</td>
<td>0.150A</td>
<td></td>
</tr>
</tbody>
</table>

¹Calculated by compiler.
²Although not specified in paper, compiler confirms that α as given is the Bunsen coefficient.
³Solubility, s and x₁, are calculated for a gas partial pressure of 101.325 kPa.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
Two of three methods used involved measuring the pressure change in a gas reservoir of known volume. The third involved weighing.
Method A: Two glass bulbs were connected by tubing fitted with a pressure transducer, gas supply and vacuum lines. The solvent (100 cm³) was degassed in one bulb equipped with a stirrer using liquid nitrogen. Gas at a higher pressure in the second bulb was quantitatively charged into the first bulb at the appropriate temperature. The final pressure in the equilibration flask was measured.
Method B: For larger quantities of gas a stainless steel supply bomb connected to a pressure gauge was filled to about 12 atm. Equilibration was in a glass flask equipped with a mercury manometer.
Method C: The increase in mass of the solution was measured.

SOURCE AND PURITY OF MATERIALS:
1. Ethene, Monsanto polymerization grade, minimum purity 99.85%.
2. Methyl benzene, Fisher spectrophotometric grade; purity not specified.

ESTIMATED ERROR:
δT/K = ± 0.01 (A); ± 0.02 (B)
δs/s = 0.02

REFERENCES:
COMPONENTS:
1. Ethene; \( \text{C}_2\text{H}_4 \); [74-85-1]
2. Methylbenzene (toluene); \( \text{C}_8\text{H}_8 \); [108-88-3]

ORIGINAL MEASUREMENTS:
Krauss, V.W.; Gestrich, W.
*Kemien - Technik* 1977, 6, 513-516.

VARIABLES:
\[ T/K = 293.15 - 313.15 \]
\[ P/kPa = 101.32 \]

PREPARED BY:
W. Hayduk

EXPERIMENTAL VALUES:
<table>
<thead>
<tr>
<th>( t/C )</th>
<th>( T/K )</th>
<th>( \text{Mole Fraction Ethene, } x_1 )</th>
<th>( \text{Ostwald Coefficient } L/\text{cm}^2\text{gas/cm}^2\text{solvent}^{-1} )</th>
<th>( \text{Bunsen Coefficient } \alpha/\text{cm}^2(\text{STP})\text{cm}^3\text{atm} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>293.15</td>
<td>0.0154</td>
<td>3.51</td>
<td>3.27</td>
</tr>
<tr>
<td>25</td>
<td>298.15</td>
<td>0.0144</td>
<td>3.32</td>
<td>3.04</td>
</tr>
<tr>
<td>30</td>
<td>303.15</td>
<td>0.0134</td>
<td>3.14</td>
<td>2.83</td>
</tr>
<tr>
<td>40</td>
<td>313.15</td>
<td>0.0119</td>
<td>2.83</td>
<td>2.47</td>
</tr>
</tbody>
</table>

There were no direct results, only a correlation. The results were calculated by the compiler for a gas partial pressure of 101.325 kPa using equations given in the paper for the applicable temperature range as follows:

\[ H = H_0 \exp(-\Delta H_L/fRT) \]
\[ C = HP \]
\[ H = \text{Henry's constant, mol/l.bar} \]
\[ H_0 = A \text{ constant, 0.00175, mol/l.bar} \]
\[ -\Delta H_L = \text{Enthalpy of solution, 10742, W s/mol} \]
\[ R = \text{Gas constant, 1.bar/mol.K} \]
\[ fR = \text{Conversion factor, 8.324, W.s.l.bar (mol^2.K)^{-1}} \]

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
The absorption vessel whose volume was 160 ml, containing a thermometer and stirring bar, was mounted in a constant temperature bath. A volume of about 100 ml of solvent was degassed then pressurized with ethene to a pressure not exceeding 2 bar in the absorption vessel. After equilibrium was achieved, the gas was slowly released into an evacuated gas expansion system connected to a mercury manometer. Any solvent vapor present in the gas was condensed in a low temperature coil. By material balance, considering the volumes of gas in the system, it was possible to calculate solubilities as Henry's constants.

SOURCE AND PURITY OF MATERIALS:
Sources and purities not specified.

ESTIMATED ERROR:
\[ \delta x_1/x_1 = \pm 3\% \text{ (compiler)} \]

REFERENCES:
COMPONENTS:  
1. Ethene; C₂H₄; [74-85-1]  
2. Methylbenzene (toluene); C₇H₈; [108-88-3]  

ORIGINAL MEASUREMENTS:  
Hannaert, H.; Haccuria, M.; Mathieu, M.P.  

VARIABLES:  
\[ T/K = 243.15 - 293.15 \]  
\[ p/KPa = 101.3 \]  

PREPARED BY:  
W. Hayduk  
H.L. Clever  

EXPERIMENTAL VALUES:  

| t /°C | T/K  | \( x_1 \)  
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>-30</td>
<td>243.15</td>
<td>0.0356</td>
</tr>
<tr>
<td>-10</td>
<td>263.15</td>
<td>0.0241</td>
</tr>
<tr>
<td>10</td>
<td>283.15</td>
<td>0.0172</td>
</tr>
<tr>
<td>20</td>
<td>293.15</td>
<td>0.0148</td>
</tr>
</tbody>
</table>

\( x_1 \) Mole fraction Ethene calculated by compilers for a gas partial pressure of 101.3 kPa using the equation developed by the authors with \( \gamma = 1 \), for the applicable temperature range:

\[
\log \left( \frac{K_{TV}}{\text{atm}} \right) = 3.68 - \left( \frac{\Delta H}{\text{cal mol}^{-1}} \right)/(2.3R(T/K))
\]

The authors' definitions are:

\[ \Delta H = 2,480 \text{ cal mol}^{-1}, \text{ Enthalpy of dissolution} \]  
\[ K = y_1/x_1 = \frac{\text{mole fraction gas in gas phase}}{\text{mole fraction gas in liquid phase}} \]  
\[ \eta / \text{atm} = \text{total pressure} \]  
\[ \gamma = \text{coefficient of fugacity} \]

The function, \( K_{TV}/\text{atm,} \) is equivalent to a Henry's constant in the form \( H_{1/z}/\text{atm} = (f_1/\text{atm})/x_1 \) where \( f_1 \) is the fugacity.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:  
The authors describe several methods used; the one used in this case is the least accurate.  
The apparatus is of glass and consists of a burette in which the gas is confined over mercury, two bulbs for the solvent, one above the other, a mercury manometer and a constant temperature bath. A measured volume of solvent is degassed in the top bulb at ambient temperature and charged to the absorption bulb in the bath. Gas is charged to the desired pressure. The quantity of gas added at constant pressure is measured. Agitation is manual.

SOURCE AND PURITY OF MATERIALS:  
1. Ethene. Air Liquide. For narcosis, 99.9 per cent.  
2. Methylbenzene. ODLite UCB. Density, \( \rho_{20}^{\text{°C}}/\text{g cm}^{-3} = 0.8689. \)

ESTIMATED ERROR:  
\[ \delta x_1/x_1 = \pm 10 \text{ to } 15\% \]  
(authors)

REFERENCES:
COMPONENTS:
1. Ethene; C₂H₄; [74-85-1]
2. Dimethylbenzene, (xylene), actual type not specified; C₆H₁₀; taken to be m-xylene [108-88-3]

ORIGINAL MEASUREMENTS:
Krauss, V.W.; Gestrich, W.
Khemie + Technik 1977, 6, 513-516.

VARIABLES:

\[ T/K = 293.15 - 313.15 \]
\[ P/kPa = 101.32 \]

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>Mole Fraction Ethene, ( x_1 )</th>
<th>1\text{Ostwald Coefficient} L/cm³\text{gas}(cm³\text{solvent})⁻¹</th>
<th>1\text{Bunsen Coefficient} α/cm³\text{(STP)}cm³atm⁻¹</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>293.15</td>
<td>0.0161</td>
<td>3.19</td>
</tr>
<tr>
<td>25</td>
<td>298.15</td>
<td>0.0150</td>
<td>3.00</td>
</tr>
<tr>
<td>30</td>
<td>303.15</td>
<td>0.0140</td>
<td>2.83</td>
</tr>
<tr>
<td>40</td>
<td>313.15</td>
<td>0.0123</td>
<td>2.53</td>
</tr>
</tbody>
</table>

There were no direct results, only a correlation. The results were calculated by the compiler for a gas partial pressure of 101.325 kPa using equations given in the paper for the applicable temperature range as follows:

\[ H = H₀ \exp\left(-\frac{ΔH_L}{RT}\right); \quad C = HP \]
\[ C = \text{Solubility, mol/l; } P = \text{Pressure, bar} \]
\[ H₀ = \text{A constant, 0.00126, mol/l.bar} \]
\[ -ΔH_L = \text{Enthalpy of solution, 11309, W s/mol} \]
\[ R = \text{Gas constant, l.bar/mol.K} \]
\[ f R = \text{Conversion factor, 8.324, W s.l.bar}(\text{mol}²\cdot\text{K})⁻¹ \text{ (determined by compiler from graphs of } H \text{ versus } T⁻¹) \]

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
The absorption vessel whose volume was 160 ml, containing a thermometer and stirring bar, was mounted in a constant temperature bath. A volume of about 100 ml of solvent was degassed then pressurized with ethene to a pressure not exceeding 2 bar in the absorption vessel. After equilibrium was achieved, the gas was slowly released into an evacuated gas expansion system connected to a mercury manometer. Any solvent vapor present in the gas was condensed in a low temperature coil. By material balance, considering the volumes of gas in the system, it was possible to calculate solubilities as Henry's constants.

SOURCE AND PURITY OF MATERIALS:
Sources and purities not specified.

ESTIMATED ERROR:
\[ δ \cdot \frac{x_1}{z_1} = ± 3\% \text{ (compiler)} \]

REFERENCES:
COMPONENTS:
1. Ethene; C₂H₄; [74-85-1]
2. Dimethylbenzenes (xylenes); C₈H₁₀; [108-38-3]

ORIGINAI MEASUREMENTS:
Hannaert, H.; Haccuria, M.; Mathieu, M.F.

VARIABLES:
T/K = 243.15 - 293.15
p₁/kPa = 101.3

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>t/C</th>
<th>T/K</th>
<th>¹Mole Fraction Ethene, x₁</th>
</tr>
</thead>
<tbody>
<tr>
<td>-30</td>
<td>243.15</td>
<td>0.0368</td>
</tr>
<tr>
<td>-10</td>
<td>263.15</td>
<td>0.0251</td>
</tr>
<tr>
<td>10</td>
<td>283.15</td>
<td>0.0180</td>
</tr>
<tr>
<td>20</td>
<td>293.15</td>
<td>0.0155</td>
</tr>
</tbody>
</table>

¹ Mole fraction solubility calculated by compiler for a gas partial pressure of 101.3 kPa using the equation developed by the authors with ν = 1, for the applicable temperature range:

\[
\log \left( \frac{KTV}{\text{atm}} \right) = 3.63 - \frac{(\Delta H / \text{cal mol}^{-1})}{(2.3R(T/K))}
\]

The authors' definitions are:

\[
\Delta H = 2,440 \text{ cal mol}^{-1}, \text{ Enthalpy of dissolution}
\]

\[
K = \frac{y}{x₁} = \text{mole fraction gas in gas phase}\]

\[
\frac{m}{\text{atm}} = \text{mole fraction gas in liquid phase}
\]

\[
ν = \text{coefficient of fugacity}
\]

The function, KTV/atm, is equivalent to a Henry's constant in the form \( H_{1,2}/\text{atm} = (f₁/\text{atm})/x₁ \), where \( f₁ \) is the fugacity.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
The authors describe several methods used; the one used in this case is the least accurate.

The apparatus is of glass and consists of a burette in which the gas is confined over mercury, two bulbs for the solvent, one above the other, a mercury manometer and a constant temperature bath. A measured volume of solvent is degassed in the top bulb at ambient temperature and charged to the absorption bulb in the bath. Gas is charged to the desired pressure. The quantity of gas added at constant pressure is measured. Agitation is manual.

SOURCE AND PURITY OF MATERIALS:
1. Ethene. Air Liquide. Specified purity 99.9%.
2. Dimethylbenzenes. Merck and Co. Mixture of 90% dimethylbenzenes, 5% methylbenzene, and 5% ethylbenzene.

ESTIMATED ERROR:
\( δ x₁/x₁ = ± 10 \) to 15% (authors)

REFERENCES:
COMPONENTS:
1. Ethene; C₂H₄; [74-85-1]
2. Cyclohexane; C₆H₁₂; [110-82-7]

ORIGINAL MEASUREMENTS:
Krauss, V.W.; Gestrich, W. 
Khimie - Technik 1977, 6, 513-516.

VARIABLES:
T/K = 293.15 - 313.15
p/KPa = 101.32

PREPARED BY:
W. Hayduk

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/C</th>
<th>T/K</th>
<th>Mole Fraction Ethene, x</th>
<th>^1Ostwald Coefficient L/cm³.gas/cm³.solvent⁻¹</th>
<th>^1Bunsen Coefficient a/cm³.(STP)cm⁻³.atm⁻¹</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>293.15</td>
<td>0.0161</td>
<td>3.63</td>
<td>3.38</td>
</tr>
<tr>
<td>25</td>
<td>298.15</td>
<td>0.0150</td>
<td>3.40</td>
<td>3.12</td>
</tr>
<tr>
<td>30</td>
<td>303.15</td>
<td>0.0139</td>
<td>3.20</td>
<td>2.88</td>
</tr>
<tr>
<td>40</td>
<td>313.15</td>
<td>0.0122</td>
<td>2.85</td>
<td>2.48</td>
</tr>
</tbody>
</table>

^1There were no direct results, only a correlation. The results were calculated by the compiler for a gas partial pressure of 101.325 kPa using equations given in the paper for the applicable temperature range as follows:

H = H₀ exp( - ΔH/L / fRT); C = H P
C = Solubility, mol/l; P = Pressure, bar
H = Henry's constant, mol/l.bar
H₀ = A constant, 0.00123, mol/l.bar
-ΔH/L = Enthalpy of solution, 11679, W s/mol
R = Gas constant, 1.bar/mol.K
f R = Conversion factor, 8.324, W.s.l.bar (mol².K)⁻¹ (determined by compiler from graphs of H versus T⁻¹)

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
The absorption vessel whose volume was 160 ml, containing a thermometer and stirring bar, was mounted in a constant temperature bath. A volume of about 100 ml of solvent was degassed then pressurized with ethene to a pressure not exceeding 2 bar in the absorption vessel. After equilibrium was achieved, the gas was slowly released into an evacuated gas expansion system connected to a mercury manometer. Any solvent vapor present in the gas was condensed in a low temperature coil. By material balance, considering the volumes of gas in the system, it was possible to calculate solubilities as Henry's constants.

SOURCE AND PURITY OF MATERIALS:
Sources and purities not specified.

Estimated Error:
δ x₁/x₁ = ± 3% (compiler)

REFERENCES:
### COMPONENTS:
1. Ethene; \( \text{C}_2\text{H}_4; [74-85-1] \)
2. Methylcyclohexane; \( \text{C}_7\text{H}_{14}; [108-87-2] \)

### ORIGINAL MEASUREMENTS:
Leites, I.L.; Ivanovskii, F.P. 

### VARIABLES:
- \( T/K = 213.15, 223.15 \)
- \( p_1/\text{kPa} = 101.325 \)

### PREPARED BY:
W. Hayduk

### EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>( t/C )</th>
<th>( T/K )</th>
<th>( \log_{10}(H/\text{mmHg}) )</th>
<th>( H/\text{atm (mole fraction)} )</th>
<th>( \text{Mole Fraction Ethene, } x_1 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>-60</td>
<td>213.15</td>
<td>3.909</td>
<td>10.67</td>
<td>0.0937</td>
</tr>
<tr>
<td>-50</td>
<td>223.15</td>
<td>4.037</td>
<td>14.33</td>
<td>0.0698</td>
</tr>
</tbody>
</table>

These results were part of a study for the behavior of solubilities in two-component solvent solutions.

1 Only graphical results were available in this paper; values of log of Henry's constant \( (H') \) were read from enlarged graphs by the compiler.

2 Values of Henry's constant \( (H) \) and mole fraction solubility \( (x_1) \) were calculated by the compiler based on the graphical results.

### AUXILIARY INFORMATION

**METHOD/APPARATUS/PROCEDURE:**
A metal cryostat was cooled with dry-ice and acetone and controlled to a temperature to \( \pm 0.05 \text{ K} \).
The equilibrium cell was mounted in the cryostat. The solvent was purified by fractional distillation and analyzed by chromatography. Details were not given.

**SOURCE AND PURITY OF MATERIALS:**
1. Ethene purity was stated to be 99.9%.
2. Methylcyclohexane was distilled and analyzed by chromatography. Actual purity not given.

**ESTIMATED ERROR:**
- \( \delta T/K = \pm 0.05 \)
- \( \delta x_1/x_1 = \pm 0.01 \) (Authors)

### REFERENCES:
### COMPONENTS:

1. Ethene (Ethylene); C₂H₄; [74-85-1]
2. Decahydronaphthalene, (Decalin) C₁₀H₁₈; [91-17-8]

### VARIABLES:

\[ T/K = 298.15, \quad 323.15 \]
\[ P/kPa = 101.3 \quad (1 \text{ atm}) \]

### EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>( T/K )</th>
<th>( H_{C_2H_4}/\text{atm} )</th>
<th>( x_{C_2H_4} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>298.15</td>
<td>72.2</td>
<td>0.0139</td>
</tr>
<tr>
<td>323.15</td>
<td>84.9</td>
<td>0.0118</td>
</tr>
</tbody>
</table>

* Calculated by compiler assuming a linear function of \( H_{C_2H_4} \) vs \( x_{C_2H_4} \), i.e. \( x_{C_2H_4} (1 \text{ atm}) = 1/H_{C_2H_4} \).

### 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. Ethene; C₂H₄; [74-85-1]
2. Naphthalene, 1,2,3,4-tetrahydro-, (tetralin); C₁₀H₁₂; [119-64-2]

ORIGINAL MEASUREMENTS:
Krauss, V.W.; Gestrich, W. Khamis - Technik 1977, 6, 513-516.

VARIABLES:
T/K = 293.15 - 313.15
p/kPa = 101.32

PREPARED BY:
W. Hayduk

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>t/C</th>
<th>T/K</th>
<th>Mole Fraction Ethene, x₁</th>
<th>¹Ostwald Coefficient L/cm³gas/cm³solvent⁻¹</th>
<th>¹Bunsen Coefficient α/cm³(STP)cm⁻³atm⁻¹</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>293.15</td>
<td>0.0127</td>
<td>2.25</td>
<td>2.09</td>
</tr>
<tr>
<td>25</td>
<td>298.15</td>
<td>0.0119</td>
<td>2.15</td>
<td>1.97</td>
</tr>
<tr>
<td>30</td>
<td>303.15</td>
<td>0.0113</td>
<td>2.05</td>
<td>1.85</td>
</tr>
<tr>
<td>40</td>
<td>313.15</td>
<td>0.0101</td>
<td>1.88</td>
<td>1.64</td>
</tr>
</tbody>
</table>

¹There were no direct results, only a correlation. The results were calculated by the compiler for a gas partial pressure of 101.325 kPa using equations given in the paper for the applicable temperature range as follows:

\[ H = H_0 \exp\left( -\frac{\Delta H_L}{RT} \right); \quad C = H P \]

C = Solubility, mol/l; P = Pressure, bar

H = Henry's constant, mol/l.bar

H₀ = A constant, 0.00212, mol/l.bar

-ΔH_L = Enthalpy of solution, 9190, W s/mol

R = Gas constant, 1.bar/mol.K

f_R = Conversion factor, 8.324, W s.l.bar (mol².K)⁻¹ (determined by compiler from graphs of H versus T⁻¹)

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
The absorption vessel whose volume was 160 ml, containing a thermometer and stirring bar, was mounted in a constant temperature bath. A volume of about 100 ml of solvent was degassed then pressurized with ethene to a pressure not exceeding 2 bar in the absorption vessel. After equilibrium was achieved, the gas was slowly released into an evacuated gas expansion system connected to a mercury manometer. Any solvent vapor present in the gas was condensed in a low temperature coil. By material balance, considering the volumes of gas in the system, it was possible to calculate solubilities as Henry's constants.

SOURCE AND PURITY OF MATERIALS:
Sources and purities not specified.

ESTIMATED ERROR:
\[ \delta x₁/x₁ = \pm 3\% \] (compiler)

REFERENCES:
COMPONENTS:
(1) Ethene or ethylene; $C_2H_4$; [74-85-1]
(2) (R)-1-Methyl-4-(1-methylethenyl) cyclohexene or Limonene; $C_{10}H_{16}$; [5989-27-5]
see also [499-97-8]

VARIABLES:
$T/K = 295.15$
$p_1/kPa = 101.3$ (1 atm)

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>Temperature $t/^\circ C$</th>
<th>$T/K$</th>
<th>Ostwald Coefficient $L/cm^3 cm^{-3}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>22.0</td>
<td>295.15</td>
<td>$2.753 \pm 3.05$ in 12 h. Equilibrium not established</td>
</tr>
</tbody>
</table>

EVALUATOR'S COMMENT: McDaniel's data should be used with caution. His values are often 20 percent or more too small when compared with more reliable data.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
The apparatus is all glass. It consists of a gas buret connected to a contacting vessel. The solvent is degassed by boiling under reduced pressure. Gas pressure or volume is adjusted using mercury displacement. Equilibration is achieved at atm pressure by hand shaking, and incrementally adding gas to the contacting chamber. Solubility measured by obtaining total uptake of gas by known volume of the solvent.

SOURCE AND PURITY OF MATERIALS:
(1) Ethene. Prepared by reaction of 1,2-dibromoethane with zinc-copper.
(2) Limonene.

ESTIMATED ERROR:
$\delta L/L \geq -0.20$

REFERENCES:
**COMPONENTS:**
1. Ethene; $C_2H_4$; [74-85-1]
2. Heptane; $C_7H_{16}$; [142-82-5]
3. Methylbenzene (toluene); $C_7H_8$; [108-88-3]

**ORIGINAL MEASUREMENTS:**
Leites, I.L.; Ivanovskii, F.P.

**VARIABLES:**
$T/K = 213.15, 223.15$
$P_1/kPa = 101.325$
$x_3 = 0 - 1.0$

**EXPERIMENTAL VALUES:**

<table>
<thead>
<tr>
<th>$t$/°C</th>
<th>$T/K$</th>
<th>$x$</th>
<th>Mole Fraction</th>
<th>$\log_{10}(H/\text{mmHg})$</th>
<th>Henry's Constant</th>
<th>Mole Fraction</th>
<th>Solvent Composition, Toluene</th>
</tr>
</thead>
<tbody>
<tr>
<td>-60</td>
<td>213.15</td>
<td>0 (heptane)</td>
<td>3.841</td>
<td>9.12</td>
<td>0.110</td>
<td>3.998</td>
<td>13.10</td>
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<tr>
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<td>0.25</td>
<td>3.848</td>
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<td>0.108</td>
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<td>12.14</td>
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<td>0.104</td>
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<td>12.51</td>
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<td></td>
<td></td>
<td>0.75</td>
<td>3.900</td>
<td>10.45</td>
<td>0.0957</td>
<td>3.996</td>
<td>13.04</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.0 (toluene)</td>
<td>3.998</td>
<td>13.10</td>
<td>0.0764</td>
<td>4.030</td>
<td>14.10</td>
</tr>
<tr>
<td>-50</td>
<td>223.15</td>
<td>0 (heptane)</td>
<td>3.965</td>
<td>12.14</td>
<td>0.0824</td>
<td>4.119</td>
<td>17.31</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.25</td>
<td>3.978</td>
<td>12.51</td>
<td>0.0800</td>
<td>3.996</td>
<td>13.04</td>
</tr>
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<td>0.0767</td>
<td>4.030</td>
<td>14.10</td>
</tr>
<tr>
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<td>0.75</td>
<td>4.030</td>
<td>14.10</td>
<td>0.0709</td>
<td>4.119</td>
<td>17.31</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.0 (toluene)</td>
<td>4.119</td>
<td>17.31</td>
<td>0.0578</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1. Compositions of two-component solvent solutions are given on a solute-free basis.
2. Only graphical results were available; values of log Henry's constant ($H'$) were read from an enlarged graph by the compiler.
3. Values of Henry's constant ($H$) and mole fraction solubility ($x_1$) were calculated by the compiler.

**AUXILIARY INFORMATION**

**METHOD/APPARATUS/PROCEDURE:**
A metal cryostat was cooled with dry-ice and acetone and the temperature was controlled to ± 0.05 K. The equilibration cell was mounted in the cryostat. The solvents were purified by fractional distillation and analyzed by chromatography. Details were not given.

**SOURCE AND PURITY OF MATERIALS:**
1. Ethene purity was stated to be 99.9%.
2. Heptane was distilled and analyzed by chromatography. Purity not specified.
3. Methylbenzene was distilled and analyzed by chromatography. Purity not specified.

**ESTIMATED ERROR:**
$\delta T/K = \pm 0.05$
$\delta x_1/x_1 = \pm 0.01$ (Authors)

**REFERENCES:**
COMPONENTS:
1. Ethene; $C_2H_4$; [74-85-1]
2. Methylcyclohexane; $C_7H_{14}$; [108-87-2]
3. Methylbenzene (toluene); $C_7H_8$; [108-88-3]

VARIABLES:
$T/K = 213.15, 223.15$
$p_i/kPa = 101.325$
$x_i = 0 - 1.0$

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>$t/C$</th>
<th>$T/K$</th>
<th>Mole Fraction</th>
<th>$\log_{10}(H/\text{mmHg})$ (mole fraction)$^{-1}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>-60</td>
<td>213.15</td>
<td>0 (m.c.hexane)</td>
<td>3.909</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.25</td>
<td>3.900</td>
</tr>
<tr>
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<td></td>
<td>0.50</td>
<td>3.900</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.75</td>
<td>3.915</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.0 (toluene)</td>
<td>3.998</td>
</tr>
<tr>
<td>-50</td>
<td>223.15</td>
<td>0 (m.c.hexane)</td>
<td>4.037</td>
</tr>
<tr>
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<td>0.25</td>
<td>4.020</td>
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<td></td>
<td></td>
<td>0.50</td>
<td>4.028</td>
</tr>
<tr>
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<td>0.75</td>
<td>4.056</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.0 (toluene)</td>
<td>4.119</td>
</tr>
</tbody>
</table>

1 Compositions of two-component solvent solutions are given on a solute-free basis.

2 Only graphical results were available; values of log Henry's constant ($H'$) were read from an enlarged graph by the compiler.

3 Values of Henry's constant ($H$) and mole fraction solubility ($x_1$) were calculated by the compiler.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
A metal cryostat was cooled with dry-ice and acetone and the temperature was controlled to $\pm 0.05$ K. The equilibration cell was mounted in the cryostat. The solvents were purified by fractional distillation and analyzed by chromatography. Details were not given.

SOURCE AND PURITY OF MATERIALS:
1. Ethene purity was stated to be 99.9%.
2. Methylcyclohexane was distilled and analyzed by chromatography. Purity not specified.
3. Methylbenzene was distilled and analyzed by chromatography. Purity not specified.

ESTIMATED ERROR:
$\delta T/K = \pm 0.05$
$\delta x_i/x_i = \pm 0.01$ (Authors)
COMPONENTS:
1. Ethene; C₂H₄; [74-85-1]
2. 1,1′-Methylenebis(methylbenzene),
(ditolyl methane); C₁₉H₁₆;
[1335-47-3]

ORIGINAL MEASUREMENTS:
Glazunova, T.V.; Ryabov, M.I.;
Lipshtein, R.A.

VARIABLES:
T/K = 291-413
P₁/kPa = 101.3

PREPARED BY:
C.L. Young

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>t/°C</th>
<th>T/K</th>
<th>Bunsen coefficient</th>
<th>Mole fraction at partial pressure of 1 atm.*</th>
</tr>
</thead>
<tbody>
<tr>
<td>18</td>
<td>291</td>
<td>1.7149</td>
<td>0.01512</td>
</tr>
<tr>
<td>50</td>
<td>323</td>
<td>1.2607</td>
<td>0.01116</td>
</tr>
<tr>
<td>140</td>
<td>413</td>
<td>0.7444</td>
<td>0.00662</td>
</tr>
</tbody>
</table>

* Calculated by compiler assuming the ideal gas law and the molar volume of component 2 is 200.7 cm³ mol⁻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:
δT/K = ± 0.5; δx/x = ±0.10

REFERENCES:
Critical Evaluation of Ethene Solubilities in Cyclohexane and Various Aromatic Hydrocarbons for Pressures greater than 0.2 MPa (2 atm)

Ten groups of researchers (1-10) have measured solubilities for ethene in cyclohexane and in various aromatic hydrocarbons at elevated pressures. Solubilities were measured by two or more groups for benzene, toluene and xylenes but in general there are relatively few data available so that extensive evaluations are not possible. One group (3) has studied two-component solvent systems.

Few sets of data included both the liquid and gas phase compositions. In this evaluation we have, where possible, checked if the available data give a linear relationship for log x versus log P, which is indicative but not conclusive of consistent data. Furthermore, where possible we have compared extrapolated values at a partial pressure of 0.1013 MPa with values determined at or near 0.1013 MPa pressure. Correlating equations have been included where possible.

Cyclohexane; C₆H₁₂; [110-82-7]

This system has been investigated (1) at six temperatures from 303 K to 423 K at pressures between 1.7 MPa and 9.0 MPa. Linear plots were obtained at all temperatures when log x was plotted against log P. There are no gross inconsistencies in the data. Considerable uncertainty is involved in the extrapolation of the data to 101.3 kPa, but the values obtained appear about 10% greater than the values obtained from the work of Krauss and Gestrich (11) (Please see low pressure Critical Evaluation). The values of Zhuze et al. (1) are therefore classified as tentative.

Benzene; C₆H₆; [71-43-2]

Ethene solubilities in benzene have been reported by five groups of research workers (2,4,8-10) for total pressures from 0.28 MPa to 19.3 MPa and for temperatures ranging from 293 to 423 K. The results of Paratella and Sagamora (8) are rejected. Their solubilities are considerably lower than those of any other group and extrapolate to 101.3 kPa to give values considerably smaller than the tentative low pressure values. The data of Hiraoka (10) are difficult to evaluate; the lower temperature solubilities are broadly consistent with Henry's law constants determined from low pressure measurements but there are no low pressure results at the higher temperatures for comparison. The data of Ellis et al. (9) at 348.15 K are broadly consistent with the data of Kozorezov et al. (4) at the same temperature. The data of Kozorezov et al. (4) appear to have a reasonable temperature dependency and together with the limited data of Ellis et al. are classified as tentative. The data of Konobeev and Lyapin (2) are consistent with the data of Kozorezov et al. (4) and are also classified as tentative.

Methylbenzene; C₇H₈; [108-88-3]

This system has been studied by four groups of workers (2,5-7) for temperatures ranging from 228 K to 473 K and total pressures from 0.1 to 6 MPa. It is difficult to evaluate the data because of the different temperature and pressure ranges involved. Frank (7) measured the solubilities of ethene in toluene at four temperatures between 273 and 323 K up to pressures of 0.4 MPa. The values of the solubilities extrapolated to 0.1013 MPa are several percent lower than the values measured at or near 0.1013 MPa. The Henry's law constants obtained from the graphs given by Tyvina et al. (5) can be used to calculate the mole fraction solubility of ethane in toluene at a partial pressure of 0.1013 MPa. The values are in fair agreement with the values measured at or near 0.1013
COMPONENTS:

1. Ethene; C\textsubscript{2}H\textsubscript{4}; [74-85-1]

2. Aromatic and Alicyclic compounds
   T/K = 196 - 423
   P/MPa up to 19.3

CRITICAL EVALUATION:

Mpa considering the problem of obtaining the solubility from the graphs. The results of Knonbeev and Lyapin (2) are consistent with the values of Tyvina et al. (5). The data of Shenderei et al. (6) are the only low temperature data available at elevated pressures. The values extrapolated to 0.1013 MPa and 238.15 and 248.15 K are consistent with the low pressure data of Leites and Ivanovski (12). Please see low pressure Critical Evaluation. None of the sets of data can be recommended but the data of Shenderei et al. (6), Tyvina et al. (5) and Konobeev and Lyapin (2) are classified as tentative for the temperature and pressure range covered by the respective data. Please see Table 1.

### Table 1. Comparison of Extrapolated High Pressure Solubilities with Low Pressure Results for the System Ethene - Methylbenzene

<table>
<thead>
<tr>
<th>T/K</th>
<th>Av. extrapolated solubility\textsuperscript{a}</th>
<th>Solubility measured at low pressure\textsuperscript{a}</th>
<th>% deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Ref. 5</td>
<td>Ref. 7</td>
<td></td>
</tr>
<tr>
<td>273.15</td>
<td>0.0204</td>
<td>0.0207</td>
<td>-1.4</td>
</tr>
<tr>
<td>293.15</td>
<td>0.0139</td>
<td>0.0152</td>
<td>-8.5</td>
</tr>
<tr>
<td>308.15</td>
<td>0.0114</td>
<td>0.0124</td>
<td>-3.9</td>
</tr>
<tr>
<td>313.15</td>
<td>0.0108</td>
<td>0.0116</td>
<td>-6.9</td>
</tr>
</tbody>
</table>

\textsuperscript{a} at a partial pressure of 0.1013 MPa

1,2-Dimethylbenzene; C\textsubscript{8}H\textsubscript{10}; [106-42-3]

1,3-Dimethylbenzene; C\textsubscript{8}H\textsubscript{10}; [108-38-3]

1,4-Dimethylbenzene; C\textsubscript{8}H\textsubscript{10}; [95-47-6]

Ethene solubilities in a mixture of xylenes were reported by Konobeev and Lyapin (2) at pressures from 0.28 MPa to 3.21 MPa and temperatures from 293 K to 333 K. Nakamura et al. (3) reported ethene solubilities in each xylene isomer at six temperatures ranging from 213 K to 303 K and total pressures up to 1.28 MPa. Although the authors did not provide ethene partial pressures, they gave average Henry's constants for each operating temperature. Assuming a direct inverse relationship between Henry's law constant and the mole fraction solubility at an ethene partial pressure of 101.3 kPa, the latter was calculated and plotted against 1/T. A linear relationship was obtained in all cases and this shows some degree of consistency of the data. The equation of the line of best fit was determined for each of the isomers. The equations of the lines and the corresponding correlation coefficients are:

1,2-dimethylbenzene

\[
\log x = -3.74 + 569.3/(T/K) \quad \text{coeff.} = 0.9991
\]

1,3-dimethylbenzene

\[
\log x = -3.85 + 591.2/(T/K) \quad \text{coeff.} = 0.9998
\]

1,4-dimethylbenzene

\[
\log x = -3.90 + 599.7/(T/K)
\]

It is not meaningful to give a correlation coefficient for the 1,4-dimethylbenzene solubilities since half of the values were obtained by extrapolation of data for the binary solvent (1,4-dimethylbenzene + ethylbenzene) results.
COMPONENTS:
1. Ethene; C2H4; [74-85-1]
2. Aromatic and Alicyclic compounds
   T/K = 196 - 423
   P/MPa up to 19.3

EVALUATOR:
C.L. Young
School of Chemistry
University of Melbourne
Parkville, Victoria
Australia, 3052
December 1993

CRITICAL EVALUATION:

In Table 2 the extrapolated high pressure solubility data of Nakamura et al. (3) have been compared with the low pressure measurements of Krauss and Gestrich (11) for 1,3-dimethylbenzene. The average deviation between the two sets of data was 3.9%. At 293.15 K the data of Konobeev and Lyapin (2) for the dimethylbenzene mixture are consistent with those of Nakamura et al. (3) at the same temperature. Both are classified as tentative.

Table 2. Comparison of Extrapolated High Pressure Solubilities with Low Pressure for the System Ethene - 1,3-Dimethylbenzene

<table>
<thead>
<tr>
<th>T/K</th>
<th>Av. extrapolated solubilitya</th>
<th>Solubility measured at low pressure a</th>
<th>% deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>293.15</td>
<td>0.0151</td>
<td>0.0159</td>
<td>-5.0</td>
</tr>
<tr>
<td>273.15</td>
<td>0.0205</td>
<td>0.0214</td>
<td>-4.0</td>
</tr>
<tr>
<td>252.65</td>
<td>0.0313</td>
<td>0.0304</td>
<td>+2.7</td>
</tr>
</tbody>
</table>

a at a partial pressure of 0.1013 MPa

Ethylbenzene; C6H10; [100-41-4]

Nakamura et al. (3) reported solubility data for ethene in ethylbenzene at temperatures ranging from 196 K to 293 K and Kororezov et al. (4) measured ethene solubilities at similar pressures but for temperatures in the range 323 K to 423 K. Both workers gave Henry's constants and using these constants values of solubilities at a partial pressure of 101.3 kPa were calculated. The data of the two groups of workers gave colinear points on a plot of $\log x$ versus $1/T$ and are thus considered to be consistent with each other. The equation of the best fit line is:

$$\log x = -3.628 + 534.5/(T/K)$$

(4)

Since this equation has a correlation coefficient of 0.9983 it provides a suitable estimate of the solubility of ethene in ethylbenzene over the temperature range 196 K to 423 K.

The data of Nakamura et al. (3) and Kororezov et al. (4) are both classified as tentative.

Diethylbenzene; C10H14; [25340-17-4]

Ethene solubilities in diethylbenzene were reported by Kozorezov et al. (4) for total pressures from 0.25 MPa to 1.52 MPa at temperatures ranging from 323 to 423 K. The authors gave Henry's constants and the mole fraction solubilities at partial pressures of 101.3 kPa were calculated (assuming a direct inverse relationship) and were plotted against $1/T$.

A linear plot was obtained; therefore, the data of Kozorezov et al. (4) are classified as tentative.

Benzene, 1,4-dimethyl- (p-xylene); C8H10; [106-42-3] and Ethylbenzene, C6H10; [100-41-4] solvent mixtures

Benzene, 1,3-dimethyl- (m-xylene); C8H10; [108-38-3] and Ethylbenzene; C6H10; [100-41-4] solvent mixtures
COMPONENTS:
1. Ethene; C₂H₄; [74-85-1]
2. Aromatic and Alicyclic compounds
   \( T/K = 196 - 423 \)
   \( P/\text{MPa} \text{ up to } 19.3 \)

EVALUATOR:
C.L. Young
School of Chemistry
University of Melbourne
Parkville, Victoria
Australia, 3052
December 1993

CRITICAL EVALUATION:

Benzene,1,2-dimethyl-,(o-xylene); C₈H₁₀; [95-47-6] and Ethylbenzene;
C₈H₁₀; [100-41-4] solvent mixtures

Nakamura et al. [3] measured the solubilities of ethene in two component
solvent mixtures containing ethylbenzene and each of the three xylene
isomers at temperatures in the range of 213.15 K to 273.15 K. The
working pressures were in the range of 192.5 kPa to 983 kPa. Based on
the evaluation of the data in the pure solvents by these authors, these
data also are classified as tentative.

References
   42-47.
   343-345.
   Khim., 1962, 36, 801-808.
   Ser., 1968, 64, 16-21.
COMPONENTS:
1. Ethene; C₂H₄; [74-85-1]
2. Cyclohexane; C₆H₁₂; [110-82-7]

ORIGINAL MEASUREMENTS:
Zhuze, T.P.; Zhurba, A.S.;
Esakov, E.A.
Min. Fuels.* 1960, 2, 2150-2152.

VARIABLES:
\[ T/K = 300-423 \]
\[ P/\text{MPa} = 2 - 10, (20-100 \text{ atm}) \]

PREPARED BY:
W. Hayduk

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>( t/^\circ\text{C} )</th>
<th>( T/K )</th>
<th>( P/\text{Atm} )</th>
<th>( p_1/\text{Atm} )</th>
<th>( p_1/\text{MPa} )</th>
<th>( \text{liquid}, x_1 )</th>
<th>( \text{vapor}, y_1 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>30</td>
<td>303.15</td>
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<td>19.8</td>
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<td>0.245</td>
<td>0.990</td>
</tr>
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<td>39.8</td>
<td>4.03</td>
<td>0.520</td>
<td>0.995</td>
</tr>
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<td></td>
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<td>59.4</td>
<td>6.02</td>
<td>0.830</td>
<td>0.990</td>
</tr>
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<td>50</td>
<td>323.15</td>
<td>20</td>
<td>19.5</td>
<td>1.98</td>
<td>0.200</td>
<td>0.975</td>
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<td></td>
<td></td>
<td>40</td>
<td>39.2</td>
<td>3.97</td>
<td>0.405</td>
<td>0.980</td>
</tr>
<tr>
<td></td>
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<td>60</td>
<td>58.8</td>
<td>5.96</td>
<td>0.510</td>
<td>0.980</td>
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<tr>
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<td></td>
<td>80</td>
<td>76.4</td>
<td>7.74</td>
<td>0.845</td>
<td>0.955</td>
</tr>
<tr>
<td>75</td>
<td>348.15</td>
<td>20</td>
<td>19.0</td>
<td>1.93</td>
<td>0.160</td>
<td>0.950</td>
</tr>
<tr>
<td></td>
<td></td>
<td>40</td>
<td>38.6</td>
<td>3.91</td>
<td>0.315</td>
<td>0.965</td>
</tr>
<tr>
<td></td>
<td></td>
<td>60</td>
<td>58.5</td>
<td>5.93</td>
<td>0.460</td>
<td>0.975</td>
</tr>
<tr>
<td></td>
<td></td>
<td>80</td>
<td>76.8</td>
<td>7.78</td>
<td>0.635</td>
<td>0.960</td>
</tr>
<tr>
<td></td>
<td></td>
<td>100</td>
<td>88.0</td>
<td>8.92</td>
<td>0.860</td>
<td>0.880</td>
</tr>
</tbody>
</table>

1Calculated by compiler.
2Only graphical data available in reference; data read from enlarged graph by compiler.

Liquid solution molar volumes are also shown as a graph.  

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
The method is similar to that described by Sage and Lacey. Accurately known masses of solvent and gas were charged into an evacuated equilibrium vessel. The temperature was controlled to ± 0.05 K. The volume occupied by the system in the equilibrium vessel was varied by forcing a definite amount of mercury into it from a graduated mercury supply vessel equipped with a movable electric indicator. Equilibrium was attained using an electromagnetic stirrer. The pressure was measured using pressure guages. A sample of the gas phase was passed to a trap cooled to 213 K with acetone and dry ice. From a reading of a gas burette connected to the trap, the volume of ethylene was determined. From the increase in weight of the trap (0.5-1.5g) the solvent content of the gas phase was obtained.

SOURCE AND PURITY OF MATERIALS:
1. Ethene contains 2.9% ethane.
2. Cyclohexane properties given as:
   Density at 20°C = 0.7801 g/cm³
   \( \rho_0 = 1.4271 \)
   Normal boiling point = 80.9°C.

ESTIMATED ERROR:
Original data: \( \delta x_1/x_1 = \pm 2\% \)
Tabulated values: \( \delta x_1/x_1 = \pm 4\% \)

REFERENCES:
Sage, B.H.; Lacey, W.N.
### COMPONENTS:

1. Ethene; \( C_2H_4 \); [74-85-1]
2. Cyclohexane; \( C_6H_{12} \); [110-82-7]

### ORIGINAL MEASUREMENTS:

Zhuze, T.P.; Zhurba, A.S.;
Esakov, E.A.


### VARIABLES:

\( T/K = 300-423 \)

\( P/MPa = 2 - 10, (20-100 \text{ atm}) \)

### PREPARED BY:

W. Hayduk

### EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>( t/°C )</th>
<th>( T/K )</th>
<th>( P/Atm )</th>
<th>( P_1/Atm )</th>
<th>( P_1/MPa )</th>
<th>liquid, ( x_1 )</th>
<th>vapor, ( y_1 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>373.15</td>
<td>20</td>
<td>17.9</td>
<td>1.81</td>
<td>0.125</td>
<td>0.895</td>
</tr>
<tr>
<td></td>
<td></td>
<td>40</td>
<td>37.2</td>
<td>3.77</td>
<td>0.260</td>
<td>0.930</td>
</tr>
<tr>
<td></td>
<td></td>
<td>60</td>
<td>56.1</td>
<td>5.68</td>
<td>0.380</td>
<td>0.935</td>
</tr>
<tr>
<td></td>
<td></td>
<td>80</td>
<td>75.2</td>
<td>7.62</td>
<td>0.525</td>
<td>0.940</td>
</tr>
<tr>
<td></td>
<td></td>
<td>100</td>
<td>91.0</td>
<td>9.22</td>
<td>0.670</td>
<td>0.910</td>
</tr>
<tr>
<td>125</td>
<td>398.15</td>
<td>20</td>
<td>16.7</td>
<td>1.69</td>
<td>0.105</td>
<td>0.835</td>
</tr>
<tr>
<td></td>
<td></td>
<td>40</td>
<td>35.0</td>
<td>3.55</td>
<td>0.220</td>
<td>0.875</td>
</tr>
<tr>
<td></td>
<td></td>
<td>60</td>
<td>53.7</td>
<td>5.44</td>
<td>0.335</td>
<td>0.895</td>
</tr>
<tr>
<td></td>
<td></td>
<td>80</td>
<td>72.0</td>
<td>7.30</td>
<td>0.450</td>
<td>0.900</td>
</tr>
<tr>
<td></td>
<td></td>
<td>100</td>
<td>88.5</td>
<td>8.97</td>
<td>0.580</td>
<td>0.865</td>
</tr>
<tr>
<td>150</td>
<td>423.15</td>
<td>20</td>
<td>--</td>
<td>--</td>
<td>0.085</td>
<td>--</td>
</tr>
<tr>
<td></td>
<td></td>
<td>40</td>
<td>--</td>
<td>--</td>
<td>0.185</td>
<td>--</td>
</tr>
<tr>
<td></td>
<td></td>
<td>60</td>
<td>--</td>
<td>--</td>
<td>0.290</td>
<td>--</td>
</tr>
<tr>
<td></td>
<td></td>
<td>80</td>
<td>--</td>
<td>--</td>
<td>0.390</td>
<td>--</td>
</tr>
<tr>
<td></td>
<td></td>
<td>100</td>
<td>--</td>
<td>--</td>
<td>0.520</td>
<td>--</td>
</tr>
</tbody>
</table>

1. Calculated by compiler.
2. Only graphical data available in reference; data read from enlarged graph by compiler.
Liquid solution molar volumes are also shown as a graph.

### SOURCE AND PURITY OF MATERIALS:

1. Ethene contains 2.9% ethane.
2. Cyclohexane properties given as:
   - Density at 20°C = 0.7801 g/cm³
   - \( n^2 = 1.4271 \)
   - Normal boiling point = 80.9°C

### ESTIMATED ERROR:

Original data: \( \delta x_1/x_1 = \pm 2\% \)
Tabulated values: \( \delta x_1/x_1 = \pm 4\% \)

### REFERENCES:

Sage, B.H.; Lacey, W.N.

### COMPONENTS:
1. Ethene; \( \text{C}_2\text{H}_4 \); [74-85-1]
2. Benzene; \( \text{C}_6\text{H}_6 \); [71-43-2]

### ORIGINAL MEASUREMENTS:
Konobeev, B.I.; Lyapin, V.V.

### VARIABLES:
- \( T/K = 293.15 - 333.15 \)
- \( P/\text{MPa} = 0.286 - 3.23 \)

### PREPARED BY:
C. L. Young

### EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>( T/K )</th>
<th>( P/10^5\text{Pa} )</th>
<th>Mole fraction of ethene in liquid ( x_{\text{C}_2\text{H}_4} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>293.15</td>
<td>3.070</td>
<td>0.036</td>
</tr>
<tr>
<td></td>
<td>8.106</td>
<td>0.096</td>
</tr>
<tr>
<td></td>
<td>14.19</td>
<td>0.172</td>
</tr>
<tr>
<td></td>
<td>17.43</td>
<td>0.224</td>
</tr>
<tr>
<td></td>
<td>21.08</td>
<td>0.288</td>
</tr>
<tr>
<td></td>
<td>31.82</td>
<td>0.502</td>
</tr>
<tr>
<td>313.15</td>
<td>2.857</td>
<td>0.024</td>
</tr>
<tr>
<td></td>
<td>8.258</td>
<td>0.076</td>
</tr>
<tr>
<td></td>
<td>17.63</td>
<td>0.174</td>
</tr>
<tr>
<td></td>
<td>23.31</td>
<td>0.220</td>
</tr>
<tr>
<td></td>
<td>32.12</td>
<td>0.380</td>
</tr>
<tr>
<td>333.15</td>
<td>2.878</td>
<td>0.018</td>
</tr>
<tr>
<td></td>
<td>8.268</td>
<td>0.061</td>
</tr>
<tr>
<td></td>
<td>17.43</td>
<td>0.136</td>
</tr>
<tr>
<td></td>
<td>32.32</td>
<td>0.278</td>
</tr>
</tbody>
</table>

### AUXILIARY INFORMATION

**METHOD/APPARATUS/PROCEDURE:**
Static equilibrium cell fitted with magnetic stirrer. Samples analysed by gas chromatography. Details in source.

**SOURCE AND PURITY OF MATERIALS:**
1. Purity better than 99.6 mole per cent.
2. No details given.

**ESTIMATED ERROR:**
\( \delta T/K = \pm 0.1 \); \( \delta P = \pm 0.5\% \); \( \delta x_{\text{C}_2\text{H}_4} = \pm 0.002 \) (estimated by compiler)

**REFERENCES:**
COMPONENTS:
1. Ethene; C₂H₄; [74-85-1]
2. Benzene; C₆H₆; [71-43-2]

ORIGINAL MEASUREMENTS:
Kozorezov, Yu.I.; Rusakov, A.P.; Pikalo, N.M.

VARIABLES:
$T/K = 323.15 - 423.15$
$P/MPa = 0.25 - 1.54$

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>$T/K$</th>
<th>$P/10^5 Pa$</th>
<th>$P/atm$</th>
<th>Mole fraction of ethene in liquid, $x_{C_2H_4}$</th>
<th>Solubility cm$^3$ (STP)/g</th>
</tr>
</thead>
<tbody>
<tr>
<td>323.15</td>
<td>2.5</td>
<td>2.5</td>
<td>0.020</td>
<td>6.0</td>
</tr>
<tr>
<td></td>
<td>5.1</td>
<td>5.0</td>
<td>0.040</td>
<td>11.9</td>
</tr>
<tr>
<td></td>
<td>10.1</td>
<td>10.0</td>
<td>0.081</td>
<td>25.4</td>
</tr>
<tr>
<td></td>
<td>15.2</td>
<td>15.0</td>
<td>0.122</td>
<td>39.9</td>
</tr>
<tr>
<td>373.15</td>
<td>2.5</td>
<td>2.5</td>
<td>0.004</td>
<td>1.3</td>
</tr>
<tr>
<td></td>
<td>5.1</td>
<td>5.0</td>
<td>0.017</td>
<td>5.1</td>
</tr>
<tr>
<td></td>
<td>10.1</td>
<td>10.0</td>
<td>0.043</td>
<td>13.0</td>
</tr>
<tr>
<td></td>
<td>15.2</td>
<td>15.0</td>
<td>0.072</td>
<td>22.3</td>
</tr>
<tr>
<td>403.15</td>
<td>5.1</td>
<td>5.0</td>
<td>0.006</td>
<td>1.7</td>
</tr>
<tr>
<td></td>
<td>10.1</td>
<td>10.0</td>
<td>0.030</td>
<td>8.6</td>
</tr>
<tr>
<td></td>
<td>15.2</td>
<td>15.0</td>
<td>0.051</td>
<td>14.9</td>
</tr>
<tr>
<td>423.15</td>
<td>6.6</td>
<td>6.5</td>
<td>0.003</td>
<td>1.0</td>
</tr>
<tr>
<td></td>
<td>10.1</td>
<td>10.0</td>
<td>0.010</td>
<td>5.1</td>
</tr>
<tr>
<td></td>
<td>15.2</td>
<td>15.0</td>
<td>0.047</td>
<td>12.1</td>
</tr>
</tbody>
</table>

'Calculated by compilers.

Henry's constant given as atm/mole fraction as follows:

<table>
<thead>
<tr>
<th>$T/K$</th>
<th>$H$, atm/mole fraction</th>
</tr>
</thead>
<tbody>
<tr>
<td>323.15</td>
<td>115.2</td>
</tr>
<tr>
<td>373.15</td>
<td>181.0</td>
</tr>
<tr>
<td>403.15</td>
<td>204.0</td>
</tr>
<tr>
<td>423.15</td>
<td>229.0</td>
</tr>
</tbody>
</table>

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
Single pass flow apparatus. Ethene allowed to flow through solvent for 3 to 5 hours. Liquid sample withdrawn and analysed by stripping out ethene and measuring amount volumetrically. Solvent in sample estimated gravimetrically.

SOURCE AND PURITY OF MATERIALS:
1. Purity 99.93 mole per cent.
2. Boiling point 80°C; melting point 54°C
$\delta^2_4 = 0.8796; \ n_D^2 = 1.5010.$

ESTIMATED ERROR:
$\delta T/K = \pm 0.5; \delta P/10^5 Pa = \pm 0.1; \delta x_{C_2H_4} = \pm 0.001$

(estimated by compiler)

REFERENCES: 
**COMPONENTS:**
1. Ethene; $\text{C}_2\text{H}_4; \quad [74-85-1]
2. Benzene; $\text{C}_6\text{H}_6; \quad [71-43-2]

**ORIGINAL MEASUREMENTS:**
Hiraoka, H.
*Rev. Phys. Chem. Japan,*
1958, 28, 64-66.

**VARIABLES:**
$T/K = 298-423$
$P/\text{MPa} = 4.1 - 19.3, (40-189 \text{ atm})$

**EXPERIMENTAL VALUES:**

<table>
<thead>
<tr>
<th>$T/K$</th>
<th>Total Pressure $P_1/\text{Atm}$ kg/cm²</th>
<th>Partial Pressure $P_1/\text{MPa}$</th>
<th>Mole Fraction Ethene $y_1$</th>
<th>Mole Fraction Ethene $x_1$</th>
</tr>
</thead>
<tbody>
<tr>
<td>298.15</td>
<td>42</td>
<td>40.6</td>
<td>0.559</td>
<td>0.999</td>
</tr>
<tr>
<td>323.15</td>
<td>42</td>
<td>40.4</td>
<td>0.421</td>
<td>0.995</td>
</tr>
<tr>
<td></td>
<td>103</td>
<td>99.6</td>
<td>0.786</td>
<td>0.999</td>
</tr>
<tr>
<td>373.15</td>
<td>42</td>
<td>39.3</td>
<td>0.264</td>
<td>0.967</td>
</tr>
<tr>
<td></td>
<td>70</td>
<td>66.7</td>
<td>0.445</td>
<td>0.985</td>
</tr>
<tr>
<td></td>
<td>103</td>
<td>99.1</td>
<td>0.654</td>
<td>0.994</td>
</tr>
<tr>
<td></td>
<td>197</td>
<td>189.8</td>
<td>0.526</td>
<td>0.995</td>
</tr>
<tr>
<td>423.15</td>
<td>42</td>
<td>35.7</td>
<td>0.186</td>
<td>0.879</td>
</tr>
<tr>
<td></td>
<td>70</td>
<td>63.7</td>
<td>0.333</td>
<td>0.940</td>
</tr>
<tr>
<td></td>
<td>103</td>
<td>96.6</td>
<td>0.483</td>
<td>0.969</td>
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<td>154</td>
<td>146.7</td>
<td>0.617</td>
<td>0.984</td>
</tr>
<tr>
<td></td>
<td>197</td>
<td>187.8</td>
<td>0.527</td>
<td>0.985</td>
</tr>
</tbody>
</table>

1Calculated by compiler.
2Calculated by compiler assuming Raoult’s Law.

**AUXILIARY INFORMATION**

**METHOD/APPARATUS/PROCEDURE:**
Equilibrium was acheived by bubbling gas at constant temperature and pressure through benzene solvent stored in a stainless steel vessel. Gas and liquid phases were sampled and analyzed. The gas phase was condensed with liquid air then slowly warmed to room temperature. The residual liquid after evaporation of ethylene was considered to be benzene. The liquid phase was sampled at constant pressure by slowly displacing the mercury in a sample bomb and adding gas at a rate required to keep the pressure constant. The liquid sample was analyzed. Further details of analysis and calculations were not given in this paper, although some earlier work was mentioned but the reference to it was not given.

**SOURCE AND PURITY OF MATERIALS:**
1. Ethene prepared by dehydration of ethanol and purified by distillation. Infra-red spectrum indicated no ether.
2. Benzene source and purity not specified.

**ESTIMATED ERROR:**

\[ \delta x_1 / x_1 = 0.02 \]

**REFERENCES:**
COMPONENTS:
1. Ethene; \( C_2 H_4 \); [74-85-1]
2. Benzene; \( C_6 H_6 \); [71-43-2]

ORIGINAL MEASUREMENTS:
Paratella, A.; Sagramora, G.

VARIABLES:
\( T / K = 298.15, 348.15 \)
\( P / \text{MPa} = 2.94-9.81, (29-97 \text{ atm}) \)

PREPARED BY:
W. Hayduk

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>( t / ^\circ \text{C} )</th>
<th>( T / K )</th>
<th>Total Pressure ( P / \text{kg cm}^{-2} )</th>
<th>Partial Pressure ( p_1 / \text{MPa} )</th>
<th>Mole Fraction, ( x_i )</th>
<th>'Henry's Constant ( H/\text{atm (mole fraction)}^{-1} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>25.0</td>
<td>298.15</td>
<td>30</td>
<td>2.942</td>
<td>2.930</td>
<td>0.0212</td>
</tr>
<tr>
<td>60</td>
<td>5.884</td>
<td>5.872</td>
<td>0.0521</td>
<td>1112</td>
<td></td>
</tr>
<tr>
<td>75.0</td>
<td>348.15</td>
<td>30</td>
<td>2.942</td>
<td>2.856</td>
<td>0.00719</td>
</tr>
<tr>
<td>60</td>
<td>5.884</td>
<td>5.800</td>
<td>0.0251</td>
<td>2281</td>
<td></td>
</tr>
<tr>
<td>100</td>
<td>9.807</td>
<td>9.738</td>
<td>0.2050</td>
<td>469</td>
<td></td>
</tr>
</tbody>
</table>

1'Calculated by compiler.

It is noted by compiler that these results are in serious disagreement with all other results.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

A dynamic method was used in which the solvent was saturated by bubbling the gas through the solvent. The body of the cell was constructed of metal. Saturation was achieved by passing the gas through the solvent. The consumption of gas was high (20-40 l/h). The solvent was initially fed into the cell, and solution subsequently withdrawn, by means of a valve and capillary tubing. Details of the pressure control and analytical systems were not available.

SOURCE AND PURITY OF MATERIALS:

1. Ethene was spectroscopy grade at 99.7% purity.
2. Benzene source and purity not given.

ESTIMATED ERROR:

\( \delta T / K = \pm 0.3 \)

Probable error in solubility is high. (Compiler)

REFERENCES:
COMPONENTS:
1. Ethene; C₂H₄; [74-85-1]
2. Benzene; C₆H₆; [71-43-2]

ORIGINAL MEASUREMENTS:
Ellis, S.R.M.; Valteris, R.L.;
Harris, G.J.
Chen. Eng. Prog. Symp. Ser.,
1968, 64, 16-21.

VARIABLES:
T/K = 348.15
P/MPa = 1.4-8.3 (14-82 atm)

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>P/atm</th>
<th>Partial pressure¹</th>
<th>Mole fraction ethene in liquid, x₁, in vapor, y₁</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>p₁/atm</td>
<td>p₁/MPa</td>
</tr>
<tr>
<td>15.0</td>
<td>13.9</td>
<td>1.41</td>
</tr>
<tr>
<td>21.1</td>
<td>20.1</td>
<td>2.04</td>
</tr>
<tr>
<td>29.9</td>
<td>28.5</td>
<td>2.88</td>
</tr>
<tr>
<td>38.1</td>
<td>36.7</td>
<td>3.72</td>
</tr>
<tr>
<td>57.1</td>
<td>55.3</td>
<td>5.60</td>
</tr>
<tr>
<td>73.5</td>
<td>70.5</td>
<td>7.14</td>
</tr>
<tr>
<td>81.6</td>
<td>78.0</td>
<td>7.90</td>
</tr>
<tr>
<td>87.1</td>
<td>81.8</td>
<td>8.29</td>
</tr>
<tr>
<td>90.0</td>
<td>82.1</td>
<td>8.32</td>
</tr>
</tbody>
</table>

¹Calculated by compiler.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
A static method with a 500 cm³ stainless steel vessel equipped with a plunger, perforated-cup stirrer was used. The perforated cup was attached to a soft iron rod which was raised up by means of an electromagnet, and dropped downward under its own weight. Ethylene was displaced from a reservoir by mercury using a volumetric piston pump to the desired pressure. After equilibration, samples of gas and liquid were withdrawn for analysis. During the sampling process, an equivalent volume of mercury was allowed to flow from the sample bomb back to the equilibration vessel. The liquid portion of the samples was condensed at atmospheric pressure using dry-ice and acetone whereas the gas portion was aspirated volumetrically over water. Analysis was by gas chromatography.

SOURCE AND PURITY OF MATERIALS:
Sources and purities not specified.

ESTIMATED ERROR:

δ x₁/x₁ = ± 0.03
δ T/K = ± 2
δ P/P = ± 0.01

REFERENCES:
COMPONENTS:
1. Ethene; $\text{C}_2\text{H}_4$; [74-85-1]
2. Methylbenzene (toluene);
   $\text{C}_7\text{H}_8$; [108-88-3]

ORIGINAL MEASUREMENTS:
Frank, V.H.P.

VARIABLES:
$T/K = 273.15 - 323.15$
$p/\text{MPa} = 0.1013 - 0.4053$

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>$T/K$</th>
<th>$p/\text{atm}$</th>
<th>Ethene $X_{\text{ET}}$</th>
<th>Percent by Weight $\omega_1$</th>
<th>Mole Fraction $x_1$</th>
<th>$k$ Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>273.15 (0°C)</td>
<td>0.1013</td>
<td>0.63</td>
<td>0.0204</td>
<td>0.55</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>0.2026</td>
<td>1.3</td>
<td>0.0415</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>0.3040</td>
<td>1.9</td>
<td>0.0598</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>0.4053</td>
<td>2.7</td>
<td>0.0835</td>
<td></td>
<td></td>
</tr>
<tr>
<td>293.15 (20°C)</td>
<td>0.1013</td>
<td>0.45</td>
<td>0.0146</td>
<td>0.40</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>0.2026</td>
<td>0.90</td>
<td>0.0290</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>0.3040</td>
<td>1.4</td>
<td>0.0446</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>0.4053</td>
<td>1.9</td>
<td>0.0598</td>
<td></td>
<td></td>
</tr>
<tr>
<td>308.15 (35°C)</td>
<td>0.1013</td>
<td>0.35</td>
<td>0.0114</td>
<td>0.30</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>0.2026</td>
<td>0.70</td>
<td>0.0226</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>0.3040</td>
<td>1.1</td>
<td>0.0352</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>0.4053</td>
<td>1.5</td>
<td>0.0476</td>
<td></td>
<td></td>
</tr>
<tr>
<td>323.15 (50°C)</td>
<td>0.1013</td>
<td>0.25</td>
<td>0.00816</td>
<td>0.20</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>0.2026</td>
<td>0.50</td>
<td>0.0162</td>
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</tr>
<tr>
<td>3</td>
<td>0.3040</td>
<td>0.75</td>
<td>0.0242</td>
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<td></td>
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<tr>
<td>4</td>
<td>0.4053</td>
<td>1.1</td>
<td>0.0352</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1 Calculated by compiler.
2 Values of a type of Henry's constant (actually $H^{-1}$) were also given in the form of the following equation:

$$C = k \cdot p$$

$C$ = Equilibrium concentration, g ethene/100 ml of solvent
$k$ = A type of Henry's constant
$p$ = Gas partial pressure, atm

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
The source of the data was stated to be reference 1. Only a graph is available in that reference. It was also stated that the Hoechst company (Germany) used these values of solubility.

There were no details of apparatus or procedure.

SOURCE AND PURITY OF MATERIALS:
Sources and purities not given.

ESTIMATED ERROR:
$$\delta \omega_1/\omega_1 = \pm 0.04 \text{ (compiler)}$$

REFERENCES:
1. Bier, G.; Lehmann, G.
   "Copolymerization" Chap. IVB of High Polymers, G. Ham, Ed. 1964,
   Vol. XVIII InterScience, New York, 169.
# COMPONENTS:

1. Ethene: \( \text{C}_2\text{H}_4 \); [74-85-1]

2. Nethylbenzene (Toluene): \( \text{C}_8\text{H}_8 \); [108-88-3]

# ORIGINAL MEASUREMENTS:

Konobeev, B.I.; Lyapin, V.V.


# VARIABLES:

\[
\begin{align*}
T/\text{K} &= 293.15 \text{ - } 333.15 \\
P/\text{MPa} &= 0.284 \text{ - } 3.16
\end{align*}
\]

# PREPARED BY:

C. L. Young

# EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>( T/\text{K} )</th>
<th>( P/\text{MPa} )</th>
<th>Mole fraction of ethene in liquid ( x_{\text{C}_2\text{H}_4} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>293.15</td>
<td>3.070</td>
<td>0.040</td>
</tr>
<tr>
<td></td>
<td>8.197</td>
<td>0.109</td>
</tr>
<tr>
<td></td>
<td>14.89</td>
<td>0.199</td>
</tr>
<tr>
<td></td>
<td>31.11</td>
<td>0.430</td>
</tr>
<tr>
<td>313.15</td>
<td>2.037</td>
<td>0.029</td>
</tr>
<tr>
<td></td>
<td>8.268</td>
<td>0.087</td>
</tr>
<tr>
<td></td>
<td>31.41</td>
<td>0.347</td>
</tr>
<tr>
<td>333.15</td>
<td>2.037</td>
<td>0.022</td>
</tr>
<tr>
<td></td>
<td>8.299</td>
<td>0.070</td>
</tr>
<tr>
<td></td>
<td>17.73</td>
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</tr>
<tr>
<td></td>
<td>31.61</td>
<td>0.287</td>
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</tbody>
</table>

# AUXILIARY INFORMATION

**METHOD/APPARATUS/PROCEDURE:**

Static equilibrium cell fitted with magnetic stirrer. Samples analysed by gas chromatography. Details in source.

**SOURCE AND PURITY OF MATERIALS:**

1. Purity better than 99.6 mole per cent.

2. No details given.

**ESTIMATED ERROR:**

\( \delta T/\text{K} = \pm 0.1; \delta P = \pm 0.5\%; \delta x_{\text{C}_2\text{H}_4} = \pm 0.002 \) (estimated by compiler)

**REFERENCES:**
COMPONENTS:
1. Ethene; C₂H₄; [74-85-1]
2. Benzene, methyl-, (toluene); C₇H₈; [108-88-3]

ORIGINAL MEASUREMENTS:

VARIABLES:
T/K = 228.05 - 248.15
P/bar = 1 - 18.2

PREPARED BY:
C.L. Young.

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>P/atm</th>
<th>P/bar</th>
<th>mole fraction of ethene in liquid; x_C₂H₄</th>
<th>solubility + cm³g⁻¹ at P₁ = 101.325 kPa</th>
</tr>
</thead>
<tbody>
<tr>
<td>248.15</td>
<td>1.0</td>
<td></td>
<td>0.0330</td>
<td>82.4</td>
</tr>
<tr>
<td></td>
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<td>26.80</td>
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<td>10.1</td>
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<td>0.3600</td>
<td>135.61</td>
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<td></td>
<td>12.2</td>
<td></td>
<td>0.4410</td>
<td>191.31</td>
</tr>
<tr>
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<td>15.2</td>
<td></td>
<td>0.5832</td>
<td>336.90</td>
</tr>
<tr>
<td></td>
<td>18.2</td>
<td></td>
<td>0.7390</td>
<td>682.40</td>
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<tr>
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<td></td>
<td>0.0408</td>
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</tr>
<tr>
<td></td>
<td>3.0</td>
<td></td>
<td>0.1280</td>
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<td></td>
<td>5.1</td>
<td></td>
<td>0.2135</td>
<td>67.22</td>
</tr>
<tr>
<td></td>
<td>10.1</td>
<td></td>
<td>0.4881</td>
<td>229.71</td>
</tr>
<tr>
<td></td>
<td>12.2</td>
<td></td>
<td>0.6200</td>
<td>294.60</td>
</tr>
<tr>
<td></td>
<td>15.2</td>
<td></td>
<td>0.8263</td>
<td>1505.00</td>
</tr>
<tr>
<td>228.05</td>
<td>1.0</td>
<td></td>
<td>0.510</td>
<td>12.95</td>
</tr>
<tr>
<td></td>
<td>3.0</td>
<td></td>
<td>0.1680</td>
<td>48.71</td>
</tr>
<tr>
<td></td>
<td>5.1</td>
<td></td>
<td>0.2930</td>
<td>99.90</td>
</tr>
<tr>
<td></td>
<td>10.1</td>
<td></td>
<td>0.7300</td>
<td>651.60</td>
</tr>
</tbody>
</table>

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
Glass equilibrium cell fitted with magnetic stirrer. Pressure measured with Bourdon gauge. Samples of liquid analysed by stripping out ethene. Details in ref. (1).

SOURCE AND PURITY OF MATERIALS:
1. Prepared from ethanol by dehydration and purified by absorption in cuprous chloride under pressure.
2. Distilled.

ESTIMATED ERROR:
δT/K = ±0.1; δP/bar = ±0.3;
δx_C₂H₄ = ±2%.
(estimated by compiler).

REFERENCES:
COMPONENTS:
1. Ethene; C2H4; [74-85-1]
2. Methylbenzene (toluene); C7H8; [108-88-3]

ORIGINAL MEASUREMENTS:
Tyvina, T.N.; Naumova, A.A.; Poliyakov, S.A.
OR

VARIABLES:
T/K = 293.15 - 473.15
P/MPa = 0.507 - 6.08

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>t/C</th>
<th>T/K</th>
<th>H'/atm (mol fraction)^-1</th>
<th>H/MPa (mol fraction)^-1</th>
<th>Ethene, x1</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>293.15</td>
<td>72.2</td>
<td>7.32</td>
<td>0.0139</td>
</tr>
<tr>
<td>40</td>
<td>313.15</td>
<td>92.8</td>
<td>9.40</td>
<td>0.0108</td>
</tr>
<tr>
<td>60</td>
<td>333.15</td>
<td>112.7</td>
<td>11.42</td>
<td>0.00888</td>
</tr>
<tr>
<td>80</td>
<td>353.15</td>
<td>135.4</td>
<td>13.72</td>
<td>0.00739</td>
</tr>
<tr>
<td>100</td>
<td>373.15</td>
<td>156.1</td>
<td>15.82</td>
<td>0.00641</td>
</tr>
<tr>
<td>120</td>
<td>393.15</td>
<td>170.3</td>
<td>17.25</td>
<td>0.00587</td>
</tr>
<tr>
<td>140</td>
<td>413.15</td>
<td>184.7</td>
<td>18.71</td>
<td>0.00542</td>
</tr>
<tr>
<td>160</td>
<td>433.15</td>
<td>196.7</td>
<td>19.93</td>
<td>0.00508</td>
</tr>
<tr>
<td>180</td>
<td>453.15</td>
<td>200.7</td>
<td>20.33</td>
<td>0.00498</td>
</tr>
<tr>
<td>200</td>
<td>473.15</td>
<td>203.3</td>
<td>20.60</td>
<td>0.00493</td>
</tr>
</tbody>
</table>

No numerical data were given; only a graph showing total pressure as a function of mole fraction toluene was included.

1Values of Henry's constants and mole fraction ethene for a partial pressure of 101.3 kPa were calculated from total pressures and compositions read from an enlarged graph by the compiler. Raoult's law was assumed for the solvent vapor pressure. Henry's law was obeyed for ethene concentrations of at least up to 0.30 mole fraction.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
The method was described in reference 1. The ethene absorber was a 1-litre pressure vessel submerged in a constant temperature bath. Ethene was bubbled through the solvent continuously at constant pressure for 3-5 hours. The ethene was passed through a reflux condenser to minimize the escape of solvent vapor. After saturation was complete, a sample of the solution was directed to an evacuated separator and allowed to flash to a low temperature and pressure. The quantity of solvent from the flashing step was weighed, while the quantity of ethene released was determined by measuring the increase in pressure, by manometer, in a gas accumulator of known volume and temperature.

SOURCE AND PURITY OF MATERIALS:
1. Ethene purity was specified to be 99.9%.
2. Methylbenzene was of the CP grade.

ESTIMATED ERROR:
\[ \delta x_1 / x_1 = \pm 4\% \text{ (compiler)} \]

REFERENCES:
1. Kozorezov, Yu. I.; Rusakov, A.P.; Pikalo, N.M.
### VARIABLES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>P/MPa</th>
<th>Mole fraction of ethene in liquid</th>
</tr>
</thead>
<tbody>
<tr>
<td>293.15</td>
<td>3.080</td>
<td>0.044</td>
</tr>
<tr>
<td></td>
<td>8.106</td>
<td>0.117</td>
</tr>
<tr>
<td></td>
<td>14.49</td>
<td>0.206</td>
</tr>
<tr>
<td></td>
<td>20.67</td>
<td>0.316</td>
</tr>
<tr>
<td></td>
<td>31.71</td>
<td>0.455</td>
</tr>
<tr>
<td>313.15</td>
<td>2.857</td>
<td>0.030</td>
</tr>
<tr>
<td></td>
<td>8.238</td>
<td>0.091</td>
</tr>
<tr>
<td></td>
<td>32.02</td>
<td>0.360</td>
</tr>
<tr>
<td>333.15</td>
<td>2.867</td>
<td>0.024</td>
</tr>
<tr>
<td></td>
<td>8.248</td>
<td>0.074</td>
</tr>
<tr>
<td></td>
<td>20.97</td>
<td>0.193</td>
</tr>
<tr>
<td></td>
<td>32.12</td>
<td>0.300</td>
</tr>
</tbody>
</table>

### EXPERIMENTAL VALUES:

EXPERIMENTAL VALUES:

**VARIBABLES:**

1. Ethene; C\textsubscript{2}H\textsubscript{4}; [74-85-1]
2. Xylene (mixture of the three isomers); C\textsubscript{8}H\textsubscript{10};

**ORIGINAL MEASUREMENTS:**

Konobeev, B.I.; Lyapin, V.V.  
Khim. Prom. 1967, 43, 114-6

**EXPERIMENTAL VALUES:**

<table>
<thead>
<tr>
<th>T/K</th>
<th>P/10^5 Pa</th>
<th>Mole fraction of ethene in liquid</th>
</tr>
</thead>
<tbody>
<tr>
<td>293.15</td>
<td>3.080</td>
<td>0.044</td>
</tr>
<tr>
<td></td>
<td>8.106</td>
<td>0.117</td>
</tr>
<tr>
<td></td>
<td>14.49</td>
<td>0.206</td>
</tr>
<tr>
<td></td>
<td>20.67</td>
<td>0.316</td>
</tr>
<tr>
<td></td>
<td>31.71</td>
<td>0.455</td>
</tr>
<tr>
<td>313.15</td>
<td>2.857</td>
<td>0.030</td>
</tr>
<tr>
<td></td>
<td>8.238</td>
<td>0.091</td>
</tr>
<tr>
<td></td>
<td>32.02</td>
<td>0.360</td>
</tr>
<tr>
<td>333.15</td>
<td>2.867</td>
<td>0.024</td>
</tr>
<tr>
<td></td>
<td>8.248</td>
<td>0.074</td>
</tr>
<tr>
<td></td>
<td>20.97</td>
<td>0.193</td>
</tr>
<tr>
<td></td>
<td>32.12</td>
<td>0.300</td>
</tr>
</tbody>
</table>

**AUXILIARY INFORMATION**

**METHOD/APPARATUS/PROCEDURE:**

Static equilibrium cell fitted with magnetic stirrer. Samples analysed by gas chromatography. Details in source.

**SOURCE AND PURITY OF MATERIALS:**

1. Purity better than 99.6 mole per cent.
2. No details given.

**ESTIMATED ERROR:**

δT/K=±0.1; δP=±0.5%; δx\textsubscript{C_2H_4} =±0.002  
(estimated by compiler)

**REFERENCES:**
COMPONENTS:
1. Ethene; C₂H₄; [74-85-1]
2. Ethylbenzene; C₈H₁₀; [100-41-4]

ORIGINAL MEASUREMENTS:
Kozorezov, Yu.I., Rusakov, A.P.; Pikalo, N.M.

VARIABLES:
T/K = 323.15 - 423.15
P/MPa = 0.25 - 1.52

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>P/10⁵Pa</th>
<th>P/atm</th>
<th>mole fraction of ethene in liquid, xC₂H₄</th>
<th>solubility, cm³(STP)/g</th>
</tr>
</thead>
<tbody>
<tr>
<td>323.15</td>
<td>2.5</td>
<td>2.5</td>
<td>0.024</td>
<td>5.2</td>
</tr>
<tr>
<td></td>
<td>5.1</td>
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<td>10.1</td>
<td>10.0</td>
<td>0.099</td>
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<td></td>
<td>15.2</td>
<td>15.0</td>
<td>0.152</td>
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</tr>
<tr>
<td>373.15</td>
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<td>2.5</td>
<td>0.013</td>
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</tr>
<tr>
<td></td>
<td>5.1</td>
<td>5.0</td>
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<td>6.4</td>
</tr>
<tr>
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<td>0.097</td>
<td>22.6</td>
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<td>5.0</td>
<td>0.022</td>
<td>4.8</td>
</tr>
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<td></td>
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<td>10.0</td>
<td>0.050</td>
<td>11.1</td>
</tr>
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<td></td>
<td>15.2</td>
<td>15.0</td>
<td>0.078</td>
<td>17.9</td>
</tr>
<tr>
<td>423.15</td>
<td>6.6</td>
<td>6.5</td>
<td>0.024</td>
<td>5.3</td>
</tr>
<tr>
<td></td>
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<td>10.0</td>
<td>0.041</td>
<td>8.9</td>
</tr>
<tr>
<td></td>
<td>15.2</td>
<td>15.0</td>
<td>0.068</td>
<td>15.5</td>
</tr>
</tbody>
</table>

1Calculated by compilers.
Henry's constant reported as atm./mole fraction as follows:

<table>
<thead>
<tr>
<th>T/K</th>
<th>H, atm/mole fraction</th>
</tr>
</thead>
<tbody>
<tr>
<td>323.15</td>
<td>101.6</td>
</tr>
<tr>
<td>373.15</td>
<td>158.6</td>
</tr>
<tr>
<td>403.15</td>
<td>183.7</td>
</tr>
<tr>
<td>423.15</td>
<td>205.3</td>
</tr>
</tbody>
</table>

METHOD/APPARATUS/PROCEDURE:
Single pass flow apparatus. Ethene allowed to flow through solvent for 3 to 5 hours. Liquid sample withdrawn and analysed by stripping out ethene and measuring amount volumetrically. Solvent in sample estimated gravimetrically.

SOURCE AND PURITY OF MATERIALS:
1. Purity 99.93 mole per cent.
2. Boiling point 135.8°C,
   \[ d_4^{20} = 0.8673; \quad n_D^{20} = 1.4960. \]

ESTIMATED ERROR:
\[ \delta T/K = \pm 0.5; \quad \delta P/10^5Pa = \pm 0.1; \quad \delta x_{C_2H_4} = \pm 0.001. \]
(estimated by compiler).

REFERENCES:
COMPONENTS:
1. Ethene; C₂H₄; [74-85-1]
2. Diethylbenzene; C₁₀H₁₁; [25340-17-4]

ORIGINAL MEASUREMENTS:
Kozorezov, Yu.I.; Rusakov, A.P.; Pikalo, N.M.

VARIABLES:
T/K = 323.15 - 423.15
P/MPa = 0.25 - 1.52

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>1P/10⁵Pa</th>
<th>P/</th>
<th>Mole fraction of ethene in liquid, x_{C₂H₄}</th>
<th>Solubility, cm³ (STP)/g</th>
</tr>
</thead>
<tbody>
<tr>
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<td>0.026</td>
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<td>373.15</td>
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<td>2.9</td>
</tr>
<tr>
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<td>5.1</td>
<td>5.0</td>
<td>0.035</td>
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</tr>
<tr>
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<td>6.6</td>
<td>6.5</td>
<td>0.034</td>
<td>5.7</td>
</tr>
<tr>
<td>373.15</td>
<td>5.1</td>
<td>5.0</td>
<td>0.035</td>
<td>6.0</td>
</tr>
<tr>
<td>403.15</td>
<td>5.1</td>
<td>5.0</td>
<td>0.035</td>
<td>6.0</td>
</tr>
<tr>
<td>423.15</td>
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<td>10.0</td>
<td>0.070</td>
<td>12.6</td>
</tr>
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<td>10.0</td>
<td>0.056</td>
<td>10.1</td>
</tr>
<tr>
<td>373.15</td>
<td>10.1</td>
<td>10.0</td>
<td>0.056</td>
<td>10.1</td>
</tr>
<tr>
<td>403.15</td>
<td>10.1</td>
<td>10.0</td>
<td>0.056</td>
<td>10.1</td>
</tr>
<tr>
<td>423.15</td>
<td>15.2</td>
<td>15.0</td>
<td>0.106</td>
<td>20.0</td>
</tr>
<tr>
<td>323.15</td>
<td>15.2</td>
<td>15.0</td>
<td>0.106</td>
<td>20.0</td>
</tr>
<tr>
<td>373.15</td>
<td>15.2</td>
<td>15.0</td>
<td>0.106</td>
<td>20.0</td>
</tr>
<tr>
<td>403.15</td>
<td>15.2</td>
<td>15.0</td>
<td>0.106</td>
<td>20.0</td>
</tr>
<tr>
<td>423.15</td>
<td>15.2</td>
<td>15.0</td>
<td>0.106</td>
<td>20.0</td>
</tr>
</tbody>
</table>

1Calculated by compilers.

Henry's constants given as atm./mole fraction as follows:

<table>
<thead>
<tr>
<th>T/K</th>
<th>323.15</th>
<th>373.15</th>
<th>403.15</th>
<th>423.15</th>
</tr>
</thead>
<tbody>
<tr>
<td>H, atm/mole fraction</td>
<td>94.1</td>
<td>141.2</td>
<td>170.1</td>
<td>185.0</td>
</tr>
</tbody>
</table>

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
Single pass flow apparatus.
Ethene allowed to flow through solvent for 3 to 5 hours. Liquid sample withdrawn and analysed by stripping out ethene and measuring amount volumetrically. Solvent in sample estimated gravimetrically.

SOURCE AND PURITY OF MATERIALS:
1. Purity 99.93 mole per cent.
2. Boiling point range 179-182°C; 
   d⁰₂₀ = 0.8643; nD²₀ = 1.4962;
   (60.9% m-isomer and 35.5% o- and p-isomers by chromatographic analysis).

ESTIMATED ERROR:
δT/K = ±0.5; δP/10⁵Pa = ±0.1; 
δx_{C₂H₄} = ±0.001
(estimated by compiler)

REFERENCES:
COMPONENTS:
1. Ethene; C₂H₄; [74-85-1]
2. Benzene,1,2-dimethyl-, (o-xylene); C₆H₁₀; [95-47-6]

ORIGINAL MEASUREMENTS:
Nakamura, E.; Koguchi, K.;
Amemiya, T.

VARIABLES:

\[ T/K = 213.15 - 293.15 \]

\[ P/kPa = 182.4 - 1276.7 (1.8 - 12.6 \text{ atm}) \]

PREPARED BY:
W. Hayduk

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>( t/C )</th>
<th>( T/K )</th>
<th>Total Pressure ( P/\text{atm} )</th>
<th>Total Pressure ( P/kPa )</th>
<th>Mole Fraction Ethene, ( x_1 )</th>
<th>Average Henry's Constant ( H/\text{atm (mole fraction)}^{-1} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>20.0</td>
<td>293.15</td>
<td>3.9</td>
<td>395.2</td>
<td>0.056</td>
<td>69.1</td>
</tr>
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<td></td>
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<td>6.8</td>
<td>689.0</td>
<td>0.097</td>
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</tr>
<tr>
<td></td>
<td></td>
<td>9.7</td>
<td>982.9</td>
<td>0.140</td>
<td></td>
</tr>
<tr>
<td>0.0</td>
<td>273.15</td>
<td>3.9</td>
<td>395.2</td>
<td>0.076</td>
<td>50.9</td>
</tr>
<tr>
<td></td>
<td></td>
<td>6.8</td>
<td>689.0</td>
<td>0.134</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>9.7</td>
<td>982.9</td>
<td>0.190</td>
<td></td>
</tr>
<tr>
<td>-21.6</td>
<td>251.55</td>
<td>3.9</td>
<td>395.2</td>
<td>0.119</td>
<td>33.2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>6.8</td>
<td>689.0</td>
<td>0.203</td>
<td></td>
</tr>
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<td></td>
<td>9.7</td>
<td>982.9</td>
<td>0.288</td>
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</tr>
<tr>
<td></td>
<td></td>
<td>12.6</td>
<td>1276.7</td>
<td>0.379</td>
<td></td>
</tr>
<tr>
<td>-30.0</td>
<td>243.15</td>
<td>4.8</td>
<td>486.4</td>
<td>0.173</td>
<td>27.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4.8</td>
<td>486.4</td>
<td>0.175</td>
<td></td>
</tr>
<tr>
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</tr>
<tr>
<td></td>
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<td>8.7</td>
<td>881.5</td>
<td>0.322</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>8.7</td>
<td>881.5</td>
<td>0.322</td>
<td></td>
</tr>
<tr>
<td></td>
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<td>9.7</td>
<td>982.9</td>
<td>0.361</td>
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<tr>
<td></td>
<td></td>
<td>12.6</td>
<td>1276.7</td>
<td>0.482</td>
<td></td>
</tr>
</tbody>
</table>

'Calculated by compiler. The solvent vapor pressure was neglected.

SOURCE AND PURITY OF MATERIALS:
1. Ethene purity was 99.6%; the impurity consisted of 0.4% nitrogen.
2. The 1,2-dimethylbenzene purity was 99.9% as checked by GC after drying using solid sodium.

ESTIMATED ERROR:

\[ \delta T/K = \pm 0.1 \]
\[ \delta P/P = \pm 0.01 \]
\[ \delta x_1/x_1 = \pm 0.02 \] (Compiler)

REFERENCES:
COMPONENTS:
1. Ethene; C\textsubscript{2}H\textsubscript{4}; [74-85-1]
2. Benzene, 1,2-dimethyl- (o-xylene); C\textsubscript{8}H\textsubscript{10}; [95-47-6]

ORIGINAL MEASUREMENTS:

VARIABLES:

\[
\begin{align*}
T/K &= 213.15-293.15 \\
P/kPa &= 182.4-1276.7 (1.8-12.6 \text{ atm})
\end{align*}
\]

EXPERIMENTAL VALUES: (continued)

<table>
<thead>
<tr>
<th>(t / ^\circ \text{C} )</th>
<th>1/T/K</th>
<th>Total Pressure ( P/\text{atm} )</th>
<th>( P/kPa )</th>
<th>( \text{Mole Fraction Ethene, } z_1 )</th>
<th>Average Henry's Constant ( H/\text{atm (mole fraction)}^{-1} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>-40.0</td>
<td>233.15</td>
<td>1.8</td>
<td>182.4</td>
<td>0.091</td>
<td>21.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3.9</td>
<td>395.2</td>
<td>0.184</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>5.8</td>
<td>587.7</td>
<td>0.276</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>6.8</td>
<td>689.0</td>
<td>0.328</td>
<td></td>
</tr>
<tr>
<td>-60.0</td>
<td>213.15</td>
<td>1.9</td>
<td>192.5</td>
<td>0.162</td>
<td>11.9</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3.9</td>
<td>395.2</td>
<td>0.319</td>
<td></td>
</tr>
</tbody>
</table>

1 Calculated by compiler.

2 The solubilities in xylene at temperatures lower than the xylene freezing point were calculated from the data for ethylbenzene-xylene mixtures given elsewhere in this volume.

The solvent vapor pressure was neglected.

An equation for Henry's constant was given: \( \log_{10} H = 3.90 - 601 (T/K)^{-1} \)

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
For lower pressures a 200 cm\textsuperscript{3} graduated glass cell was used. Solvent was charged to 100 cm\textsuperscript{3}; then the cell and contents were weighed. For degassing, ethene was pressured into the cell from a 170 cm\textsuperscript{3} ss bomb; then the cell was shaken, gas evacuated and cell recharged with ethene several times. After degassing, the cell contents were equilibrated at constant temperature and pressure for 3-4 h. After the volume of solution was measured, the sealed cell was placed in a desiccator and later weighed at room temperature. For higher pressures two cells, one glass the other ss, of identical volume were used simultaneously. The same procedure was used except that the solution volume was measured in the glass cell and the final mass in the ss cell. The glass tended to fail at high pressures.

SOURCE AND PURITY OF MATERIALS:
1. Ethene purity was 99.6%; the impurity consisted of 0.4% nitrogen.
2. The 1,2-dimethylbenzene purity was 99.9% as checked by GC after drying using solid sodium.

ESTIMATED ERROR:
\[
\begin{align*}
\delta T/K &= \pm 0.1 \\
\delta P/P &= \pm 0.01 \\
\delta z_1/z_1 &= \pm 0.02 \text{ (Compiler)}
\end{align*}
\]

REFERENCES:
COMPONENTS:
1. Ethene; C₂H₄; [74-85-1]
2. Benzene, 1,3-dimethyl-,
   (m-xylene); C₆H₁₀; [108-38-3]

ORIGINAL MEASUREMENTS:
Nakamura, E.; Koguchi, K.;
Amemiya, T.

VARIABLES:
\( T/K = 213.15-293.15 \)
\( P/kPa = 182.4-1276.7 \) (1.8-12.6 atm)

PREPARED BY:
W. Hayduk

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>( T/C )</th>
<th>Total Pressure</th>
<th>Mole Fraction</th>
<th>Average Henry's Constant, ( H/\text{atm(mole fraction)} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>20.0</td>
<td>293.15</td>
<td>3.9 395.2</td>
<td>0.058 66.3</td>
</tr>
<tr>
<td>6.8 689.0</td>
<td>0.103</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9.7 982.9</td>
<td>0.146</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.0</td>
<td>273.15</td>
<td>3.9 395.2</td>
<td>0.080 48.7</td>
</tr>
<tr>
<td>6.8 689.0</td>
<td>0.141</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9.7 982.9</td>
<td>0.119</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-20.5</td>
<td>252.65</td>
<td>3.9 395.2</td>
<td>0.120 32.0</td>
</tr>
<tr>
<td>6.8 689.0</td>
<td>0.207</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9.7 982.9</td>
<td>0.302</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12.6</td>
<td>1276.7</td>
<td>0.395</td>
<td></td>
</tr>
<tr>
<td>-40.0</td>
<td>233.15</td>
<td>3.9 395.2</td>
<td>0.189 20.5</td>
</tr>
<tr>
<td>6.8 689.0</td>
<td>0.332</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9.7 982.9</td>
<td>0.510</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-50.0</td>
<td>223.15</td>
<td>1.8 182.4</td>
<td>0.120 15.5</td>
</tr>
<tr>
<td>3.9 385.2</td>
<td>0.250</td>
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</tr>
<tr>
<td>5.8 587.7</td>
<td>0.388</td>
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<td></td>
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<td>-60.0</td>
<td>213.15</td>
<td>1.9 192.5</td>
<td>0.164 11.8</td>
</tr>
<tr>
<td>3.9 395.2</td>
<td>0.331</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.8 486.4</td>
<td>0.441</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\( ^1 \) Calculated by compiler.
\( ^2 \) The solubilities at temperatures lower than the xylene freezing point were calculated from the data for ethylbenzene-xylene mixtures given elsewhere in this volume.
The solvent vapor pressure was neglected.
An equation for Henry's constant was given: \( \log_{10} H = 3.84-591 (T/K)^{-1} \)

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
For lower pressures a 200 cm³ graduated glass cell was used. Solvent was charged to 100 cm³; then the cell and contents were weighed. For degassing, ethene was pressurized into the cell from a 170 cm³ ss bomb; then the cell was shaken, gas evacuated and cell recharged with ethene several times. After degassing, the cell contents were equilibrated at constant temperature and pressure for 3-4 h. After the volume of solution was measured, the sealed cell was placed in a desiccator and later weighed at room temperature. For higher pressures two cells, one glass the other ss, of identical volume were used simultaneously. The same procedure was used except that the solution volume was measured in the glass cell and the final mass in the ss cell. The glass tended to fail at high pressures.

SOURCE AND PURITY OF MATERIALS:
1. Ethene purity was 99.6%; the impurity consisted of 0.4% nitrogen.
2. The 1,3-dimethylbenzene purity was 99.9% as checked by GC after drying using solid sodium.

ESTIMATED ERROR:
\( \delta T/K = \pm 0.1 \)
\( \delta P = \pm 0.01 \)
\( \delta x_1 / x_1 = \pm 0.02 \) (Compiler)

REFERENCES:
COMPONENTS:
1. Ethene; C₂H₄; [74-85-1]
2. Benzene, 1,4-dimethyl-, (p-xylene); C₈H₁₀; [106-42-3]

VARIABLES:

\[ \frac{T}{K} = 233.15 - 303.15 \]
\[ \frac{P}{kPa} = 192.5 - 982.9 \] (1.9-9.7 atm)

PREPARED BY:
W. Hayduk

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>t/C</th>
<th>Total Pressure</th>
<th>Mole Fraction Ethene, ( x_1 )</th>
<th>Average Henry's Constant, ( \frac{H}{atm \text{ (mole fraction)}} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>30.0</td>
<td>303.15</td>
<td>3.9 395.2</td>
<td>0.050</td>
</tr>
<tr>
<td>30.0</td>
<td>303.15</td>
<td>3.9 395.2</td>
<td>0.051</td>
</tr>
<tr>
<td>6.8</td>
<td>689.0</td>
<td>0.091</td>
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<td>6.8</td>
<td>689.0</td>
<td>0.132</td>
<td></td>
</tr>
<tr>
<td>9.7</td>
<td>982.9</td>
<td>0.154</td>
<td></td>
</tr>
<tr>
<td>20.0</td>
<td>293.15</td>
<td>3.9 395.2</td>
<td>0.061</td>
</tr>
<tr>
<td>20.0</td>
<td>293.15</td>
<td>6.8 689.0</td>
<td>0.106</td>
</tr>
<tr>
<td>9.7</td>
<td>982.9</td>
<td>0.154</td>
<td></td>
</tr>
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<td>10.0</td>
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<td>0.125</td>
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<td>6.8</td>
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<td>982.9</td>
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<td>251.95</td>
<td>3.9 395.2</td>
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</tr>
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</tr>
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<tr>
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<td>1.9 192.5</td>
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<tr>
<td>3.9</td>
<td>395.2</td>
<td>0.197</td>
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</tr>
<tr>
<td>6.8</td>
<td>689.0</td>
<td>0.360</td>
<td></td>
</tr>
</tbody>
</table>

1 Calculated by compiler.
2 The solubilities at temperatures lower than the xylene freezing point were calculated from the data for ethylbenzene-xylene mixtures given elsewhere in this volume.

The solvent vapor pressure was neglected.

An equation for Henry's constant was given:

\[ \log_{10} H = 3.71 - 561 \left( \frac{T}{K} \right)^{-1} \]

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

For lower pressures a 200 cm³ graduated glass cell was used. Solvent was charged to 100 cm³; then the cell and contents were weighed. For degassing, ethene was pressured into the cell from a 170 cm³ ss bomb; then the cell was shaken, gas evacuated and cell recharged with ethene several times. After degassing, the cell contents were equilibrated at constant temperature and pressure for 3-4 h. After the volume of solution was measured, the sealed cell was placed in a dessicator and later weighed at room temperature. For higher pressures two cells, one glass the other ss, of identical volume were used simultaneously. The same procedure was used except that the solution volume was measured in the glass cell and the final mass in the ss cell. The glass tended to fail at high pressures.

SOURCE AND PURITY OF MATERIALS:

1. Ethene purity was 99.6%; the impurity consisted of 0.4% nitrogen.
2. The 1,4-dimethylbenzene purity was 99.9% as checked by GC after drying using solid sodium.

ESTIMATED ERROR:

\[ \delta \frac{T}{K} = \pm 0.1 \]
\[ \delta \frac{P}{P} = \pm 0.01 \]
\[ \delta \frac{x_1}{x_1} = \pm 0.02 \] (Compiler)

REFERENCES:
COMPONENTS:
1. Ethene; C₂H₄; [74-85-1]
2. Ethylbenzene; C₆H₅CH₃; [100-41-4]

VARIABLES:

\[ \frac{T}{K} = 195.15 - 293.15 \]
\[ P/kPa = 121.6 - 1277 \text{ (1.2-12.6 atm)} \]

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>t/C</th>
<th>[1/T]</th>
<th>Total Pressure P/atm</th>
<th>Mole Fraction Ethene, [x]</th>
<th>Average Henry's Constant H/atm (mole fraction)⁻¹</th>
</tr>
</thead>
<tbody>
<tr>
<td>20.0</td>
<td>293.15</td>
<td>3.9</td>
<td>395.2</td>
<td>0.057</td>
</tr>
<tr>
<td>6.8</td>
<td>689.0</td>
<td>0.103</td>
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<td></td>
</tr>
<tr>
<td>9.7</td>
<td>982.9</td>
<td>0.154</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.0</td>
<td>273.15</td>
<td>3.9</td>
<td>395.2</td>
<td>0.080</td>
</tr>
<tr>
<td>6.8</td>
<td>689.0</td>
<td>0.139</td>
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<td></td>
</tr>
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<td>9.7</td>
<td>982.9</td>
<td>0.201</td>
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<td>395.2</td>
<td>0.121</td>
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<td>0.190</td>
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<td>689.0</td>
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<td>0.516</td>
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<td>192.5</td>
<td>0.160</td>
</tr>
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<td>3.9</td>
<td>395.2</td>
<td>0.338</td>
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<td></td>
</tr>
<tr>
<td>4.8</td>
<td>486.4</td>
<td>0.495</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-77.2</td>
<td>195.95</td>
<td>1.2</td>
<td>121.6</td>
<td>0.159</td>
</tr>
<tr>
<td>1.9</td>
<td>192.5</td>
<td>0.279</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.9</td>
<td>293.8</td>
<td>0.284</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.9</td>
<td>293.8</td>
<td>0.284</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1Calculated by compiler. The solvent vapor pressure was neglected.

An equation for Henry's constant was given:

\[ \log_{10}H = 3.77 - 571 \left( \frac{T}{K} \right)^{-1} \]

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

For lower pressures a 200 cm³ graduated glass cell was used. Solvent was charged to 100 cm³; then the cell and contents were weighed. For degassing, ethene was pressured into the cell from a 170 cm³ ss bomb; then the cell was shaken, gas evacuated and cell recharged with ethene several times. After degassing, the cell contents were equilibrated at constant temperature and pressure for 3-4 h. After the volume of solution was measured, the sealed cell was placed in a desiccator and later weighed at room temperature. For higher pressures two cells, one glass the other ss, of identical volume were used simultaneously. The same procedure was used except that the solution volume was measured in the glass cell and the final mass in the ss cell. The glass tended to fail at high pressures.

SOURCE AND PURITY OF MATERIALS:

1. Ethene purity was 99.6%; the impurity was nitrogen, 0.4%.
2. Ethyl benzene source and purity not given.

ESTIMATED ERROR:

\[ \delta T/K = \pm 0.1 \]
\[ \delta P/P = \pm 0.01 \]
\[ \delta x_1/x_1 = \pm 0.02 \text{ (compiler)} \]

REFERENCES:

COMPONENTS:

1. Ethene; \( C_2 H_4 \); [74-85-1]
2. Benzene, 1,2-dimethyl-,
   (o-xylene); \( C_8 H_{10} \); [95-47-6]
3. Ethylbenzene; \( C_8 H_{10} \); [100-41-4]

ORIGINAL MEASUREMENTS:

Nakamura, E.; Koguchi, K.;
Amemiya, T.

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>( t / {^\circ}C )</th>
<th>( T / {^\circ}K )</th>
<th>( P / \text{atm} )</th>
<th>( P / \text{kPa} )</th>
<th>( \text{Number of Moles, } x = 0.311-0.593 )</th>
<th>( \text{Mole Fraction Ethylbenzene in Solvent, } x_3 )</th>
<th>( \text{Mole Fraction Ethene, } x_1 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>-40.0</td>
<td>233.15</td>
<td>1.8</td>
<td>182.4</td>
<td>( e:0.5545 )</td>
<td>0.0809</td>
<td>0.311</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>( e:0.2504 )</td>
<td></td>
<td>0.091</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3.9</td>
<td>395.2</td>
<td>( e:0.4854 )</td>
<td>0.1608</td>
<td>0.311</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5.8</td>
<td>587.7</td>
<td>( e:0.5497 )</td>
<td>0.3066</td>
<td>0.311</td>
</tr>
<tr>
<td></td>
<td></td>
<td>6.8</td>
<td>689.0</td>
<td>( e:0.5249 )</td>
<td>0.3722</td>
<td>0.311</td>
</tr>
<tr>
<td>-60.0</td>
<td>213.15</td>
<td>1.9</td>
<td>192.5</td>
<td>( e:0.3272 )</td>
<td>0.1540</td>
<td>0.593</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3.9</td>
<td>395.2</td>
<td>( e:0.4768 )</td>
<td></td>
<td>0.161</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>( e:0.4755 )</td>
<td></td>
<td>0.331</td>
</tr>
</tbody>
</table>

1 Calculated by compiler.
2 The symbols \( o \), and \( e \), refer to actual number of moles of o-xylene, and ethylbenzene, in gas-free solvent solution, respectively.
3 The ethene-free solvent composition \( (x'_3) \) was calculated by the compiler.

The purpose of these low temperature measurements was to determine the hypothetical solubility in xylene below the xylene freezing point.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

For lower pressures a 200 cm³ graduated glass cell was used. Solvent was charged to 100 cm³; then the cell and contents were weighed. For degassing, ethene was pressured into the cell from a 170 cm³ ss bomb; then the cell was shaken, gas evacuated and cell recharged with ethene several times. After degassing, the cell contents were equilibrated at constant temperature and pressure for 3-4 h. After the volume of solution was measured, the sealed cell was placed in a desiccator and later weighed at room temperature. For higher pressures two cells, one glass the other ss, of identical volume were used simultaneously. The same procedure was used except that the solution volume was measured in the glass cell and the final mass in the ss cell. The glass tended to fail at high pressures.

SOURCE AND PURITY OF MATERIALS:

1. Ethene purity was 99.6%.
2. 1,2-Dimethylbenzene purity was 99.9% as determined by GC.
3. Ethylbenzene source and purity not given.

ESTIMATED ERROR:

\[ \delta T/\text{K} = \pm 0.1 \]
\[ \delta P/\text{P} = \pm 0.01 \]
\[ \delta x'_3/x'_1 = \pm 0.02 \text{ (Compiler)} \]

REFERENCES:
COMPONENTS:
1. Ethene, \( \text{C}_2\text{H}_4 \); [74-85-1]
2. Benzene, 1,3-dimethyl-, (m-xylene), \( \text{C}_8\text{H}_{10} \); [108-38-3]
3. Ethylbenzene, \( \text{C}_8\text{H}_{10} \); [100-41-4]

VARIABLES:
\( T/K = 213.15 \)
\( P/kPa = 192.5-486.4 \) (1.9-4.8 atm)
Ethylbenzene mole fr., \( x_3 \): 0.298

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>( t/C )</th>
<th>( T/K )</th>
<th>Total Pressure ( P/\text{atm} )</th>
<th>Number of Moles,</th>
<th>( \text{Mole Fraction} ) Ethylbenzene ( x_3 )</th>
<th>( \text{Mole Fraction} ) Ethene ( x_1 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>-60.0</td>
<td>213.15</td>
<td>1.9</td>
<td>192.5</td>
<td>m=0.5630</td>
<td>0.1561</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3.9</td>
<td>395.2</td>
<td>m=0.5677</td>
<td>0.4032</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4.8</td>
<td>486.4</td>
<td>m=0.5677</td>
<td>0.6210</td>
</tr>
</tbody>
</table>

1 Calculated by compiler.
2 The symbols \( m \), and \( e \), refer to actual number of moles of m-xylene, and ethylbenzene, in gas-free solvent solution, respectively.
3 The ethene-free solvent composition \( (x'_1) \) was calculated by the compiler.

The purpose of these low temperature measurements was to determine the hypothetical solubility in xylene below the xylene freezing point.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
For lower pressures a 200 cm³ graduated glass cell was used. Solvent was charged to 100 cm³; then the cell and contents were weighed. For degassing, ethene was pressured into the cell from a 170 cm³ ss bomb; then the cell was shaken, gas evacuated and cell recharged with ethene several times. After degassing, the cell contents were equilibrated at constant temperature and pressure for 3-4 h. After the volume of solution was measured, the sealed cell was placed in a desiccator and later weighed at room temperature. For higher pressures two cells, one glass the other ss, of identical volume were used simultaneously. The same procedure was used except that the solution volume was measured in the glass cell and the final mass in the ss cell. The glass tended to fail at high pressures.

SOURCE AND PURITY OF MATERIALS:
1. Ethene purity was 99.6%.
2. 1,3-Dimethylbenzene purity was 99.9%.
3. Ethylbenzene purity not given.

ESTIMATED ERROR:
\( \delta T/K = \pm 0.1 \)
\( \delta T/P = \pm 0.01 \)
\( \delta x_3/x_1 = \pm 0.02 \) (Compiler)

REFERENCES:

ORIGINAL MEASUREMENTS:
Nakamura, E.; Koguchi, K.;
Amemiya, T.
COMPONENTS:
1. Ethene; C₂H₄; [74-85-1]
2. Benzene, 1,4-dimethyl-,
(p-xylene); C₆H₄; [106-42-3]
3. Ethylbenzene; C₈H₁₀; [100-41-4]

ORIGINAL MEASUREMENTS:
Nakamura, E.; Koguchi, K.;
Amemiya, T.

PREPARED BY:
W. Hayduk

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>t/C</th>
<th>T/K</th>
<th>Total Pressure</th>
<th>Number of Moles</th>
<th>Mole Fraction</th>
<th>Mole Fraction</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>P/atm</td>
<td>2P/kPa</td>
<td>Solvent</td>
<td>Ethene</td>
</tr>
<tr>
<td>0.0</td>
<td>273.15</td>
<td>3.9</td>
<td>395.2</td>
<td>p:0.5525</td>
<td>0.0699</td>
</tr>
<tr>
<td>6.8</td>
<td>689.0</td>
<td>p:0.5613</td>
<td>0.1358</td>
<td>0.3041</td>
<td>0.144</td>
</tr>
<tr>
<td>9.7</td>
<td>982.9</td>
<td>p:0.5567</td>
<td>0.2053</td>
<td>0.3041</td>
<td>0.204</td>
</tr>
<tr>
<td>-21.2</td>
<td>251.95</td>
<td>3.9</td>
<td>395.2</td>
<td>p:0.3505</td>
<td>0.1144</td>
</tr>
<tr>
<td>6.8</td>
<td>689.0</td>
<td>p:0.3536</td>
<td>0.2214</td>
<td>0.5599</td>
<td>0.216</td>
</tr>
<tr>
<td>9.7</td>
<td>982.9</td>
<td>p:0.3530</td>
<td>0.3540</td>
<td>0.5599</td>
<td>0.306</td>
</tr>
<tr>
<td>-40.0</td>
<td>233.15</td>
<td>1.9</td>
<td>192.5</td>
<td>p:0.2172</td>
<td>0.0834</td>
</tr>
<tr>
<td>3.9</td>
<td>395.2</td>
<td>p:0.2177</td>
<td>0.1904</td>
<td>0.7285</td>
<td>0.192</td>
</tr>
<tr>
<td>6.8</td>
<td>689.0</td>
<td>p:0.2197</td>
<td>0.4125</td>
<td>0.7285</td>
<td>0.338</td>
</tr>
</tbody>
</table>

1 Calculated by compiler.
2 The symbols p and e refer to actual number of moles of p-xylene, and ethylbenzene, in gas-free solvent solution, respectively.
3 The ethene-free solvent composition (x_e) was calculated by the compiler. The purpose of these low temperature measurements was to determine the hypothetical solubility in xylene below the xylene freezing point.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
For lower pressures a 200 cm³ graduated glass cell was used. Solvent was charged to 100 cm³; then the cell and contents were weighed. For degassing, ethene was pressured into the cell from a 170 cm³ ss bomb; then the cell was shaken, gas evacuated and cell recharged with ethene several times. After degassing, the cell contents were equilibrated at constant temperature and pressure for 3-4 h. After the volume of solution was measured, the sealed cell was placed in a desiccator and later weighed at room temperature. For higher pressures two cells, one glass the other ss, of identical volume were used simultaneously. The same procedure was used except that the solution volume was measured in the glass cell and the final mass in the ss cell. The glass tended to fail at high pressures.

SOURCE AND PURITY OF MATERIALS:
1. Ethene purity was 99.6%.
2. 1,4-Dimethylbenzene purity was 99.9% as determined by GC.
3. Ethylbenzene source and purity not given.

ESTIMATED ERROR:
δT/K = ± 0.1
δP/P = ± 0.01
δx_e/x_e = ± 0.02 (Compiler)

REFERENCES:
Critical Evaluation of Ethene Solubility in Alkanols and Other Alcohols

for pressures Less than 0.2 MPa

The solubilities of ethene in normal alkanols for a pressure of essentially 101.3 kPa were reported by some seven groups of researchers (1-7). Only for two of these solvents, for methanol and butanol, were data provided over temperature range greater than 10 K. In addition, ethene solubilities are available for 2-propanol (7), cyclohexanol (8), dipropylene glycol (9), phenol (9) and benzyl alcohol (9). Finally, solubilities are available for a two-component solvent solution composed of 1-butanol and 1,2-ethanediol (ethylene glycol) (10) at 298.15 K.

It is useful to test whether the solubility of ethene at one temperature (298.15 K) follows a linear relation in the normal alcohols when plotted as \( \log x_1 \) versus \( \log C_n \) where \( x_1 \) is the mole fraction solubility and \( C_n \) is the number of carbon atoms in each of the alkanols.

It was previously found that such a linear relation was obtained for the solubilities of ethane (11) and for propane, butane and 2-methylpropane as well (12). Only three research groups reported ethene solubilities in more than one alkanol solvent. Boyer and Bircher (2) provided solubility data for all the alkanols from methanol to 1-octanol at 298.15, Narasimhan et al. (4) for ethanol to 1-pentanol and Yano et al. (5) provided data for methanol to 1-propanol. These data especially, provide a means for testing the consistency of the data at 298.15 K among three groups.

Figure 1 shows all the available data for ethene solubilities at 298.15 K in the alkanols from methanol to 1-octanol as the mole fraction solubility, \( x_1 \), versus the solvent carbon number on log scales. It may be observed that the data appear consistent except for the solubilities in methanol. For this solvent only, the data of Boyer and Bircher (2) appear consistent while that of Narasimhan et al. (4) and Yano et al. (5) appear too high by more than 5% whereas the data of Ohgaki et al. (3) appear too low by more than 5%. It will be shown subsequently that the data of Boyer and Bircher in methanol are also consistent with the extrapolated data of Hannaert et al. (6) and Shenderei et al. (1). The resulting linear relation for the solubility of ethene in the alkanols for a gas partial pressure of 101.3 kPa and a temperature of 298.15 K, excluding the data outside the 5% range mentioned above, and expressed in two ways is:

\[
\log x_1 = 0.5140 \log C_n - 2.3702 \tag{1}
\]

\[
x_1 = 0.004264 C_n^{0.5140}
\]

The correlation coefficient for equation (1) is 0.9950 and the maximum deviation of the 15 data points from the calculated line is 5%. Based on equation (1) the solubilities were calculated and are shown in Table 1.

Table 1: Calculated solubility of ethene in the alkanols at 298.15 K and 101.3 kPa partial pressure

<table>
<thead>
<tr>
<th>( C_n )</th>
<th>1 (methanol)</th>
<th>2 (ethanol)</th>
<th>3 (propanol)</th>
<th>4 (butanol)</th>
<th>5 (pentanol)</th>
<th>6 (hexanol)</th>
<th>7 (heptanol)</th>
<th>8 (octanol)</th>
</tr>
</thead>
<tbody>
<tr>
<td>( x_1 )</td>
<td>0.00426</td>
<td>0.00609</td>
<td>0.00750</td>
<td>0.00869</td>
<td>0.00975</td>
<td>0.0107</td>
<td>0.0116</td>
<td>0.0124</td>
</tr>
<tr>
<td>( C_n )</td>
<td>0.00426</td>
<td>0.00609</td>
<td>0.00750</td>
<td>0.00869</td>
<td>0.00975</td>
<td>0.0107</td>
<td>0.0116</td>
<td>0.0124</td>
</tr>
</tbody>
</table>
**COMPONENTS:**

1. Ethene; \( \text{C}_2\text{H}_4 \); \([74-85-1]\)
2. Alkanols; methanol to 1-octanol for pressures less than 0.2 MPa (2 atm)

**EVALUATOR:**

W. Hayduk  
Chemical Engineering  
University of Ottawa  
Ottawa, Ontario  
Canada K1N 6N5  
June, 1992

**CRITICAL EVALUATION:**

Fig. 1 Solubility of ethene in alkanols from methanol to 1-octanol at 298.15 K and an ethene partial pressure of 101.3 kPa.
COMPONENTS:
1. Ethene; C2H4; [74-85-1]
2. Alcohols; pressures less than 0.2 MPa (2 atm)

EVALUATOR:
W. Hayduk
Chemical Engineering
University of Ottawa
Ottawa, Ontario
Canada KIN 6N5
June, 1992

CRITICAL EVALUATION:

Solubilities in the individual solvents are discussed in more detail below.

Methanol; CH4O; [67-56-1]

Solubilities of ethene in methanol were measured at temperatures from 298.15 K (25°C) to 217.15 K (-56°C) but, surprisingly, there are no data above 298.15 K. The low temperature values of Shenderei et al. (1) and Hanneart et al. (6) as well as that of Boyer and Bircher (2) at 298.15 K are highly consistent and can be represented by the following linear relationship in which T is in K and $x_1$ is the mole fraction solubility:

$$\log x_1 = 574.8/ (T/K) - 4.284$$ (2)

The correlation coefficient for the regression line is 0.9992. The values for the ethene solubility in methanol as expressed by equation (2) are classified as tentative for the temperature range from 217.15 K to 298.15 K and are shown in Table 2.

<table>
<thead>
<tr>
<th>$t$, °C</th>
<th>$T$, K</th>
<th>$x_1$, Mole fraction ethene</th>
</tr>
</thead>
<tbody>
<tr>
<td>25</td>
<td>298.15</td>
<td>0.00440</td>
</tr>
<tr>
<td>20</td>
<td>293.15</td>
<td>0.00475</td>
</tr>
<tr>
<td>10</td>
<td>283.15</td>
<td>0.00557</td>
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<tr>
<td>0</td>
<td>273.15</td>
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<tr>
<td>-10</td>
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<td>0.00795</td>
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<td>-20</td>
<td>253.15</td>
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</tr>
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<td>-30</td>
<td>243.15</td>
<td>0.0120</td>
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<tr>
<td>-40</td>
<td>233.15</td>
<td>0.0152</td>
</tr>
<tr>
<td>-50</td>
<td>223.15</td>
<td>0.0196</td>
</tr>
</tbody>
</table>

Ethanol; C2H6O; [64-17-5]

The three values of Boyer and Bircher (2), Narasimhan et al. (4) and Yano et al. (5) for ethene solubility in ethanol at 298.15 K are within 2% of the average value which corresponds to a mole fraction at an ethene partial pressure of 101.3 kPa of $x_1 = 0.00614$. The solubility of Narasimhan et al. at 293.15 K is consistent with those at 298.15 K. These solubilities are classified as tentative.

Further, if it is assumed that the temperature coefficient of solubility is the same as for methanol, extrapolation to other temperatures may be made using the following equation:

$$\log x_1 = 574.8/(T/K) - 4.140$$ (3)

The above equation is not recommended if accurate results are required and for extrapolation to temperatures far from the ambient.
**COMPONENTS:**

1. Ethene; C₂H₄; [74-85-1]
2. Alcohols; pressures less than 0.2 MPa (2 atm)

**EVALUATOR:**

W. Hayduk
Chemical Engineering
University of Ottawa
Ottawa, Ontario
Canada K1N 6N5
June, 1992

**CRITICAL EVALUATION:**

1-Propanol; C₃H₈O; [71-23-8]

The three values of Boyer and Bircher (2), Narasimhan et al. (4) and Yano et al. (5) for ethene solubility in 1-propanol at 298.15 K are within 3% of the average value which corresponds to a mole fraction at an ethene partial pressure of 101.3 kPa of \( x_1 = 0.00737 \). The solubilities of Narasimhan et al., and Boyer and Bircher at 293.15 K, and 308.15 K, respectively, are consistent with those at 298.15 K. These solubilities are classified as tentative.

Further, if it is assumed that the temperature coefficient of solubility in 1-propanol is the same as that in 1-butanol (see below), extrapolation to other temperatures may be made using the following equation:

\[
\log x_1 = \frac{543.6}{T/\text{K}} - 3.956
\]

The above equation is considered to be the best available relation for the solubility of ethene in 1-propanol and is classified as tentative for the temperature range for which data are available, that is from 263.95 K to 343.15 K. Solubilities calculated by means of equation (5) are listed in Table 3.

**1-Butanol; C₄H₁₀O; [71-36-3]**

Three research groups have contributed to the solubility data for ethene in 1-butanol; these are Narasimhan et al. (4) Boyer and Bircher (2) and Sahgal et al. (7). The temperature span of the data, nearly 80 K, permits a reasonably good estimate of the temperature coefficient of solubility. A regression line including the 8 data points yields the following equation with a maximum deviation of 5% and a correlation coefficient of 0.9942:

\[
\log x_1 = \frac{543.6}{T/\text{K}} - 3.890
\]

The above equation is considered to be the best available relation for the solubility of ethene in 1-butanol and is classified as tentative for the temperature range for which data are available, that is from 263.95 K to 343.15 K. Solubilities calculated by means of equation (5) are listed in Table 3.

**1-Pentanol; C₅H₁₂O; [71-41-0]**

The two values for ethene solubilities in 1-pentanol at 298.15 K (2,4) are within 2% of the average value which corresponds to a mole fraction...
fraction of $x_1 = 0.0102$. The solubilities of Narisamhan et al. (4) and Boyer and Birch (2), at 293.15 K and 308.15 K, respectively, are consistent with those at 298.15 K. These solubilities are classified as tentative.

Further, if it is assumed that the temperature coefficient of solubility in 1-pentanol is the same as that in 1-butanol, extrapolation to other temperatures may be made using the following equation:

$$\log x_1 = \frac{543.6}{T/K} - 3.185$$ (6)

While the above equation represents the limited solubility data, it is not recommended if accurate data are required outside the temperature range within which experimental results are available.

1-Hexanol; C₆H₁₄O; [111-27-3]
1-Heptanol; C₇H₁₆O; [110-70-6]
1-Octanol; C₈H₁₈O; [111-87-5]

Only the data of Boyer and Birch (2) are available for the solubilities of ethene at an ethene partial pressure of 101.3 kPa in 1-hexanol, 1-heptanol and 1-octanol at 298.15 K and in the latter solvent at 308.15 K as well. The data of Boyer and Birch appear entirely consistent with those of other researchers when comparisons are possible. Hence these data are classified as tentative.

Since extrapolation to other temperatures is often required, equations will be provided based on the temperature coefficient of solubility in 1-butanol:

For 1-hexanol:

$$\log x_1 = \frac{543.6}{T/K} - 3.794$$ (7)

For 1-heptanol:

$$\log x_1 = \frac{543.6}{T/K} - 3.755$$ (8)

For 1-octanol

$$\log x_1 = \frac{543.6}{T/K} - 3.718$$ (9)

It is emphasized that the above equations are approximate only, and are based on few data and uncertain temperature coefficients of solubility.

Figure 2 is shown for three reasons. First it summarizes most of the available data for the solubilities of ethene in the normal alcohols at low pressure. Next it emphasizes the scarcity of the data for most temperatures above and below the ambient even in these common solvents. Finally, Figure 2 shows the diagrammatic representation of the extrapolating equations, Equations 2 to 9, that are listed in this Critical Evaluation.

2-Propanol (isopropanol); C₃H₈O; [67-63-0]

Ethene solubilities in 2-propanol were reported for three temperatures, 273.15, 298.15 and 323.15 K, by Sahgal et al. (7). The solubilities in this branch-chained alcohol are some 11% lower than in the straight-chained alcohol, 1-propanol. The temperature span is sufficient to calculate an equation for interpolating or extrapolating the data:
Fig. 2 Ethene solubility in alkanols for an ethene partial pressure of 101.3 KPa as a function of temperature.
COMPONENTS:

1. Ethene; C₂H₄; [74-85-1]
2. Alcohols; pressures less than 0.2 MPa (2 atm)

CRITICAL EVALUATION:

\[
\log \alpha = \frac{581.7}{(T/K)} - 4.1247
\]  

(10)

The above equation should not be considered accurate beyond the temperature range for which it was developed. Calculated values of solubility based on equation (10) are listed in Table 4. These data are classified as tentative.

Table 4: Ethene solubilities in 2-propanol for a gas partial pressure of 101.3 kPa as calculated using equation (1)

<table>
<thead>
<tr>
<th>T, °C</th>
<th>T, K</th>
<th>αᵣ, Mole fraction ethene</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>273.15</td>
<td>0.0101</td>
</tr>
<tr>
<td>10</td>
<td>283.15</td>
<td>0.00851</td>
</tr>
<tr>
<td>20</td>
<td>293.15</td>
<td>0.00724</td>
</tr>
<tr>
<td>25</td>
<td>298.15</td>
<td>0.00671</td>
</tr>
<tr>
<td>30</td>
<td>303.15</td>
<td>0.00623</td>
</tr>
<tr>
<td>40</td>
<td>313.15</td>
<td>0.00541</td>
</tr>
<tr>
<td>50</td>
<td>323.15</td>
<td>0.00474</td>
</tr>
</tbody>
</table>

Cyclohexanol; C₆H₁₂O; [108-93-0]

Cauquil's (8) single value for the ethene solubility in cyclohexanol is rejected for two reasons. It is most unlikely that the solubility in cyclohexanol will be only about one tenth that in 1-hexanol. Also Clever (13) found that the value reported by Cauquil for the solubility of methane in cyclohexanol was only one half that found by reliable researchers.

1,2-Ethanediol (ethylene glycol); C₂H₅O₂; [107-21-1]

Two groups of researchers measured the solubility of ethene in 1,2-ethanediol. These were Sahgal et al. (7) at 298.15 K and Hannaert et al. (6) at 303.15 K. The value of Hannaert et al. is less than half that of Sahgal et al., a most unlikely reduction in solubility for an increase in temperature of 5 K. Since the work was conducted under my supervision, I am aware of the care that was taken to ensure saturation of this viscous solvent and, therefore, believe the higher solubility to be correct. The value of Hannaert et al. was measured by a gas chromatographic method which in many instances has been subject to errors. The former value is classified as tentative.

2,2-[1,2 Ethanediylbis (oxy)] bis-ethanol, (triethylene glycol); C₆H₁₄O₄; [112-27-6]

The solubility of ethene in triethylene glycol was measured by Hannaert et al. for a temperature of 303.15 K. There is some doubt as to the accuracy of the chromatographic method used by these workers (see above) for viscous solvents, but no real comparison is possible in this case. Therefore, the value reported is classified as tentative.

Propanol, oxybis-, (Dipropylene glycol); C₆H₁₄O₃; [25265-71-8]

Phenol; C₆H₅O; [108-95-2]

Benzenemethanol (benzyl alcohol); C₇H₈O; [100-51-6]

Lenoir et al. (9) reported ethene solubility data for the solvents oxybispropanol, phenol and benzenemethanol. Their method of measurement involved gas chromatography at very low gas partial pressures with the
COMPONENTS:

1. Ethene; $C_2H_4$; [74-85-1]
2. Alcohols; pressures less than 0.2 MPa (2 atm)

EVALUATOR:

W. Hayduk
Chemical Engineering
University of Ottawa
Ottawa, Ontario
Canada K1N 6N5
June, 1992

CRITICAL EVALUATION:

result that extrapolation of the data to pressures in the order of 101.3 kPa is considered to involve significant errors. Because there are not other comparable results, these data are classified as tentative.

1-Butanol and 1,2-Ethanediol (ethylene glycol) solutions; $C_4H_{10}O$; [71-36-3] and $C_2H_5O_2$; [107-21-1]

Sahgal and Hayduk (10) reported solubilities of ethene at 101.3 kPa pressure at 298.15 K in the two-component solvent solutions composed of 1-butanol and 1,2-ethanediol (ethylene glycol). All compositions from pure 1-butanol to pure 1,2-ethanediol were used. These results are consistent with those for the pure solvents and are classified as tentative.

References

**COMPONENTS:**
1. Ethene; C₂H₄; [74-85-1]
2. Methanol; CH₃O; [67-56-1]

**ORIGINAL MEASUREMENTS:**

**VARIABLES:**
T/K = 217-273
P/kPa = 101.325

**EXPERIMENTAL VALUES:**

<table>
<thead>
<tr>
<th>t/C</th>
<th>T/K</th>
<th>Henry’s Constant H/atm (mole fraction)⁻¹</th>
<th>Mole Fraction Ethene, x₁</th>
<th>Partial Molal Volume Ethene Vᵢ/cm³ (mole)⁻¹</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>273.15</td>
<td>152.2</td>
<td>0.00657</td>
<td>--</td>
</tr>
<tr>
<td>-10</td>
<td>263.15</td>
<td>126.3</td>
<td>0.00792</td>
<td>--</td>
</tr>
<tr>
<td>-25</td>
<td>248.15</td>
<td>91.5</td>
<td>0.0109</td>
<td>62.5</td>
</tr>
<tr>
<td>-35</td>
<td>238.15</td>
<td>72.5</td>
<td>0.0138</td>
<td>59.0</td>
</tr>
<tr>
<td>-45</td>
<td>228.15</td>
<td>56.3</td>
<td>0.0178</td>
<td>55.0</td>
</tr>
<tr>
<td>-56</td>
<td>217.15</td>
<td>42.3</td>
<td>0.0236</td>
<td>--</td>
</tr>
</tbody>
</table>

The authors expressed the effect of temperature on H by:

\[
\log H = 4.336 + 590(T/K)^{-1}
\]

Partial molal volume of ethylene dissolved in methanol at low temperatures are also given.

¹Calculated by compiler for an ethylene partial pressure of 101.325 kPa.

**METHOD/APPARATUS/PROCEDURE:**
Glass equilibrium cell fitted with a magnetic stirrer. Pressure measured with a Bourdon gauge. Samples of liquid analyzed by stripping out ethene. The solubilities were measured at several pressures below atmospheric and Henry’s constant was determined. Details in ref. (1).

**SOURCE AND PURITY OF MATERIALS:**
1. Commercial ethene was purified by absorption and complex formation at 0°C under pressure in cuprous chloride. Impurities were not absorbed. The ethylene was regenerated at 60°C, condensed, and analyzed by GC.

2. Distilled.

Actual purities not given.

**REFERENCES:**
COMPONENTS:
(1) Ethene; \( \text{C}_2\text{H}_4; \) [74-85-1]
(2) Methanol; \( \text{CH}_3\text{OH}; \) [67-56-1]

ORIGINAL MEASUREMENTS:
Boyer, F. L.; Bircher, L. J.

VARIABLES:

<table>
<thead>
<tr>
<th>( \text{T/K} )</th>
<th>( \text{P/kPa} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>298.15</td>
<td>101.325 (1 atm)</td>
</tr>
</tbody>
</table>

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

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>( \text{T/K} )</th>
<th>Mol Fraction</th>
<th>Bunsen Coefficient(^1)</th>
<th>Ostwald Coefficient(^3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>298.15</td>
<td>43.9</td>
<td>2.41</td>
<td>2.63 ( \pm 0.02 )</td>
</tr>
</tbody>
</table>

\(^1\) \( \text{cm}^3\text{(STP)} \text{cm}^{-3} \text{atm}^{-1} \)

The Bunsen coefficient was calculated by the compiler.

The mole fraction solubility was calculated from Boyer's thesis (1).

The author's observed a linear relationship between the logarithm of the mole fraction solubility and the number of linear alcohol carbon atoms. Boyer's thesis gives the equations:

\[
\log x_l = -2.387 + 0.543 \log C \text{ for } 298.15 \text{ K}
\]

\[
\log x_l = -2.474 + 0.580 \log C \text{ for } 308.15 \text{ K}
\]

where \( C \) is the number of alcohol carbon atoms. Most of the mole fraction solubility values given in Table II of the paper were calculated from the equation for 298.15 K.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

A commercial Van Slyke blood gas apparatus (E. H. Sargent Co.) was modified by the authors. The total pressure of the gas and the solvent vapor in the solution chamber was adjusted to a pressure of one atm. The pressure was maintained at one atm during the solution process. The saturated solution was transferred to a bulb below the lower stopcock of the extraction vessel and sealed off. The gas and solvent vapor were then brought to volume over mercury. See (2) for details of the extraction procedure.

SOURCE AND PURITY OF MATERIALS:

(1) Ethene. Matheson Co. Stated to be 99.5 mol per cent.
(2) Methanol. Source not given. Treated by standard methods to remove aldehydes and ketones, then dried and distilled.

ESTIMATED ERROR:

\[
\delta \text{T/K} = \pm 0.01
\]

\[
\delta \text{L/cm}^3 = \pm 0.02
\]

REFERENCES:

COMPONENTS:
1. Ethene; \( \text{C}_2\text{H}_4 \); [74-85-1]
2. Methanol; \( \text{C}_2\text{H}_5\text{OH} \); [67-56-1]

ORIGINAL MEASUREMENTS:
Ohgaki, K.; Nishii, H.;
Katayama, T.

VARIABLES:
\[ T/\text{K} = 298.15 \pm 0.01 \]
\[ P/\text{kPa} = 60.8 - 97.0 \]

PREPARED BY:
W. Hayduk

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>Total Pressure ( P/\text{kPa} )</th>
<th>Liquid Mole fraction ( (10^4)x_1 )</th>
<th>Gas Mole fraction ( y_1 )</th>
<th>Henry's Constant, MPa ( H = p_1/x_1 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>60.771</td>
<td>1.568</td>
<td>0.7103</td>
<td>27.26</td>
</tr>
<tr>
<td>61.564</td>
<td>1.573</td>
<td>0.7140</td>
<td>27.68</td>
</tr>
<tr>
<td>87.980</td>
<td>2.541</td>
<td>0.7986</td>
<td>27.30</td>
</tr>
<tr>
<td>97.007</td>
<td>2.842</td>
<td>0.8169</td>
<td>27.50</td>
</tr>
</tbody>
</table>

Average = 27.43

The solubility calculated by compiler for an ethylene partial pressure of 101.325 kPa is \( x_1 = 0.00369 \) mole fraction ethylene.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
A small (20 cm\(^3\)) magnetically stirred absorption vessel was connected to a larger (100 cm\(^3\)) gas reservoir at higher pressure in a constant temperature bath. The volumes of lines, valves and vessels were accurately determined. A quartz Bourdon gauge was used to measure the system pressure. A known mass of deaerated solvent was charged to the absorption vessel and the amount of vapor released on charging was estimated. Gas was charged incrementally to maintain a constant pressure until no additional gas was required. The change in pressure in the gas supply reservoir was used to determine the quantity consumed.

SOURCE AND PURITY OF MATERIALS:
1. Ethene, min. purity 99.95%.
2. Methanol, spectrograde, actual purity unspecified.

ESTIMATED ERROR:
\[ \delta T/\text{K} = \pm 0.01 \]
\[ \delta x_1/x_1 = \pm 0.5\% \text{ (authors)} \]

REFERENCES:
COMPONENTS:
1. Ethene; C₂H₄; [74-85-1]
2. Methanol; CH₃OH; [67-56-1]

ORIGINAL MEASUREMENTS:
Narasimhan, S.; Natarajan, G.S.; Nageshwar, G.D.


VARIABLES: T/K = 293.15, 298.15
P/kPa = 101.325

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>t/C</th>
<th>T/K</th>
<th>P = 101.325xₐ</th>
<th>p = 101.325xₐ</th>
<th>( ^{1}\text{Ostwald Coefficient} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>293.15</td>
<td>0.00484</td>
<td>0.00554</td>
<td>3.29</td>
</tr>
<tr>
<td>25</td>
<td>298.15</td>
<td>0.00422</td>
<td>0.00505</td>
<td>3.03</td>
</tr>
</tbody>
</table>

\( ^{1}\)Calculated by compiler. It is assumed that the mole fraction solubility, \( x \), as originally given, is for a total pressure of 101.325 kPa although not specifically so stated in the paper. The mole fraction solubility is calculated for a partial pressure of 101.325 kPa.

Gas molar volumes of 23910, and 24330 cm³/mole were used for the temperatures 293.15 K, and 298.15 K, respectively, and for a pressure of 101.325 kPa when calculating \( L \).

It was confirmed by private communication with Dr. Nageshwar that \( x \) was for a total pressure of one atmosphere.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
The solvent was held in a jacketed burette. Constant temperature water was circulated through the jacket. Gas was bubbled through the solvent until saturated. The dissolved gas content was determined by an electrometric dead-stop titration technique which yielded the bromine number. The electrometric titrator was based on a design given in reference 1.

SOURCE AND PURITY OF MATERIALS:
1. Ethene prepared by catalytic dehydration of ethanol over activated alumina at 350-400°C and analyzed by chromatography. Purity not given.
2. Methanol was treated for the removal of aldehydes and ketones and then distilled twice in a packed column.

ESTIMATED ERROR:
\( \delta \ x / x = \pm 3\% \)
(Estimated by compiler)

REFERENCES:
1. Dubois, H.D.; Skoog, D.A.
COMPONENTS:
1. Ethene; C₂H₄; [74-85-1]
2. Methanol; CH₄O; [67-56-1]

ORIGINAL MEASUREMENTS:
Yano, T.; Kidaka, T. Miyamoto, H.; Murakami, T.

VARIABLES:
T/K = 298.15
P/kPa = 101.325

PREPARED BY:
W. Hayduk

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>Mole Fraction</th>
<th>¹ Ostwald Coefficient</th>
<th>Henry's Constant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ethene, x₁</td>
<td>P₁ = 101.325 kPa</td>
<td>H/atm (mole fraction)⁻¹</td>
</tr>
<tr>
<td>t/C</td>
<td>T/K</td>
<td>P/kPa</td>
</tr>
<tr>
<td>25.0</td>
<td>298.15</td>
<td>0.00408</td>
</tr>
</tbody>
</table>

¹Calculated by compiler.

Although not specifically stated in paper it was assumed by the compiler that the reported solubility was for a total pressure of 101.325 kPa; therefore, the solubility for a partial pressure of 101.325 kPa was calculated assuming Henry's law and an ethene molar volume of 24320 cm³/mole at 298.15 K and 101.325 kPa.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
A glass apparatus was employed in which the uptake of gas by a known volume of solvent in a dissolution cell was volumetrically determined. The gas was displaced by mercury as the gas dissolved at constant pressure. A magnetically operated gas circulating pump and bubbling tip were provided for bubbling the gas through the solvent in the dissolution cell.

SOURCE AND PURITY OF MATERIALS:
1. Source and purity not given.
2. Source and purity not given.

ESTIMATED ERROR:
δ x₁/x₁ = ± 0.03 (Compiler)

REFERENCES:
COMPONENTS:
1. Ethene; \( \text{C}_2\text{H}_4; \) [74-85-1]
2. Methanol; \( \text{CH}_3\text{OH} \) [67-56-1]

ORIGINAL MEASUREMENTS:
Hannaert, H.; Haccuria, M.; Mathieu, M.F.

VARIABLES:
\( T/K = 223.15 - 293.15 \)
\( \rho_1/kPa = 101.3 \)

PREPARED BY:
W. Hayduk

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>( t/°C )</th>
<th>( T/K )</th>
<th>( \text{1 Mole Fraction Ethene, } x_1 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>-50</td>
<td>223.15</td>
<td>0.0187</td>
</tr>
<tr>
<td>-30</td>
<td>243.15</td>
<td>0.0117</td>
</tr>
<tr>
<td>-10</td>
<td>263.15</td>
<td>0.0078</td>
</tr>
<tr>
<td>10</td>
<td>283.15</td>
<td>0.0056</td>
</tr>
<tr>
<td>20</td>
<td>293.15</td>
<td>0.0048</td>
</tr>
</tbody>
</table>

\( \text{Mole fraction solubility calculated by compiler for a gas partial pressure of } 101.3 \text{ kPa using the equation developed by the authors with } \nu = 1, \text{ for the applicable temperature range:} \)

 \[ \log (K \nu) = 4.21 - (\Delta H/\text{cal mol}^{-1})/(2.3R(T/K)) \]

The authors' definitions are:

\( \Delta H = 2,530 \text{ cal mol}^{-1}, \text{ Enthalpy of dissolution} \)

\[ K = y_1/x_1 = \text{mole fraction gas in gas phase} / \text{mole fraction gas in liquid phase} \]

\( \pi / \text{atm} = \text{total pressure} \)

\( \nu = \text{coefficient of fugacity} \)

The function, \( K\nu/\text{atm} \), is equivalent to a Henry's constant in the form \( K_{H1}/\text{atm} = (\rho_1/\text{atm})/x_1 \) where \( \rho_1 \) is the fugacity.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The authors describe several methods used; the one used in this case is the least accurate.

The apparatus is of glass and consists of a burette in which the gas is confined over mercury, two bulbs for the solvent, one above the other, a mercury manometer and a constant temperature bath. A measured volume of solvent is degassed in the top bulb at ambient temperature and charged to the absorption bulb in the bath. Gas is charged to the desired pressure. The quantity of gas added at constant pressure is measured. Agitation is manual.

SOURCE AND PURITY OF MATERIALS:

   Specified purity 99.9%.

   At 20°C density specified as \( \rho = 0.7944 \text{ g cm}^{-3} \) and refractive index \( n(D) = 1.3285 \).

ESTIMATED ERROR:

\[ \delta x_1/x_1 = \pm 10 \text{ to } 15\% \] (authors)

REFERENCES:
COMPONENTS:
(1) Ethene; C₂H₄; [74-85-1]
(2) Ethanol; C₂H₅OH; [64-17-5]

ORIGINAL MEASUREMENTS:
Boyer, F. L.; Bircher, L. J.

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 Coefficient¹</th>
<th>Ostwald Coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>298.15</td>
<td>61.4</td>
<td>2.34</td>
<td>2.56 ± 0.02</td>
</tr>
</tbody>
</table>

¹ a/cm³ (STP) cm⁻³ atm⁻¹

The Bunsen coefficient was calculated by the compiler.
The mole fraction solubility was taken from Boyer's thesis (1).
See the methanol data sheet for the equations relating the mole fraction solubility and the number of normal alcohol carbon numbers.

AUXILIARY INFORMATION

METHOD/APPROATUS/PROCEDURE:
A commercial Van Slyke blood gas apparatus (E. H. Sargent Co.) was modified by the authors.
The total pressure of the gas and the solvent vapor in the solution chamber was adjusted to a pressure of one atm. The pressure was maintained at one atm during the solution process. The saturated solution was transferred to a bulb below the lower stopcock of the extraction vessel and sealed off. The gas and solvent vapor were then brought to volume over mercury. See (2) for details of the extraction procedure.

SOURCE AND PURITY OF MATERIALS:
(1) Ethene. Matheson Co. Stated to be 99.5 mol per cent.
(2) Ethanol. Source not given. Treated by standard methods to remove aldehydes and ketones, then dried and distilled.

ESTIMATED ERROR:
δT/K = ± 0.01
δL/cm³ = ± 0.02

REFERENCES:
**COMPONENTS:**
1. Ethene; $C_2H_4$ [74-85-1]
2. Ethanol; $C_2H_5OH$ [64-17-5]

**ORIGINAL MEASUREMENTS:**
Yano, T.; Kidaka, T. Miyamoto, H.; Murakami, T.

**VARIABLES:**
- $T/K = 298.15$
- $P/kPa = 101.325$

**PREPARED BY:**
W. Hayduk

**EXPERIMENTAL VALUES:**

<table>
<thead>
<tr>
<th>Mole Fraction</th>
<th>¹Ostwald Coefficient</th>
<th>¹Henry's Constant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ethene, $x_i$</td>
<td>$L/cm^3gas(cm^3 H_2O/atm) \cdot \text{(mole fraction)}$</td>
<td></td>
</tr>
<tr>
<td>$t/C$</td>
<td>$T/K$</td>
<td>$P=101.325 \text{ kPa}$</td>
</tr>
<tr>
<td>25.0</td>
<td>298.15</td>
<td>0.00558</td>
</tr>
</tbody>
</table>

¹Calculated by compiler.

Although not specifically stated in paper it was assumed by the compiler that the reported solubility was for a total pressure of 101.325 kPa; therefore, the solubility for a partial pressure of 101.325 kPa was calculated assuming Henry's law and an ethene molar volume of 24320 cm$^3$ / mole at 298.15 K and 101.325 kPa.

**AUXILIARY INFORMATION**

**METHOD/APPARATUS/PROCEDURE:**
A glass apparatus was employed in which the uptake of gas by a known volume of solvent in a dissolution cell was volumetrically determined. The gas was displaced by mercury as the gas dissolved at constant pressure. A magnetically operated gas circulating pump and bubbling tip were provided for bubbling the gas through the solvent in the dissolution cell.

**SOURCE AND PURITY OF MATERIALS:**
1. Source and purity not given.
2. Source and purity not given.

**ESTIMATED ERROR:**
\[ \delta x_i/x_i = \pm 0.03 \] (Compiler)

**REFERENCES:**
COMPONENTS:
1. Ethene; C₂H₄; [74-85-1]
2. Ethanol; C₂H₆O; [64-17-5]

ORIGINAL MEASUREMENTS:
Narasimhan, S.; Natarajan, G.S.;
Nageshwar, G.D.

VARIABLES:
\( T/K = 293.15, 298.15 \)
\( P/kPa = 101.325 \)

PREPARED BY:
W. Hayduk

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>( T/K )</th>
<th>( P = 101.325/z )</th>
<th>( \frac{P}{101.325} )</th>
<th>( \frac{1}{L/cm^3 gas (cm^3 solvent)^{-1}} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>293.15</td>
<td>0.00633</td>
<td>0.00671</td>
</tr>
<tr>
<td>25</td>
<td>298.15</td>
<td>0.00575</td>
<td>0.00624</td>
</tr>
</tbody>
</table>

1Calculated by compiler. It is assumed that the mole fraction solubility, \( z \), as originally given, is for a total pressure of 101.325 kPa although not specifically so stated in the paper. The mole fraction solubility is calculated for a partial pressure of 101.325 kPa.

Gas molar volumes of 23910, and 24330 cm³/mole were used for the temperatures 293.15 K, and 298.15 K, respectively, and for a pressure of 101.325 kPa when calculating \( L \).

It was confirmed by private communication with Dr. Nageshwar that \( z \) was for a total pressure of one atmosphere.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
The solvent was held in a jacketed burette. Constant temperature water was circulated through the jacket. Gas was bubbled through the solvent until saturated. The dissolved gas content was determined by an electrometric dead-stop titration technique which yielded the bromine number. The electrometric titrator was based on a design given in reference 1.

SOURCE AND PURITY OF MATERIALS:
1. Ethene prepared by catalytic dehydration of ethanol over activated alumina at 350-400°C and analyzed by chromatography. Purity not given.
2. Ethanol was treated for the removal of aldehydes and ketones and then distilled twice in a packed column.

ESTIMATED ERROR:
\[ \frac{\delta z}{z} = \pm 3\% \]
(Estimated by compiler)

REFERENCES:
1. Dubois, H.D.; Skoog, D.A.
COMPONENTS:
(1) Ethene; \( \text{C}_2\text{H}_4 \); [74-85-1]
(2) 1-Propanol; \( \text{C}_3\text{H}_7\text{OH} \); [71-23-8]

ORIGINAL MEASUREMENTS:
Boyer, F. L.; Bircher, L. J.

VARIABLES:
T/K: 298.15, 308.15
P/kPa: 101.325 (1 atm)

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

EXPERIMENTAL VALUES:

\[
\begin{array}{c|c|c|c}
\text{T/K} & \text{Mol Fraction} & \text{Bunsen Coefficient}^1 \text{ L/cm}^3 \text{ cm}^{-3} & \text{Ostwald Coefficient} \\
& \text{10}^4 x_1 & \alpha & \text{L/cm}^3 \text{ cm}^{-3} \\
\hline
298.15 & 73.6 & 2.21 & 2.41 \pm 0.01 \\
308.15 & 62.7 & 1.95 & 2.20 \pm 0.08 \\
\end{array}
\]

The Bunsen coefficients were calculated by the compiler.
The mole fraction solubilities were taken from Boyer's thesis (1).
See the methanol data sheet for the equations relating the mole fraction solubility and the number of normal alcohol carbon numbers.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
A commercial Van Slyke blood gas apparatus (E. H. Sargent Co.) was modified by the authors.
The total pressure of the gas and the solvent vapor in the solution chamber was adjusted to a pressure of one atm. The pressure was maintained at one atm during the solution process. The saturated solution was transferred to a bulb below the lower stopcock of the extraction vessel and sealed off. The gas and solvent vapor were then brought to volume over mercury. See (2) for details of the extraction procedure.

SOURCE AND PURITY OF MATERIALS:
(1) Ethene. Matheson Co. Stated to be 99.5 mol per cent.
(2) 1-Propanol. Source not given. Treated by standard methods to remove aldehydes and ketones, then dried and distilled.

ESTIMATED ERROR:
\[ \delta T/K = \pm 0.01 \]
\[ \delta L/cm^3 = \pm 0.01 \ (at \ 298.15 \ K) \]
\[ \pm 0.08 \ (at \ 308.15 \ K) \]

REFERENCES:
COMPONENTS:
1. Ethene; C₂H₄; [74-85-1]
2. 1- Propanol; C₃H₇O; [71-23-8]

ORIGINAL MEASUREMENTS:
Narasimhan, S.; Natarajan, G.S.; Nageshwar, G.D.

VARIABLES: T/K = 293.15, 298.15
P/kPa = 101.325

PREPARED BY:
W. Hayduk

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>t/C</th>
<th>T/K</th>
<th>P = 101.325/ₓ₁</th>
<th>P = 101.325/ₓ₁</th>
<th>¹Ostwald Coefficient L/cm³ gas.(cm³ solvent)⁻¹</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>293.15</td>
<td>0.00804</td>
<td>0.00820</td>
<td>2.64</td>
</tr>
<tr>
<td>25</td>
<td>298.15</td>
<td>0.00737</td>
<td>0.00758</td>
<td>2.47</td>
</tr>
</tbody>
</table>

¹Calculated by compiler. It is assumed that the mole fraction solubility, x, as originally given, is for a total pressure of 101.325 kPa although not specifically so stated in the paper. The mole fraction solubility is calculated for a partial pressure of 101.325 kPa.

Gas molar volumes of 23910, and 24330 cm³/mole were used for the temperatures 293.15 K, and 298.15 K, respectively, and for a pressure of 101.325 kPa when calculating L.

It was confirmed by private communication with Dr. Nageshwar that x was for a total pressure of one atmosphere.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
The solvent was held in a jacketed burette. Constant temperature water was circulated through the jacket. Gas was bubbled through the solvent until saturated. The dissolved gas content was determined by an electrometric dead-stop titration technique which yielded the bromine number. The electrometric titrator was based on a design given in reference 1.

SOURCE AND PURITY OF MATERIALS:
1. Ethene prepared by catalytic dehydration of ethanol over activated alumina at 350-400°C and analyzed by chromatography. Purity not given.
2. 1-Propanol was treated for the removal of aldehydes and ketones and then distilled twice in a packed column.

ESTIMATED ERROR:

δₓ₁/ₓ₁ = ±3%  
(Estimated by compiler)

REFERENCES:
1. Dubois, H.D.; Skoog, D.A.  
COMPONENTS:
1. Ethene; C₂H₄; [74-85-1]
2. 1-Propanol; C₃H₇O; [71-23-8]

ORIGINAL MEASUREMENTS:
Yano, T.; Kidaka, T. Miyamoto, H.; Murakami, T.

VARIABLES:
\[ \frac{T}{K} = 298.15 \]
\[ P/kPa = 101.325 \]

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>Mole Fraction Ethene/(x_i)</th>
<th>Ostwald Coefficient</th>
<th>Henry's Constant (H/atm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ethene/(x_i) For: (P=101.325) kPa</td>
<td>(P_i=101.325) kPa solvent (^{-1})</td>
<td>(\text{mole fraction}^2)</td>
</tr>
<tr>
<td>(t/C)</td>
<td>(T/K)</td>
<td></td>
</tr>
<tr>
<td>25.0</td>
<td>298.15</td>
<td>0.00697</td>
</tr>
</tbody>
</table>

1Calculated by compiler.
Although not specifically stated in paper it was assumed by the compiler that the reported solubility was for a total pressure of 101.325 kPa; therefore, the solubility for a partial pressure of 101.325 kPa was calculated assuming Henry's law and an ethene molar volume of 24320 cm\(^3\)/mole at 298.15 K and 101.325 kPa.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
A glass apparatus was employed in which the uptake of gas by a known volume of solvent in a dissolution cell was volumetrically determined. The gas was displaced by mercury as the gas dissolved at constant pressure. A magnetically operated gas circulating pump and bubbling tip were provided for bubbling the gas through the solvent in the dissolution cell.

SOURCE AND PURITY OF MATERIALS:
1. Source and purity not given.
2. Source and purity not given.

ESTIMATED ERROR:
\[ \delta x_1/x_1 = \pm 0.03 \text{ (Compiler)} \]

REFERENCES:
COMPONENTS:
(1) Ethene; C₂H₄; [74-85-1]
(2) 1-Butanol; C₄H₉OH; [71-36-3]

ORIGINAL MEASUREMENTS:
Boyer, F. L.; Bircher, L. J.

VARIABLES:
T/K: 298.15, 308.15
P/kPa: 101.325 (1 atm)

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>Mol Fraction</th>
<th>Bunsen Coefficient $10^4 x_J$</th>
<th>Ostwald Coefficient $\alpha$</th>
<th>L/cm³ cm⁻³ atm⁻¹</th>
</tr>
</thead>
<tbody>
<tr>
<td>298.15</td>
<td>82.4</td>
<td>2.07</td>
<td>2.26 ± 0.01</td>
<td></td>
</tr>
<tr>
<td>308.15</td>
<td>77.3</td>
<td>1.87</td>
<td>2.11 ± 0.02</td>
<td></td>
</tr>
</tbody>
</table>

$1 \alpha$/cm³ (STP) cm⁻³ atm⁻¹

The Bunsen coefficients were calculated by the compiler.

The mole fraction solubilities were taken from Boyer's thesis (1).

See the methanol data sheet for the equations relating the mole fraction solubility and the number of normal alcohol carbon numbers.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
A commercial Van Slyke blood gas apparatus (E. H. Sargent Co.) was modified by the authors.

The total pressure of the gas and the solvent vapor in the solution chamber was adjusted to a pressure of one atm. The pressure was maintained at one atm during the solution process. The saturated solution was transferred to a bulb below the lower stopcock of the extraction vessel and sealed off. The gas and solvent vapor were then brought to volume over mercury. See (2) for details of the extraction procedure.

SOURCE AND PURITY OF MATERIALS:
(1) Ethene. Matheson Co. Stated to be 99.5 mol per cent.
(2) 1-Butanol. Source not given. Treated by standard methods to remove aldehydes and ketones, then dried and distilled.

ESTIMATED ERROR:

$\delta T/K = \pm 0.01$

$\delta L/cm^3 = \pm 0.01$ (at 298.15 K)
$\pm 0.02$ (at 308.15 K)

REFERENCES:
COMPONENTS:
1. Ethene; C₂H₄; [74-85-1]
2. 1-Butanol; C₄H₁₀O; [71-36-3]

ORIGINAL MEASUREMENTS:
Sahgal, A.; La, H.M.; Hayduk, W.

VARIABLES:
T/K = 264-343
P/kPa = 101.325

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/C</th>
<th>Mole Fraction Ethene x₁</th>
<th>Ostwald Coefficient L/ cm³ gas (cm³ solvent)⁻¹</th>
</tr>
</thead>
<tbody>
<tr>
<td>-9.2</td>
<td>0.0149</td>
<td>3.62</td>
</tr>
<tr>
<td>25</td>
<td>0.00834</td>
<td>2.23</td>
</tr>
<tr>
<td>49</td>
<td>0.00596</td>
<td>1.67</td>
</tr>
<tr>
<td>70</td>
<td>0.00511</td>
<td>1.50</td>
</tr>
</tbody>
</table>

Mole fraction ethene, x₁, is for a gas partial pressure of 101.325 kPa.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
A glass apparatus equipped with a gas storage burette, a spiral tube for gas absorption, a miniature internal manometer and a solution storage burette was used. Degassed solvent was injected at a constant rate into the absorption spiral by means of a syringe-pump while the gas was displaced by mercury using a mechanical elevating device for a mercury bottle, at a rate required to keep the gas pressure constant. Readings of the volume of vapor-free gas consumed and volume of solvent required to achieve saturation were obtained from which the solubility was calculated. Constant temperature fluid was circulated through a jacket enclosing the burettes and absorption spiral.

SOURCE AND PURITY OF MATERIALS:
1. Ethene was CP grade from Matheson, 99.5 mole % minimum purity.
2. 1-Butanol was from Fisher of 99.0 mole % minimum purity.

ESTIMATED ERROR:
δx₁/ₓ₁ = ±2%
δT/K = ±0.05

REFERENCES:
**COMPONENTS:**
1. Ethene; \( \text{C}_2\text{H}_4 \); [74-85-1]
2. 1-Butanol; \( \text{C}_\text{12}\text{H}_\text{26} \); [71-36-3]

**ORIGINAL MEASUREMENTS:**
Narasimhan, S.; Natarajan, G.S.; Nageshwar, G.D.

**VARIABLES:**
- \( T/K = 293.15, 298.15 \)
- \( P/kPa = 101.325 \)

**EXPERIMENTAL VALUES:**

<table>
<thead>
<tr>
<th>( T/K )</th>
<th>( P = 101.325 )</th>
<th>( 1_P = 101.325 )</th>
<th>( L/cm^3 \text{ gas}(cm^3 \text{ solvent})^{-1} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>293.15</td>
<td>0.00950</td>
<td>0.00956</td>
</tr>
<tr>
<td>25</td>
<td>298.15</td>
<td>0.00864</td>
<td>0.00871</td>
</tr>
</tbody>
</table>

Calculated by compiler. It is assumed that the mole fraction solubility, \( x_1 \) as originally given, is for a total pressure of 101.325 kPa although not specifically so stated in the paper. The mole fraction solubility is calculated for a partial pressure of 101.325 kPa.

Gas molar volumes of 23910, and 24330 cm\(^3\)/mole were used for the temperatures 293.15 K, and 298.15 K, respectively, and for a pressure of 101.325 kPa when calculating \( L \).

It was confirmed by private communication with Dr. Nageshwar that \( x_1 \) was for a total pressure of one atmosphere.

**AUXILIARY INFORMATION**

**METHOD/APPARATUS/PROCEDURE:**
The solvent was held in a jacketed burette. Constant temperature water was circulated through the jacket. Gas was bubbled through the solvent until saturated. The dissolved gas content was determined by an electrometric dead-stop titration technique which yielded the bromine number. The electrometric titrator was based on a design given in reference 1.

**SOURCE AND PURITY OF MATERIALS:**
1. Ethene prepared by catalytic dehydration of ethanol over activated alumina at 350-400°C and analyzed by chromatography. Purity not given.
2. 1-Butanol was treated for the removal of aldehydes and ketones and then distilled twice in a packed column.

**ESTIMATED ERROR:**
\[ \delta \frac{x_1}{x_1} = \pm 3\% \]
(Estimated by compiler)

**REFERENCES:**
1. Dubois, H.D.; Skoog, D.A.
COMPONENTS:
1. Ethene; C\textsubscript{2}H\textsubscript{4}; [74-85-1]
2. 1-Pentanol; C\textsubscript{5}H\textsubscript{12}O; [71-41-0]

ORIGINAL MEASUREMENTS:
Narasimhan, S.; Natarajan, G.S.; Nageshwar, G.D.

VARIABLES: \( T/K = 293.15, 298.15 \)
\( P/\text{kPa} = 101.325 \)

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>( t/\text{C} )</th>
<th>( T/K )</th>
<th>( P = 101.325 )</th>
<th>( P_1 = 101.325 )</th>
<th>( ^{1}\text{Ostwald Coefficient } L/\text{cm}^3 \text{ gas/(cm}^3 \text{ solvent)} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>293.15</td>
<td>0.01082</td>
<td>0.01083</td>
<td>2.42</td>
</tr>
<tr>
<td>25</td>
<td>298.15</td>
<td>0.00995</td>
<td>0.00996</td>
<td>2.25</td>
</tr>
</tbody>
</table>

\(^{1}\)Calculated by compiler. It is assumed that the mole fraction solubility, \( x_1 \), as originally given, is for a total pressure of 101.325 kPa although not specifically so stated in the paper. The mole fraction solubility is calculated for a partial pressure of 101.325 kPa.

Gas molar volumes of 239.10 and 243.30 cm\(^3\)/mole were used for the temperatures 293.15 K, and 298.15 K, respectively, and for a pressure of 101.325 kPa when calculating \( L \).

It was confirmed by private communication with Dr. Nageshwar that \( x_1 \) was for a total pressure of one atmosphere.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
The solvent was held in a jacketed burette. Constant temperature water was circulated through the jacket. Gas was bubbled through the solvent until saturated. The dissolved gas content was determined by an electrometric dead-stop titration technique which yielded the bromine number. The electrometric titrator was based on a design given in reference 1.

SOURCE AND PURITY OF MATERIALS:
1. Ethene prepared by catalytic dehydration of ethanol over activated alumina at 350-400°C and analyzed by chromatography. Purity not given.
2. 1-Pentanol was treated for the removal of aldehydes and ketones and then distilled twice in a packed column.

ESTIMATED ERROR:
\[ \delta x_1 / x_1 = \pm 3\% \]
(Estimated by compiler)

REFERENCES:
1. Dubois, H.D.; Skoog, D.A.
COMPONENTS:
(1) Ethene; C\textsubscript{2}H\textsubscript{4}; [74-85-1]
(2) l-Pentanol; C\textsubscript{5}H\textsubscript{11}OH; [71-41-0]

ORIGINAL MEASUREMENTS:
Boyer, F. L.; Bircher, L. J.

VARIABLES:
\begin{align*}
T/K: & \quad 298.15, 308.15 \\
P/kPa: & \quad 101.325 (1 \text{ atm})
\end{align*}

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

EXPERIMENTAL VALUES:
\begin{tabular}{cccc}
\hline
T/K & Mol Fraction \(10^4x_j\) & Bunsen Coefficient \(\alpha\) & Ostwald Coefficient \(L/cm^3 cm^{-3}\) \\
\hline
298.15 & 100.4 & 2.04 & 2.23 \(\pm\) 0.03 \\
308.15 & 88.7 & 1.82 & 2.05 \(\pm\) 0.01 \\
\hline
\end{tabular}

\(1 \ a/cm^3\text{(STP)} cm^{-3} \text{ atm}^{-1}\)

The Bunsen coefficients were calculated by the compiler.

The mole fraction solubilities were taken from Boyer's thesis (1).

See the methanol data sheet for the equations relating the mole fraction solubility and the number of normal alcohol carbon numbers.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
A commercial Van Slyke blood gas apparatus (E. H. Sargent Co.) was modified by the authors.

The total pressure of the gas and the solvent vapor in the solution chamber was adjusted to a pressure of one atm. The pressure was maintained at one atm during the solution process. The saturated solution was transferred to a bulb below the lower stopcock of the extraction vessel and sealed off. The gas and solvent vapor were then brought to volume over mercury. See (2) for details of the extraction procedure.

SOURCE AND PURITY OF MATERIALS:
(1) Ethene. Matheson Co. Stated to be 99.5 mol per cent.

(2) l-Pentanol. Source not given. Treated by standard methods to remove aldehydes and ketones, then dried and distilled.

ESTIMATED ERROR:
\begin{align*}
\delta T/K = & \quad \pm 0.01 \\
\delta L/cm^3 = & \quad \pm 0.03 (at 298.15 K) \\
& \quad \pm 0.01 (at 308.15 K)
\end{align*}

REFERENCES:

COMPONENTS:
(1) Ethene; C₂H₄; [74-85-1]
(2) 1-Hexanol; C₆H₁₃OH; [111-27-3]

ORIGINAL MEASUREMENTS:
Boyer, F. L.; Bircher, L. J.

VARIABLES:

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

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

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>Mol Fraction</th>
<th>Bunsen Coefficient¹</th>
<th>Ostwald Coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>298.15</td>
<td>106.9</td>
<td>1.91</td>
<td>2.08 ± 0.03</td>
</tr>
</tbody>
</table>

¹ $\alpha$/cm³(STP) cm⁻³ atm⁻¹

The Bunsen coefficient was calculated by the compiler.
The mole fraction solubility was taken from Boyer's thesis (1).
See the methanol data sheet for the equations relating the mole fraction solubility and the number of normal alcohol carbon numbers.

METHOD/APPARATUS/PROCEDURE:
A commercial Van Slyke blood gas apparatus (E. H. Sargent Co.) was modified by the authors.
The total pressure of the gas and the solvent vapor in the solution chamber was adjusted to a pressure of one atm. The pressure was maintained at one atm during the solution process. The saturated solution was transferred to a bulb below the lower stopcock of the extraction vessel and sealed off. The gas and solvent vapor were then brought to volume over mercury. See (2) for details of the extraction procedure.

SOURCE AND PURITY OF MATERIALS:
(1) Ethene. Matheson Co. Stated to be 99.5 mol per cent.
(2) 1-Hexanol. Source not given. Treated by standard methods to remove aldehydes and ketones, then dried and distilled.

ESTIMATED ERROR:

$\delta T/K = \pm 0.01$
$\delta \alpha/\text{cm}^3 = \pm 0.03$

REFERENCES:
**COMPONENTS:**
(1) Ethene; C₂H₄; [74-85-1]
(2) 1-Heptanol; C₇H₁₅OH; [111-70-6]

**ORIGINAL MEASUREMENTS:**
Boyer, F. L.; Bircher, L. J.

**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</th>
<th>Ostwald Coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>298.15</td>
<td>117.0</td>
<td>1.88</td>
<td>2.05 ± 0.02</td>
</tr>
</tbody>
</table>

1. \( \alpha/cm^3 \text{(STP)} \text{ cm}^{-3} \text{ atm}^{-1} \)

The Bunsen coefficient was calculated by the compiler.

The mole fraction solubility was taken from Boyer's thesis (1).

See the methanol data sheet for the equations relating the mole fraction solubility and the number of normal alcohol carbon numbers.

**AUXILIARY INFORMATION**

**METHOD/APPARATUS/PROCEDURE:**
A commercial Van Slyke blood gas apparatus (E. H. Sargent Co.) was modified by the authors.

The total pressure of the gas and the solvent vapor in the solution chamber was adjusted to a pressure of one atm. The pressure was maintained at one atm during the solution process. The saturated solution was transferred to a bulb below the lower stopcock of the extraction vessel and sealed off. The gas and solvent vapor were then brought to volume over mercury. See (2) for details of the extraction procedure.

**SOURCE AND PURITY OF MATERIALS:**
(1) Ethene. Matheson Co. Stated to be 99.5 mol per cent.
(2) 1-Heptanol. Source not given. Treated by standard methods to remove aldehydes and ketones, then dried and distilled.

**ESTIMATED ERROR:**
\[ \delta T/K = \pm 0.01 \]
\[ \delta L/cm^3 = \pm 0.02 \]

**REFERENCES:**
**COMPONENTS:**

1. Ethene: \( \text{C}_2\text{H}_4 \); [74-85-1]
2. 1-Octanol: \( \text{C}_8\text{H}_{17}\text{OH} \); [111-87-5]

**ORIGINAL MEASUREMENTS:**

Boyer, F. L.; Bircher, L. J.

\[ \text{J. Phys. Chem. 1960, 64, 1330 - 1331.} \]

**VARIABLES:**

- **T/K:** 298.15, 308.15
- **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(^1)</th>
<th>Ostwald Coefficient (^3)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(10^3x_1)</td>
<td>(\alpha)</td>
<td>(L/cm^3) cm(^{-3})</td>
</tr>
<tr>
<td>298.15</td>
<td>129.0</td>
<td>1.75</td>
<td>1.91 ± 0.03</td>
</tr>
<tr>
<td>308.15</td>
<td>110.0</td>
<td>1.56</td>
<td>1.76 ± 0.02</td>
</tr>
</tbody>
</table>

\(^1\) \(\alpha/cm^3\) (STP) cm\(^{-3}\) atm\(^{-1}\)

The Bunsen coefficients were calculated by the compiler.
The mole fraction solubilities were taken from Boyer’s thesis (1).
See the methanol data sheet for the equations relating the mole fraction solubility and the number of normal alcohol carbon numbers.

**AUXILIARY INFORMATION**

**METHOD/APPARATUS/PROCEDURE:**

A commercial Van Slyke blood gas apparatus (E. H. Sargent Co.) was modified by the authors.

The total pressure of the gas and the solvent vapor in the solution chamber was adjusted to a pressure of one atm. The pressure was maintained at one atm during the solution process. The saturated solution was transferred to a bulb below the lower stopcock of the extraction vessel and sealed off. The gas and solvent vapor were then brought to volume over mercury. See (2) for details of the extraction procedure.

**SOURCE AND PURITY OF MATERIALS:**

1. Ethene. Matheson Co. Stated to be 99.5 mol per cent.
2. 1-Octanol. Source not given. Treated by standard methods to remove aldehydes and ketones, then dried and distilled.

**ESTIMATED ERROR:**

\(\delta T/K = \pm 0.01\)
\(\delta L/cm^3 = \pm 0.03\) (at 298.15 K)
\(\pm 0.02\) (at 308.15 K)

**REFERENCES:**

COMPONENTS:
1. Ethene; \( \text{C}_2\text{H}_4; [74-85-1] \)
2. 2-Propanol; \( \text{C}_3\text{H}_8\text{O}; [67-63-0] \)

VARIABLES: \( T/K = 273-323 \)
\( P/kPa = 101.325 \)

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>( t/C )</th>
<th>( T/K )</th>
<th>Mole Fraction Ethene, ( x_1 )</th>
<th>Ostwald Coefficient ( L/ \text{cm}^3\text{gas (cm}^3\text{ solvent)}^{-1} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>273.15</td>
<td>0.0101</td>
<td>3.02</td>
</tr>
<tr>
<td>25</td>
<td>298.15</td>
<td>0.00673</td>
<td>2.14</td>
</tr>
<tr>
<td>50</td>
<td>323.15</td>
<td>0.00473</td>
<td>1.58</td>
</tr>
</tbody>
</table>

Mole fraction ethene, \( x_1 \), is for a gas partial pressure of 101.325 kPa.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
A glass apparatus equipped with a gas storage burette, a spiral tube for gas absorption, a miniature internal manometer and a solution storage burette was used. Degassed solvent was injected at a constant rate into the absorption spiral by means of a syringe-pump while the gas was displaced by mercury using a mechanical elevating device for a mercury bottle, at a rate required to keep the gas pressure constant. Readings of the volume of vapor-free gas consumed and volume of solvent required to achieve saturation were obtained from which the solubility was calculated. Constant temperature fluid was circulated through a jacket enclosing the burettes and absorption spiral.

SOURCE AND PURITY OF MATERIALS:
1. Ethene was CP grade from Matheson, 99.5 mole % minimum purity.
2. 2-Propanol was from J.T. Baker of 99.9 mole % purity.

ESTIMATED ERROR:
\( \delta x_1/x_1 = \pm 2\% \)
\( \delta T/K = \pm 0.05 \)

REFERENCES:
<table>
<thead>
<tr>
<th>COMPONENTS:</th>
<th>ORIGINAL MEASUREMENTS:</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) Ethene or ethylene; C₂H₄; [74-85-1]</td>
<td>Cauquil, G.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>VARIABLES:</th>
<th>PREPARED BY:</th>
</tr>
</thead>
<tbody>
<tr>
<td>T/K = 299</td>
<td>H. L. Clever</td>
</tr>
<tr>
<td>P₁/kPa = 102</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>EXPERIMENTAL VALUES:</th>
</tr>
</thead>
<tbody>
<tr>
<td>The author states that one liter of cyclohexanol absorbs 301 cm³ ethene at 26 °C and 766 mmHg.</td>
</tr>
<tr>
<td>The compiler calculates a Ostwald coefficient of ( \frac{L}{L'} = 0.301 ) and a mole fraction solubility of ( x_L = 1.27 \times 10^{-3} ) at 299 K and a gas partial pressure of 101.325 kPa (1 atm).</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>AUXILIARY INFORMATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>METHOD/APPARATUS/PROCEDURE:</td>
</tr>
<tr>
<td>The apparatus appears to be of the Bunsen type.</td>
</tr>
<tr>
<td>The initial and final volumes of gas in contact with the liquid were measured. The vapor pressure of the liquid was ignored.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SOURCE AND PURITY OF MATERIALS:</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) Ethene. No information.</td>
</tr>
<tr>
<td>(2) Cyclohexanol. Distilled, boiling point 160.9 °C at 766 mmHg. Degassed and tested to be air free.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ESTIMATED ERROR:</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \delta L/L = \pm 0.05 ) (compiler)</td>
</tr>
</tbody>
</table>

| REFERENCES: |
### COMPONENTS:

1. Ethene; \( \text{C}_2\text{H}_4 \); [74-85-1]
2. 1,2-Ethanediol (ethylene glycol); \( \text{C}_2\text{H}_5\text{O}_2 \); [107-21-1]

### ORIGINAL MEASUREMENTS:

Sahgal, A.; La, H.M.; Hayduk, W.

### VARIABLES:

\( \frac{T}{K} = 298.15 \)
\( \frac{p}{kPa} = 101.325 \)

### EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>( t/ \degree C )</th>
<th>( \frac{T}{K} )</th>
<th>( 10^3 x_1 )</th>
<th>( L/ \text{cm}^3\text{gas} \left( \text{cm}^3\text{solvent} \right)^{-1} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>25</td>
<td>298.15</td>
<td>7.15</td>
<td>0.312</td>
</tr>
</tbody>
</table>

Mole fraction ethene, \( x_1 \), is for a gas partial pressure of 101.325 kPa.

### AUXILIARY INFORMATION

**METHOD/APPARATUS/PROCEDURE:**

A glass apparatus equipped with a gas storage burette, a spiral tube for gas absorption, a miniature internal manometer and a solution storage burette was used. Degassed solvent was injected at a constant rate into the absorption spiral by means of a syringe-pump while the gas was displaced by mercury using a mechanical elevating device for a mercury bottle, at a rate required to keep the gas pressure constant. Readings of the volume of vapor-free gas consumed and volume of solvent required to achieve saturation were obtained from which the solubility was calculated. Constant temperature fluid was circulated through a jacket enclosing the burettes and absorption spiral.

**SOURCE AND PURITY OF MATERIALS:**

1. Ethene was CP grade from Matheson, 99.5 mole % minimum purity.
2. 1,2-Ethanediol was from Fisher Chemicals of 99.8 mole % purity.

**ESTIMATED ERROR:**

\[ \delta \frac{x_1}{x} = \pm 2\% \]
\[ \delta \frac{T}{K} = \pm 0.05 \]

**REFERENCES:**
COMPONENTS:
1. Ethene; C₂H₄; [74-85-1]
2. 1,2-Ethanediol (ethylene glycol); C₆H₄O₂; [107-21-1]

ORIGINAL MEASUREMENTS:
Hannaert, H.; Haccuria, M.; Mathieu, M.P.

VARIABLES:
\[ \frac{T}{K} = 303.15 \]
\[ p_1/\text{kPa} = 101.3 \]

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>t°C</th>
<th>( \frac{T}{K} )</th>
<th>( K_T )</th>
<th>( x_1 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>30</td>
<td>303.15</td>
<td>3,200</td>
<td>0.000313</td>
</tr>
</tbody>
</table>

Mole fraction solubility calculated by compiler for a gas partial pressure of 101.3 kPa with \( v = 1 \).

The authors' definitions for \( K_T \) are:

\[ K = \frac{y_1}{x_1} = \frac{\text{mole fraction gas in gas phase}}{\text{mole fraction gas in liquid phase}} \]

\[ \pi / \text{atm} = \text{total pressure} \]

\[ v = \text{coefficient of fugacity} \]

The function, \( K_{T\pi} / \text{atm} \), is equivalent to a Henry's constant in the form \( H_{1,2} / \text{atm} = (f_1/\text{atm})/z_1 \) where \( f_1 \) is the fugacity.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
The authors describe several methods used; the one used in this case is the gas chromatographic method.

The stationary phase of the column was impregnated with a known mass of solvent. Nitrogen was used for determining the free volume of gas in the column. Various corrections were employed for dead volumes in the tubing and detector as well as for inlet and outlet pressures. Unfortunately the method could only be used with solvents of very low volatility.

SOURCE AND PURITY OF MATERIALS:
1. Ethene. Air Liquide. Specified purity 99.9%.
2. 1,2-Ethanediol. No information.

ESTIMATED ERROR:
\[ \delta x_1/x_1 = \pm 2 \text{ to } 5\% \] (authors)

REFERENCES:
COMPONENTS:
1. Ethene; C₂H₄; [74-85-1]
2. 2,2-[[1,2-Ethanediylbis (oxy)] bis-ethanol, (triethylene glycol)]; C₆H₁₄O₄; [112-27-6]

ORIGINAL MEASUREMENTS:
Hannaert, H.; Haccuria, M.; Mathieu, M.P.

VARIABLES:
\[ T/K = 303.15 \]
\[ p / \text{kPa} = 101.3 \]

EXPERIMENTAL VALUES:
\[ t / \text{C} \quad T/K \quad 1 \text{Mole Fraction Ethene, } x₁ \]
\[ 30 \quad 303.15 \quad 550 \quad 0.00182 \]

' Mole fraction solubility calculated by compiler for a gas partial pressure of 101.3 kPa with \( \nu = 1 \).

The authors' definitions for \( K_{nv} \) are:
\[ K = y₁/x₁ = \text{mole fraction gas in gas phase} / \text{mole fraction gas in liquid phase} \]
\[ \pi/ \text{atm} = \text{total pressure} \]
\[ \nu = \text{coefficient of fugacity} \]

The function, \( K_{nv}/\text{atm} \), is equivalent to a Henry's constant in the form \( H_{1,2}/\text{atm} = (f₁/\text{atm})/x₁ \) where \( f₁ \) is the fugacity.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
The authors describe several methods used; the one used in this case is the gas chromatographic method.
The stationary phase of the column was impregnated with a known mass of solvent. Nitrogen was used for determining the free volume of gas in the column. Various corrections were employed for dead volumes in the tubing and detector as well as for inlet and outlet pressures. Unfortunately the method could only be used with solvents of very low volatility.

SOURCE AND PURITY OF MATERIALS:
1. Ethene. Air Liquide. Specified purity 99.9%.
2. Triethylene glycol. No information.

ESTIMATED ERROR:
\[ \delta x₁/x₁ = \pm 2 \text{ to } 5\% \]
(authors)

REFERENCES:
COMPONENTS:
1. Ethene; C₂H₄; [74-85-1]
2. Propanol, oxybis-; (Dipropylene glycol); C₆H₁₄O₂; [25265-71-8]

ORIGINAL MEASUREMENTS:

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

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>( T/K )</th>
<th>Henry's constant ( H_{C₂H₄}/atm )</th>
<th>Mole fraction at 1 atm* ( x_{C₂H₄} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>298.2</td>
<td>204</td>
<td>0.00490</td>
</tr>
<tr>
<td>323.2</td>
<td>254</td>
<td>0.00394</td>
</tr>
<tr>
<td>343.2</td>
<td>295</td>
<td>0.00339</td>
</tr>
</tbody>
</table>

* Calculated by compiler assuming a linear function of \( H_{C₂H₄} \) vs \( x_{C₂H₄} \).

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. Ethene; $\text{C}_2\text{H}_4$; [74-85-1]
2. Phenol; $\text{C}_6\text{H}_6\text{O}$; [108-95-2]

### ORIGINAL MEASUREMENTS:
Lenoir, J-Y.; Renault, P.; Renon, H.

### VARIABLES:
- $T/K = 323.2$
- $P/kPa = 101.3$

### PREPARED BY:
C. L. Young

### EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>$T/K$</th>
<th>Henry's constant $H_{\text{C}_2\text{H}_4}/\text{atm}$</th>
<th>Mole fraction at 1 atm* $x_{\text{C}_2\text{H}_4}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>323.2</td>
<td>259</td>
<td>0.00386</td>
</tr>
</tbody>
</table>

* Calculated by compiler assuming a linear function of $H_{\text{C}_2\text{H}_4}$ vs $x_{\text{C}_2\text{H}_4}$, i.e., $x_{\text{C}_2\text{H}_4} (1 \text{ atm}) = 1/H_{\text{C}_2\text{H}_4}$.

### 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. Ethene (Ethylene); C₂H₄; [74-85-1]
2. Benzenemethanol (Benzyl alcohol); C₇H₈O; [100-51-6]

ORIGINAL MEASUREMENTS:
Lenoir, J-Y.; Renault, P. Renon, H.

VARIABLES:

<table>
<thead>
<tr>
<th>Variable</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>T/K</td>
<td>298.15</td>
</tr>
<tr>
<td>P/kPa</td>
<td>101.32</td>
</tr>
</tbody>
</table>

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>Henry's constant H_{C₂H₄}/atm</th>
<th>Mole fraction at 1 atm* x_{C₂H₄}</th>
</tr>
</thead>
<tbody>
<tr>
<td>298.15</td>
<td>160</td>
<td>0.00625</td>
</tr>
</tbody>
</table>

* Calculated by compiler assuming a linear function of $H_{C₂H₄}$ vs $x_{C₂H₄}$, i.e. $x_{C₂H₄}$ (1 atm) = $1/H_{C₂H₄}$.

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. Ethene; C\textsubscript{2}H\textsubscript{4}; [74-85-1]
2. 1-Butanol; C\textsubscript{4}H\textsubscript{10}O; [71-36-3]
3. 1,2-Ethanediol (ethylene glycol); C\textsubscript{2}H\textsubscript{5}O\textsubscript{2}; [107-21-1]

ORIGINAL MEASUREMENTS:
Sahgal, A.; Hayduk, W.

VARIABLES:

\begin{align*}
T/K &= 298.15 \\
P/kPa &= 101.325 \\
x_1/Mole Fraction &= 0-1.0
\end{align*}

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>(T/C)</th>
<th>(T/K)</th>
<th>(x_1) Volume Fraction(^1)</th>
<th>(x_1) Mole Fraction(^2)</th>
<th>Mole Fraction Ethene, (x_1)</th>
<th>L/cm(^3) gas/cm(^3) solvent (^{-1})</th>
</tr>
</thead>
<tbody>
<tr>
<td>25</td>
<td>298.15</td>
<td>0</td>
<td>0</td>
<td>0.000834</td>
<td>2.23</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.174</td>
<td>0.260</td>
<td>0.00611</td>
<td>1.82</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.201</td>
<td>0.295</td>
<td>0.00570</td>
<td>1.72</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.342</td>
<td>0.461</td>
<td>0.00456</td>
<td>1.48</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.407</td>
<td>0.531</td>
<td>0.00384</td>
<td>1.31</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.490</td>
<td>0.615</td>
<td>0.00334</td>
<td>1.17</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.790</td>
<td>0.860</td>
<td>0.00151</td>
<td>0.604</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.927</td>
<td>0.956</td>
<td>0.00106</td>
<td>0.450</td>
</tr>
<tr>
<td></td>
<td>1.0(Glycol)</td>
<td>1.000</td>
<td>1.000</td>
<td>0.000715</td>
<td>0.312</td>
</tr>
</tbody>
</table>

\(^1\)Volume fraction is based on volumes of two liquid components before mixing.

\(^2\)Mole fraction is shown on a gas-free basis.

Values for pure solvents were previously given (in reference 1).

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
The apparatus utilized a continuous flow of deaerated solvent injected into a glass absorption spiral tube by means of a calibrated syringe pump. The mixed solvent was prepared volumetrically then deaerated and a sample analyzed by a density measurement. A mercury lift device was used for continuously adjusting the residual volume at constant pressure in a gas storage burette. Solvent injection and gas consumption rates were used to calculate solubilities. This paper also includes solution densities and refractive indices as well as ethene molecular diffusivities in the solutions.

SOURCE AND PURITY OF MATERIALS:
1. Ethene was CP grade from Matheson with minimum purity of 99.5 mole %. Molar volume used at 298.15 K and 101.325 kPa was 24,326 cm\(^3\)/mole.
2. 1-Butanol was from Fisher; purity 99.0 mole %.
3. 1,2-Ethanediol was from Fisher; purity 99.8 mole %.

ESTIMATED ERROR:

\begin{align*}
\frac{\partial T}{T} &= \pm 0.05 \\
\frac{\partial P}{P} &= \pm 0.01 \\
\frac{\partial x_1}{x_1} &= \pm 0.001 \\
\frac{\partial x_1}{x_1} / x_1 &= \pm 0.02
\end{align*}

REFERENCES:
1. Sahgal, A.; La, H.M.; Hayduk, W.

**COMPONENTS:**
1. Ethene; C₂H₄; [74-85-1]
2. Alkanols, pressures greater than 0.2 MPa (2 atm)

**EVALUATOR:**
Walter Hayduk  
Department of Chemical Engineering  
University of Ottawa  
Ottawa, ON  
Canada K1N 6N5  
November, 1993

**CRITICAL EVALUATION:**

Critical Evaluation of Ethene Solubilities in Alkanol Solvents for Pressures greater than 0.2 MPa (2 atm)

Four groups of researchers (1-4) reported solubilities of ethene in methanol, ethanol, 1-propanol and 1-octanol for temperatures ranging from 228.15 K to 498.15 K and pressures ranging from 0.10 MPa to 10.9 MPa. No data are available for the numerous other alkanols and alcohols.

The data of Konobeev and Lyapin (1) for three of the alkanols are listed for pressures of their experiments; hence, it was necessary to use the solvent vapor pressure to estimate the corresponding ethene partial pressure. Further, these data are entirely self-consistent so that the effect of both temperature and pressure can be expressed by a simple equation of the form:

\[ \log x_p = \frac{A}{T} + B \log (p/\text{MPa}) - C \]  

The above equation is useful over small temperature ranges when \( \log x_p \) is proportional to the inverse of absolute temperature, and when Henry's law is obeyed or therefore, when \( \log x_p \) is proportional to \( \log p \) with the constant, \( B \), being approximately equal to one.

Ethene solubilities in the individual solvents are discussed in detail below:

**Methanol; CH₄O; [67-56-1]**

Konobeev and Lyapin (1) reported ethene solubilities for a range of pressures in methanol at temperatures of 293.15 K, 313.15 K and 333.15 K, and Shenderei et al. (2) reported solubilities at low temperatures, 248.15 K, 238.15 K and 228.05 K. Both of these sets of data obey Henry's law for mole fraction solubilities of less than 0.08. The data of Shenderei et al. are approximately consistent with low pressure data (at 0.1013 MPa) and are classified as tentative. On the other hand, when extrapolated to a pressure of 0.1013 MPa, the data of Konobeev and Lyapin fall below those of other workers by about 16%. With this caution concerning the data of Konobeev and Lyapin, these data are also classified as tentative.

The data of Konobeev and Lyapin are described by the following equation up to an ethene partial pressure of 2 MPa with an average deviation from the data of 2.1% and a maximum deviation of 8.0%:

\[ \log x_p = 538.17/(T/K) - 3.2071 + 1.026 \log (p/\text{MPa}) \]  

The data of Shenderei et al. are described by the following equation with average, and maximum deviations, of 3.0%, and 8.9%, respectively, and to a maximum pressure of 0.6 MPa:

\[ \log x_p = 810.59/(T/K) - 4.2434 + 1.032 \log (p/\text{MPa}) \]  

The temperature effects expressed in the above two equations are sufficiently different so that a single, simple equation cannot successfully describe the data from both sources. Nor should the equations be used outside the temperature and pressure ranges for which they were developed. Figure 1 shows the experimental data and the equations discussed above.

**Ethanol; C₂H₆O; [64-17-5]**

Ellis et al. (3) reported solubilities of ethene in ethanol at 348.15 K (75°C) and for gas partial pressures from 1.46 MPa to 10.9 MPa. When
COMPONENTS:
1. Ethene; C₂H₄; [74-85-1]
2. Alkanols, pressures greater than 0.2 MPa (2 atm)

EVALUATOR:
Walter Hayduk
Department of Chemical Engineering
University of Ottawa
Ottawa, ON
Canada KIN 6N5
November, 1993

CRITICAL EVALUATION:

the data were plotted on log-log coordinates, the relationship between mole fraction solubility and ethene partial pressure was found to be consistent and linear up to a pressure of 7 MPa. For this linear subset of data, the equation of the line best representing the data is:

\[ \log x_p = 1.0094 \log (p/\text{MPa}) - 1.5067 \]  

In the above equation \( p \) represents the ethene partial pressure in MPa. This equation represents the reduced data (4 points) with an average deviation of 1.8%, and a maximum deviation of 3.0%.

The data of Ellis et al. (3) are classified as tentative.

1-Propanol; C₃H₈O; [71-23-8]

Two groups of researchers have reported solubilities of ethene in 1-propanol at high pressures; these are Konobeev and Lyapin (1) for the temperatures 293.15 K, 313.15 K and 333.15 K, and Pryanikova et al. (4) for temperatures from 373.15 K to 498.15 K. The latter researchers reported their results only in graphical form. The results of the former researchers will be discussed first.

The data of Konobeev and Lyapin cover a pressure range from 0.29 MPa to 3.26 MPa. The conventional temperature dependence for the solubility is observed, and at the same time, the relatively simple dependence for varying gas partial pressures is also observed.

These solubility data for 1-propanol are represented by the following equation:

\[ \log x_p = \frac{487.93}{(T/\text{K})} + 1.051 \log (p/\text{MPa}) - 2.8356 \]  

Equation (5) represents the solubility data with an average deviation of 3.1% and a maximum deviation of 10.0%. It is cautioned, however, that while the equation and data are self-consistent, when the equation is extrapolated to 0.1013 MPa pressure, a value much lower (about 25%) than that actually measured at that lower pressure is obtained. Hence, extrapolation beyond the indicated temperatures and pressures is liable to produce large errors.

The graphical, high temperature, high pressure results of Pryanikova et al. (4) were enlarged and readings obtained from the enlargement. Hence, these results are not equivalent to the data formerly discussed. However, when the results of the two research groups are compared directly it is found that the solubilities at 373.15 K of Pryanikova et al. correspond approximately, and even exceed in magnitude the results of Konobeev and Lyapin at 333.15 K, a most unlikely event. The mole fraction solubilities are expected to decrease with an increase in temperature. It is considered, therefore, that the results of Pryanikova et al. are somewhat too high and/or those of Konobeev and Lyapin are somewhat too low. It is not possible to unequivocally indicate which data are the more reliable although the latter data appear self-consistent and numerical values are reported.

Both sets of results are classified as tentative.

1-Octanol; C₈H₁₈O; [111-87-5]

Only the data of Konobeev and Lyapin (1) are available for solubilities at high pressure in 1-octanol and these are for the temperatures 293.15 K, 313.15 K and 333.15 K and for a pressure range from 0.28 MPa to 3.24 MPa. As for the previous solvent, 1-propanol, the temperature and
CRITICAL EVALUATION:

Fig. 1  Ethene Solubility in Methanol as a function of Temperature and Pressure

The pressure dependence for these data are well represented by the following equation:

\[ \log x_p = \frac{489.62}{(T/K)} + 1.002 \log (p/\text{MPa}) - 2.6590 \]  \hspace{1cm} (6)

The above equation represents the solubility data with an average deviation of 3.0% and a maximum deviation of the 12 data points of 6.1%. It is cautioned for this solvent also, that while the equation and data are self-consistent, when the equation is extrapolated to 0.1013 MPa pressure, a value much lower (about 33%) than that actually measured at that lower pressure is obtained. Hence, extrapolation beyond the indicated temperature and pressure ranges is liable to produce large errors.
COMPONENTS:
1. Ethene; C$_2$H$_4$; [74-85-1]
2. Alkanols, pressures greater than 0.2 MPa (2 atm)

CRITICAL EVALUATION:

The data of Konobeev and Lyapin for 1-octanol solvent are classified as tentative.

References

**COMPONENTS:**
1. Ethene; C₂H₄; [74-85-1]
2. Methanol; CH₃OH; [67-56-1]

**ORIGINAL MEASUREMENTS:**
Konobeev, B.I.; Lyapin, V.V.

**VARIABLES:**
\[ T/K = 293.15 - 333.15 \]
\[ P/\text{MPa} = 0.13 - 3.22 \]

**PREPARED BY:**
C. L. Young

**EXPERIMENTAL VALUES:**

<table>
<thead>
<tr>
<th>T/K</th>
<th>P/10⁵Pa</th>
<th>Mole fraction of ethene in liquid ( x_{\text{C}_2\text{H}_4} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>293.15</td>
<td>1.317</td>
<td>0.005</td>
</tr>
<tr>
<td></td>
<td>3.080</td>
<td>0.012</td>
</tr>
<tr>
<td></td>
<td>8.197</td>
<td>0.034</td>
</tr>
<tr>
<td></td>
<td>15.71</td>
<td>0.067</td>
</tr>
<tr>
<td></td>
<td>32.12</td>
<td>0.165</td>
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<tr>
<td>313.15</td>
<td>2.888</td>
<td>0.008</td>
</tr>
<tr>
<td></td>
<td>8.248</td>
<td>0.024</td>
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<tr>
<td></td>
<td>17.83</td>
<td>0.057</td>
</tr>
<tr>
<td></td>
<td>32.22</td>
<td>0.120</td>
</tr>
<tr>
<td>333.15</td>
<td>2.888</td>
<td>0.005</td>
</tr>
<tr>
<td></td>
<td>8.288</td>
<td>0.019</td>
</tr>
<tr>
<td></td>
<td>17.93</td>
<td>0.048</td>
</tr>
<tr>
<td></td>
<td>32.22</td>
<td>0.089</td>
</tr>
</tbody>
</table>

**AUXILIARY INFORMATION**

**METHOD/APPARATUS/PROCEDURE:**
Static equilibrium cell fitted with magnetic stirrer. Samples analysed by gas chromatography. Details in source.

**SOURCE AND PURITY OF MATERIALS:**
1. Purity better than 99.6 mole per cent.
2. No details given.

**ESTIMATED ERROR:**
\[ \delta T/K = \pm 0.1; \delta P = \pm 0.5\% \delta x_{\text{C}_2\text{H}_4} = \pm 0.002 \]
(estimated by compiler)

**REFERENCES:**
COMPONENTS:
1. Ethene; $\text{C}_2\text{H}_4; [74-85-1]$
2. Methanol; $\text{CH}_3\text{OH}; [67-56-1]$

VARIABLES:
- $T/K = 228-248$
- $P/\text{MPa} = 0.10-1.82, (1-18 \text{ atm})$

ORIGINAL MEASUREMENTS:

PREPARED BY:
W. Hayduk

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>$T/K$</th>
<th>$t/\degree C$</th>
<th>Total Pressure</th>
<th>Solubility$^2$ s</th>
<th>Mole fraction, $x_1$</th>
<th>$s/\text{cm}^3(\text{g})^{-1}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>248.15</td>
<td>-25.0</td>
<td>1 0.1013</td>
<td>0.0100</td>
<td>7.74</td>
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<td></td>
<td>3 0.3040</td>
<td>0.0311</td>
<td>22.29</td>
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</tr>
<tr>
<td></td>
<td></td>
<td>5 0.5066</td>
<td>0.0520</td>
<td>38.23</td>
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</tr>
<tr>
<td></td>
<td></td>
<td>10 1.013</td>
<td>0.1181</td>
<td>92.81</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>12 1.216</td>
<td>0.1552</td>
<td>127.85</td>
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</tr>
<tr>
<td></td>
<td></td>
<td>15 1.520</td>
<td>0.2163</td>
<td>192.11</td>
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</tr>
<tr>
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<td></td>
<td>18 1.824</td>
<td>0.3103</td>
<td>313.10</td>
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</tr>
<tr>
<td>238.15</td>
<td>-35.0</td>
<td>1 0.1013</td>
<td>0.0138</td>
<td>9.75</td>
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<td>0.0430</td>
<td>31.32</td>
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</tr>
<tr>
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<td>5 0.5066</td>
<td>0.0751</td>
<td>56.51</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>10 1.013</td>
<td>0.1750</td>
<td>147.84</td>
<td></td>
</tr>
<tr>
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<td></td>
<td>12 1.216</td>
<td>0.2265</td>
<td>203.51</td>
<td></td>
</tr>
<tr>
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<td></td>
<td>15 1.520</td>
<td>0.3631</td>
<td>397.19</td>
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</tr>
<tr>
<td>228.05</td>
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<td>0.0177</td>
<td>10.39</td>
<td></td>
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<tr>
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<td>0.0600</td>
<td>44.48</td>
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<tr>
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<td>5 0.5066</td>
<td>0.1100</td>
<td>86.14</td>
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<td>0.3051</td>
<td>305.87</td>
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<tr>
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<td></td>
<td>12 1.216</td>
<td>0.5700</td>
<td>920.11</td>
<td></td>
</tr>
</tbody>
</table>

$^1$Calculated by compiler.

$^2$Solubility, $s$, expressed as $\text{cm}^3$ ethene at NTP per g of solvent.

It is noted that solubilities listed in this paper for a pressure of 101.3 kPa using a low pressure apparatus are up to 9% higher than those using the high pressure apparatus (see low pressure data).

**AUXILIARY INFORMATION**

**METHOD/APPARATUS/PROCEDURE:**
Glass equilibrium cell fitted with a magnetic stirrer. Pressure measured with a Bourdon gauge. Samples of liquid analyzed by stripping out ethene. The solubilities were measured at several pressures below atmospheric and Henry's constant was determined. Details in ref. (1).

**SOURCE AND PURITY OF MATERIALS:**
1. Commercial ethene was purified by absorption and complex formation at 0°C under pressure in cuprous chloride. Impurities were not absorbed. The ethylene was regenerated at 60°C, condensed, and analyzed by GC.

2. Distilled.

Actual purities not given.

**ESTIMATED ERROR:**

$$\delta x_1 / x_1 = \pm 2\%$$

(Estimated by compiler)

**REFERENCES:**
COMPONENTS:
1. Ethene; C\textsubscript{2}H\textsubscript{4}; [74-85-1]
2. Ethanol; C\textsubscript{2}H\textsubscript{6}O; [64-17-5]

ORIGINAL MEASUREMENTS:
Ellis, S.R.M.; Valteris, R.L.;
Harris, G.J.
Chem. Eng. Prog. Symp. Ser.,
1968, 64, 16-21.

VARIABLES:
\( T/K = 348.15 \)
\( P/\text{MPa} = 1.5 - 10.9 \) (14-108 atm)

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>( P/\text{atm} )</th>
<th>( \text{Partial pressure}^1 )</th>
<th>Mole fraction ethene in liquid, ( x_1 )</th>
<th>Mole fraction ethene in vapor, ( y_1 )</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>( p/\text{atm} )</td>
<td>( p/\text{MPa} )</td>
<td></td>
</tr>
<tr>
<td>15.1</td>
<td>14.4</td>
<td>1.46</td>
<td>0.045</td>
</tr>
<tr>
<td>27.2</td>
<td>26.2</td>
<td>2.65</td>
<td>0.084</td>
</tr>
<tr>
<td>40.1</td>
<td>38.9</td>
<td>3.94</td>
<td>0.128</td>
</tr>
<tr>
<td>62.9</td>
<td>61.2</td>
<td>6.20</td>
<td>0.192</td>
</tr>
<tr>
<td>88.1</td>
<td>85.0</td>
<td>8.61</td>
<td>0.297</td>
</tr>
<tr>
<td>106.5</td>
<td>99.8</td>
<td>10.1</td>
<td>0.373</td>
</tr>
<tr>
<td>119.7</td>
<td>107.8</td>
<td>10.9</td>
<td>0.458</td>
</tr>
</tbody>
</table>

^1Calculated by compiler

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
A static method with a 500 cm\textsuperscript{3} stainless steel vessel equipped with a plunger, perforated-cup stirrer was used. The perforated cup was attached to a soft iron rod which was raised up by means of an electromagnet, and dropped downward under its own weight. Ethylene was displaced from a reservoir by mercury using a volumetric piston pump to the desired pressure. After equilibration, samples of gas and liquid were withdrawn for analysis. During the sampling process, an equivalent volume of mercury was allowed to flow from the sample bomb back to the equilibration vessel. The liquid portion of the samples was condensed at atmospheric pressure using dry-ice and acetone whereas the gas portion was aspirated volumetrically over water. Analysis was by gas chromatography.

SOURCE AND PURITY OF MATERIALS:
Sources and purities not specified.

ESTIMATED ERROR:
\[ \delta x_1/x_1 = \pm 0.03 \quad T/K = \pm 2 \]
\[ \delta P/P = \pm 0.01 \]

REFERENCES:
COMPONENTS:
1. Ethene; C₂H₄; [74-85-1]
2. 1-Propanol; C₃H₇O; [71-23-8]

ORIGINAL MEASUREMENTS:
Pryanikova, R.O.; Efremova, G.D.; Malikov, D.A.; Zagorets, P.A.; Shostenko, A.G.; Dodonov, A.M.

VARIABLES:
\[ T/K = 448.15 - 498.15 \]
\[ P_1 / \text{MPa} = 1.19 - 4.98 \]

PREPARED BY:
W. Hayduk

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>( T/K )</th>
<th>( P/\text{atm} )</th>
<th>( P_1/\text{MPa} )</th>
<th>( x_3 ) Ethene, ( x_1 ) Propanol, ( H/\text{MPa(mol fraction)} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>498.15 (225 C)</td>
<td>65.2</td>
<td>4.32</td>
<td>0.85</td>
</tr>
<tr>
<td>39.5</td>
<td>2.90</td>
<td>0.90</td>
<td>0.10</td>
</tr>
<tr>
<td>473.15 (200 C)</td>
<td>62.5</td>
<td>4.98</td>
<td>0.80</td>
</tr>
<tr>
<td>39.3</td>
<td>2.46</td>
<td>0.90</td>
<td>0.10</td>
</tr>
<tr>
<td>28.0</td>
<td>1.23</td>
<td>0.95</td>
<td>0.05</td>
</tr>
<tr>
<td>448.15 (175 C)</td>
<td>55.5</td>
<td>4.83</td>
<td>0.80</td>
</tr>
<tr>
<td>32.4</td>
<td>2.39</td>
<td>0.90</td>
<td>0.10</td>
</tr>
<tr>
<td>21.0</td>
<td>1.19</td>
<td>0.95</td>
<td>0.05</td>
</tr>
</tbody>
</table>

1Only graphical results were presented in this paper in the form of total pressure (\( P \)) as a function of mole fraction propanol (\( x_1 \)). Values were read from an enlarged graph by the compiler.  
2The ethene partial pressure (\( P_1 \)) was estimated using Raoult's law, and the Henry's law constant (\( H \)) as well as the mole fraction solubility for an ethene partial pressure of 0.101325 MPa (\( x_1 \)) were calculated by the compiler.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
The apparatus and procedure are described in reference 1. The equilibration device is a capillary tube containing an internal mixer which is moved up and down by means of an external, motor-driven magnet. The capillary tube is sealed in a vertical position and connected to a gas and liquid charging system, pressure gauges, as well as a volume regulator to maintain a constant pressure and to determine the volume of gas charged. Molar volumes of liquid solutions are also given as a function of solution compositions, temperatures and pressures.

SOURCE AND PURITY OF MATERIALS:
Sources and purities not specified.

ESTIMATED ERROR:
\[ \frac{\delta x_1}{x_1} = \pm 3.0\% \] (compiler)

REFERENCES:
1. Kritchevskii, I.R.; Efremova, G.D.
### COMPONENTS:
1. Ethene; \( C_2H_4; \) [74-85-1]
2. 1-Propanol; \( C_3H_8O; \) [71-23-8]

### ORIGINAL MEASUREMENTS:
Pryanikova, R.O.; Efremova, G.D.; Malikov, D.A.; Zagorets, P.A.; Shostenko, A.G.; Dodonov, A.M.

### VARIABLES:
\[ T/K = 373.15 - 423.15 \]
\[ p/MPa = 1.08 - 4.68 \]

### PREPARED BY:
W. Hayduk

### EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>( T/K )</th>
<th>( P/\text{atm} )</th>
<th>( P_1/\text{MPa} )</th>
<th>( x_3 )</th>
<th>( x_1 )</th>
<th>( H/\text{MPa (mol fraction)} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>423.15</td>
<td>50.5</td>
<td>4.68</td>
<td>0.80</td>
<td>0.20</td>
<td>23.4</td>
</tr>
<tr>
<td>(150 C)</td>
<td>39.1</td>
<td>3.51</td>
<td>0.85</td>
<td>0.15</td>
<td>(0.00434)</td>
</tr>
<tr>
<td>27.7</td>
<td>2.32</td>
<td>0.80</td>
<td>0.90</td>
<td>0.10</td>
<td></td>
</tr>
<tr>
<td>16.5</td>
<td>1.15</td>
<td>0.80</td>
<td>0.95</td>
<td>0.05</td>
<td></td>
</tr>
<tr>
<td>373.15</td>
<td>43.0</td>
<td>4.37</td>
<td>0.80</td>
<td>0.20</td>
<td>21.4</td>
</tr>
<tr>
<td>(100 C)</td>
<td>32.6</td>
<td>3.21</td>
<td>0.85</td>
<td>0.15</td>
<td>(0.00473)</td>
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<td>22.1</td>
<td>2.14</td>
<td>0.80</td>
<td>0.90</td>
<td>0.10</td>
<td></td>
</tr>
<tr>
<td>11.7</td>
<td>1.08</td>
<td>0.80</td>
<td>0.95</td>
<td>0.05</td>
<td></td>
</tr>
</tbody>
</table>

1 Only graphical results were presented in this paper in the form of total pressure \( (P) \) as a function of mole fraction propanol \( (x_3) \). Values were read from an enlarged graph by the compiler.

2 The ethene partial pressure \( (P_1) \) was estimated using Raoult's law, and the Henry's law constant \( (H) \) as well as the mole fraction solubility for an ethene partial pressure of 0.101325 MPa \( (x_1) \) were calculated by the compiler.

### AUXILIARY INFORMATION

**METHOD/APPARATUS/PROCEDURE:**
The apparatus and procedure are described in reference 1. The equilibration device is a capillary tube containing an internal mixer which is moved up and down by means of an external, motor-driven magnet. The capillary tube is sealed in a vertical position and connected to a gas and liquid charging system, pressure gauges, as well as a volume regulator to maintain a constant pressure and to determine the volume of gas charged.

Molar volumes of liquid solutions are also given as a function of solution compositions, temperatures and pressures.

**SOURCE AND PURITY OF MATERIALS:**
Sources and purities not specified.

**ESTIMATED ERROR:**
\[ T/K = \pm 1.0 \]
\[ \delta x_1/x_1 = \pm 3.0\% \text{ (compiler)} \]

**REFERENCES:**
1. Kritchevskii, I.R.; Efremova, G.D.
**COMPONENTS:**
1. Ethene; C$_2$H$_4$; [74-85-1]
2. 1-Propanol; C$_3$H$_6$OH; [71-23-8]

**ORIGINAL MEASUREMENTS:**
Konobeev, B.I.; Lyapin, V.V.

**VARIABLES:**
$T/K = 293.15 - 333.15$
$P/\text{MPa} = 0.29 - 3.26$

**EXPERIMENTAL VALUES:**

<table>
<thead>
<tr>
<th>$T/K$</th>
<th>$P/10^3\text{Pa}$</th>
<th>Mole fraction of ethene in liquid $x_{C_2H_4}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>293.15</td>
<td>3.090</td>
<td>0.019</td>
</tr>
<tr>
<td></td>
<td>8.167</td>
<td>0.055</td>
</tr>
<tr>
<td></td>
<td>15.81</td>
<td>0.109</td>
</tr>
<tr>
<td></td>
<td>32.32</td>
<td>0.237</td>
</tr>
<tr>
<td>313.15</td>
<td>2.888</td>
<td>0.012</td>
</tr>
<tr>
<td></td>
<td>8.288</td>
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<td></td>
<td>17.93</td>
<td>0.094</td>
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<tr>
<td></td>
<td>32.63</td>
<td>0.180</td>
</tr>
<tr>
<td>333.15</td>
<td>2.888</td>
<td>0.011</td>
</tr>
<tr>
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<td>8.309</td>
<td>0.034</td>
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<tr>
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<td>17.93</td>
<td>0.082</td>
</tr>
<tr>
<td></td>
<td>32.63</td>
<td>0.147</td>
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</table>

**AUXILIARY INFORMATION**

**METHOD/APPARATUS/PROCEDURE:**
Static equilibrium cell fitted with magnetic stirrer. Samples analysed by gas chromatography. Details in source.

**SOURCE AND PURITY OF MATERIALS:**
1. Purity better than 99.6 mole per cent.
2. No details given.

**ESTIMATED ERROR:**
$\delta T/K = \pm 0.1$; $\delta P = \pm 0.5$; $\delta x_{C_2H_4} = \pm 0.002$
(estimated by compiler)

**REFERENCES:**
COMPONENTS:
1. Ethene; C₂H₄; [74-85-1]
2. 1-Octanol; C₈H₁₇OH; [111-87-5]

VARIABLES:
\[ T/K = 293.15 - 333.15 \]
\[ P/MPa = 0.28 - 3.24 \]

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>P/10⁵Pa</th>
<th>( x_{C₂H₄} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>293.15</td>
<td>3.131</td>
<td>0.034</td>
</tr>
<tr>
<td></td>
<td>8.288</td>
<td>0.083</td>
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<td></td>
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<td>8.258</td>
<td>0.066</td>
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<td></td>
<td>17.73</td>
<td>0.138</td>
</tr>
<tr>
<td></td>
<td>32.42</td>
<td>0.253</td>
</tr>
<tr>
<td>333.15</td>
<td>2.057</td>
<td>0.018</td>
</tr>
<tr>
<td></td>
<td>8.278</td>
<td>0.052</td>
</tr>
<tr>
<td></td>
<td>17.83</td>
<td>0.121</td>
</tr>
<tr>
<td></td>
<td>32.22</td>
<td>0.214</td>
</tr>
</tbody>
</table>

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
Static equilibrium cell fitted with magnetic stirrer. Samples analysed by gas chromatography. Details in source.

SOURCE AND PURITY OF MATERIALS:
1. Purity better than 99.6 mole per cent.
2. No details given.

ESTIMATED ERROR:
\[ \delta T/K = \pm 0.1; \delta P = \pm 0.5\%; \delta x_{C₂H₄} = \pm 0.002 \]
(estimated by compiler)

REFERENCES:

ORIGINAL MEASUREMENTS:
Konobeev, D.I.; Lyapin, V.V.
COMPONENTS:
1. Ethene; \( \text{C}_2\text{H}_4 \); [74-85-1]
2. Organic halides

EVALUATOR:
Peter G.T. Fogg
School of Applied Chemistry
University of North London
Holloway Road, London, N7 8DB, U.K.
November, 1993

CRITICAL EVALUATION:

Critical evaluation of the solubility of ethene at a partial pressure not greater than 101.3 kPa in organic halides

In general mole fraction solubility in organic halides is lower than in alkanes but higher than in solvents containing oxygen or nitrogen. Consistent measurements in several organic halides have been obtained by more than one group. This enables a more reliable characterisation of the solubility pattern in organic halides than in oxygen or nitrogen compounds.

Tetrachloromethane; \( \text{CCl}_4 \); [56-23-5]

Solubility in tetrachloromethane at a partial pressure of 101.3 kPa has been reported by Horiuti (1), Narasimhan and Nageshwar (2), Sahgal et al. (3), Leites and Ivanovskii (4), Hannaert et al. (5), Brückl and Kim (6), and by Jadot (7). From the information available the single measurement by Narasimhan appears to be inconsistent with other measurements and must be ignored. The 19 data points from other sources can be fitted to the equation

\[
\ln x_1 = -20.598 + 1773.8/(T/K) + 1.8277 \ln(T/K)
\]

where \( x_1 \) is the mole fraction solubility at \( p_1 = 1.013 \) kPa

standard deviation in values of \( x_1 = 3.1 \times 10^{-4} \)

This equation is recommended for the temperature range 253-323 K.

Trichloromethane; \( \text{CHCl}_3 \); [67-66-3]

Solubility in trichloromethane was measured by Leites and Ivanovskii (4) at 243.15 K and by Camacho Rubio et al. (8) at 293-308 K. In each case data was presented in graphical form only. Data points from the two graphs fit the equation

\[
\ln x_1 = -9.4327 + 1525.5/(T/K)
\]

where \( x_1 \) is the mole fraction solubility at \( p_1 = 1.013 \) kPa

standard deviation in values of \( x_1 = 3.1 \times 10^{-4} \)

This equation is based on 5 data points and corresponds to a solubility curve which differs from the pattern of curves shown by most of the other halocompounds for which corresponding data is available (see fig 1). It should be accepted on a tentative basis for the temperature range 253-323 K pending further measurements on the system.

Chloroethene; \( \text{C}_2\text{H}_3\text{Cl} \); [75-01-4]

Solubility in chloroethene was measured by Hannaert et al. (5) over the temperature range of 213.15-243.15 K. Results were published in the form of an equation for Henry's constant over this temperature range. Mole fraction solubility can be assumed to vary linearly with pressure to at least 101.3 kPa. Extrapolation of the mole fraction solubility to 298.15 K gives a value of 0.0183, close to the solubility in octane and appreciably greater than that in tetrachloro and trichloromethane. There is no reason to doubt Hannaert's measurements but they must be accepted on a tentative basis until they are confirmed by other measurements.

1,2-Dichloroethane; \( \text{C}_2\text{H}_4\text{Cl}_2 \); [107-06-2]

Hannaert et al. (5) also measured solubility in 1,2-dichloroethane in the temperature range 273.15-313.15 K. Choudhari and Doraiswami (9) measured solubility in the range 280-300.5 K. There is poor agreement between the two sets of measurements. The mole fraction solubility at 292.5 K from Hannaert's data is 0.00934 compared with Choudhari's value of 0.00804.
COMPONENTS:
1. Ethene; C₂H₄; [74-85-1]
2. Organic halides

CRITICAL EVALUATION:

The evaluator cannot determine which is likely to be the more reliable measurements. Data from the two sources can be fitted to the equation

\[ \ln x_i = -279.08 + 12799/(T/K) + 40.604 \ln x_i \]

where \( x_i \) is the mole fraction solubility at \( p_i = 1.013 \) kPa
standard deviation in values of \( x_i = 7.3 \times 10^{-4} \)

The variation in solubility with change in temperature as indicated by this equation is inconsistent with the variation in solubility in other halocompounds (see fig.1). This equation should not be used outside the temperature range 273-313 K. Further measurements are needed on this system.

1,1,2,2-Tetrachloroethane: C₂H₂Cl₄; [79-34-5]

Velichko et al. (10) reported solubility in 1,1,2,2-tetrachloroethane over a partial pressure range to 101.3 kPa at three temperature from 273.15 to 298.15 K. Mole fraction solubilities at a partial pressure of 101.3 kPa fit the equation

\[ \ln x_i = -11.562 + 1977.3/(T/K) \]

where \( x_i \) is the mole fraction solubility at \( p_i = 1.013 \) kPa
standard deviation in values of \( x_i = 5.2 \times 10^{-4} \)

As can be seen in fig 1 the measurements indicate a much steeper change in mole fraction solubility with change in temperature as compared with most other chlorocompounds for which data are available. The change is similar to that apparent from the measurements on trichloromethane in the temperature range 293.15-308.15 K but needs confirmation by further work.

Chlorobenzene; C₆H₅Cl; [108-90-7]
Bromobenzene; C₆H₅Br; [108-86-1]

Solubility in chlorobenzene at a partial pressure of 101.3 kPa has been measured by Lopez et al. (11), Horuii (1), and by Sahgal et al. (3) Measurements cover the temperature range 263.15 to 363.15 K and are consistent with one another. Data can be fitted to the equation

\[ \ln x_i = -26.1311 + 1950.0/(T/K) + 2.6600 \ln(T/K) \]

where \( x_i \) is the mole fraction solubility at \( p_i = 1.013 \) kPa
standard deviation in values of \( x_i = 6.7 \times 10^{-5} \)

This equation is recommended by the evaluator for the temperature range 263.15 to 363.15 K.

Solubility in bromobenzene was also measured by Lopez et al. (11) in the temperature range 263.15 to 303.15 K. Mole fraction solubility at a partial pressure of 101.3 kPa may be fitted to the equation

\[ \ln x_i = -25.783 + 1910.4/(T/K) + 2.5971 \ln(T/K) \]

where \( x_i \) is the mole fraction solubility at \( p_i = 1.013 \) kPa
standard deviation in values of \( x_i = 1.2 \times 10^{-5} \)

This equation fits the experimental data slightly better than the one given by the authors. There is no reason to doubt the validity of these measurements but they should be accepted on a tentative basis until confirmed by further measurements.
COMPONENTS:

1. Ethene; \( \text{C}_2\text{H}_4; \ [74-85-1] \)
2. Organic halides

CRITICAL EVALUATION:

Chlorocyclohexane; \( \text{C}_6\text{H}_7\text{Cl}; \ [542-18-7] \)
Bromocyclohexane; \( \text{C}_6\text{H}_7\text{Br}; \ [108-85-0] \)

Lopez et al. (12), measured the solubility in chlorocyclohexane and in bromocyclohexane in the temperature range 263.15 to 303.15 K. Mole fraction solubility in chlorocyclohexane is greater than in bromocyclohexane and also greater than in chlorobenzene. Mole fraction solubility in cyclohexylamine is similarly greater than that in benzenamine.

The evaluator has found that the data for solubility in chlorocyclohexane at a partial pressure of gas of 101.3 kPa fits the equation

\[
\ln x_1 = -9.8501 + 1275.4/(T/K) + 0.2262 \ln(T/K)
\]

where \( x_1 \) is the mole fraction solubility at \( P_1 = 1.013 \text{ kPa} \),

standard deviation in values of \( x_1 = 1.0 \times 10^{-5} \); temp. range 263-303 K

This equation gives better fit than the one given by the authors.

Data for bromocyclohexane may be fitted to the equation

\[
\ln x_1 = -28.775 + 2045.2/(T/K) + 3.0748 \ln(T/K)
\]

where \( x_1 \) is the mole fraction solubility at \( P_1 = 1.013 \text{ kPa} \),

standard deviation in values of \( x_1 = 2.2 \times 10^{-5} \); temp. range 263-303 K

This equation gives better fit than the one given by the authors.

There is no reason to doubt the measurements of solubility in these two solvents and they can be accepted on a tentative basis until confirmed by other workers.

Mixed solvents

Trichloromethane; \( \text{CHCl}_3; \ [67-66-3] \) + 2-propanone; \( \text{C}_3\text{H}_6\text{O}; \ [67-64-1] \)
methylbenzene; \( \text{C}_7\text{H}_8; \ [108-88-3] \)

Leites and Ivanovskii (4) measured solubility in mixtures of trichloromethane with 2-propanone and with methylbenzene at 243.15 K. No other data for these mixtures are available for comparison. The solubility in pure trichloromethane is consistent with measurements at higher temperatures. The value of the solubility in pure 2-propanone differs by about 8% from that calculated from Hannaert's data. Data for the mixture of trichloromethane and 2-propanone may be accepted on a tentative basis, bearing in mind the uncertainty in the data for pure 2-propanone. Leites and Ivanovskii also measured solubility in pure methylbenzene at 213.15, 223.15 and 243.15 K. The value at 243.15 K differs by about 6% from the value calculated from an equation published by Hannaert et al. (5). The solubility in mixtures of trichloromethane and methylbenzene may be accepted on a tentative basis.

Tetrachloromethane; \( \text{CCl}_4; \ [56-23-5] \) + heptane; \( \text{C}_7\text{H}_{16}; \ [142-82-5] \)

Leites and Ivanovskii measured solubility in mixtures of tetrachloromethane and heptane at 253.15 K. Their value for the solubility in pure tetrachloromethane at 253.15 K is consistent with data at higher temperatures from other workers. In addition their measurements of solubility in pure heptane from 213.15 to 253.15 K are consistent with measurements by other workers (3,7) at higher temperatures. The data for solubility in mixtures of tetrachloromethane and heptane may be accepted on a tentative basis.
COMPONENTS:

1. Ethene; C₂H₄; [74-85-1]
2. Organic halides

CRITICAL EVALUATION:

Tetrachloromethane; CCl₄; [56-23-5] + benzene; C₆H₆; [71-43-2]

Narasimham & Nageshwar (2) measured solubility in mixtures of tetrachloromethane and benzene at 293.15 K. Mole fraction solubilities corrected to a partial pressure of 101.3 kPa vary linearly with mole fraction of benzene. There is some uncertainty concerning corrections for the partial pressure of solvent (see compilation sheet). The solubility in pure tetrachloromethane at a partial pressure of 101.3 kPa, as estimated by the compiler from data reported in the same paper, has been rejected by the evaluator in favour of measurements by other workers. The value of the solubility in pure benzene which they reported is about 4% greater than that reported by Horiuti (1).

References

COMPONENTS:
1. Ethene; C$_2$H$_4$; [74-85-1]
2. Organic halides

CRITICAL EVALUATION:

EVALUATOR:
Peter G.T. Fogg
School of Applied Chemistry
University of North London
Holloway Road, London, N7 8DB, U.K.
November, 1993

Figure 1 The solubility of ethene at a partial pressure of 101.3 kPa in organic halides

a Chloroethene
b Trichloromethane
c Tetrachloromethane
d Chlorocyclohexane
e Bromocyclohexane
f Chlorobenzene
g Bromobenzene
h 1,2-Dichloroethene
i 1,1,2,2-Tetrachloroethane
rl reference line based on Raoult's law equation.
COMPONENTS:
(1) Ethene or ethylene; C₂H₄; [74-85-1]
(2) Tetrachloromethane or carbon tetrachloride; CCl₄; [56-23-5]

ORIGINAL MEASUREMENTS:
Horiuti, J.

VARIABLES:
\( T/K: 273.15 - 313.15 \)
\( p_1/kPa: 101.325 \text{ (1 atm)} \)

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

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>( T/K )</th>
<th>( 10^2x_1 )</th>
<th>Bunsen Coefficient ( g/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>273.15</td>
<td>2.069</td>
<td>5.027</td>
<td>5.027</td>
</tr>
<tr>
<td>278.15</td>
<td>1.910</td>
<td>4.605</td>
<td>4.689</td>
</tr>
<tr>
<td>283.15</td>
<td>1.779</td>
<td>4.259</td>
<td>4.415</td>
</tr>
<tr>
<td>288.15</td>
<td>1.659</td>
<td>3.942</td>
<td>4.159</td>
</tr>
<tr>
<td>293.15</td>
<td>1.549</td>
<td>3.654</td>
<td>3.922</td>
</tr>
<tr>
<td>298.15</td>
<td>1.451</td>
<td>3.400</td>
<td>3.711</td>
</tr>
<tr>
<td>303.15</td>
<td>1.360</td>
<td>3.164</td>
<td>3.511</td>
</tr>
<tr>
<td>308.15</td>
<td>1.282</td>
<td>2.962</td>
<td>3.341</td>
</tr>
<tr>
<td>313.15</td>
<td>1.203</td>
<td>2.759</td>
<td>3.163</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.

Smoothed Data: For use between 273.15 and 313.15 K.

\[ \ln x_1 = -8.0980 + 11.5219/(T/100K) \]

The standard error about the regression line is \( 2.62 \times 10^{-5} \).

<table>
<thead>
<tr>
<th>( T/K )</th>
<th>( 10^2x_1 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>273.15</td>
<td>2.065</td>
</tr>
<tr>
<td>283.15</td>
<td>1.780</td>
</tr>
<tr>
<td>288.15</td>
<td>1.658</td>
</tr>
<tr>
<td>293.15</td>
<td>1.549</td>
</tr>
<tr>
<td>298.15</td>
<td>1.450</td>
</tr>
<tr>
<td>303.15</td>
<td>1.361</td>
</tr>
<tr>
<td>313.15</td>
<td>1.205</td>
</tr>
</tbody>
</table>

AUXILIARY INFORMATION

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) Ethene. Prepared by dropping ethanol into orthophosphoric acid. The gas was cooled, passed through several wash solutions, dried, and fractionated from liquid air several times.

(2) Tetrachloromethane. Kahlbaum. Dried over P₂O₅ 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. Ethene; \( \text{C}_2\text{H}_4; \ [74-85-1] \)
2. Tetrachloromethane; \( \text{CCl}_4; \ [56-23-5] \)

ORIGINAL MEASUREMENTS:
Narasimhan, S.; Nageshwar, G.W.
Chem. Petro-Chem. J. (India)

VARIABLES:
\( T/K = 293.15 \)
\( p/kPa = 101.325 \)

PREPARED BY:
W. Hayduk

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>( t/C )</th>
<th>( T/K )</th>
<th>( \text{Mole Fraction Ethene for:} )</th>
<th>( \text{Ostwald Coefficient} )</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>( p/kPa = 101.325 )</td>
<td>( p/kPa = 101.325 )</td>
</tr>
<tr>
<td>20</td>
<td>293.15</td>
<td>0.01612</td>
<td>0.01827</td>
</tr>
</tbody>
</table>

Although not specifically stated in the paper, it is assumed that the mole fraction solubility is for a total pressure of 101.325 kPa.

2Calculated by compiler; a gas molar volume of 23910 cm\(^3\)/mole was used at 293.15 K and 101.325 kPa for the calculation of \( L \), and Henry's law was assumed to apply for the calculation of \( x_1 \).

It was confirmed by personal communication that the solubilities were measured at atmospheric pressure.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
The solvent was held in a jacketed burette. Constant temperature water was circulated through the jacket. Gas was bubbled through the solvent until saturated. The dissolved gas content was determined by an electrometric dead-stop titration technique which yielded the bromine number. The electrometric titrator was based on a design given in reference 1.

SOURCE AND PURITY OF MATERIALS:
1. Ethene prepared by catalytic dehydration of ethanol over activated alumina at 350-400°C and analyzed by chromatography. Purity not given.
2. Tetrachloromethane was distilled twice in a laboratory packed column.

ESTIMATED ERROR:
\( \delta x_1 / x_1 = \pm 3\% (\text{Estimated by compiler}) \)

REFERENCES:
1. Dubois, H.D.; Skoog, D.A.
**COMPONENTS:**
1. Ethene; \( \text{C}_2\text{H}_4; \) [74-85-1]
2. Tetrachloromethane; \( \text{CCl}_4; \) [56-23-5]

**ORIGINAL MEASUREMENTS:**
Sahgal, A.; La, H.M.; Hayduk, W.

**VARIABLES:**
- \( T/K = 273-323 \)
- \( P/kPa = 101.325 \)

**PREPARED BY:**
W. Hayduk

**EXPERIMENTAL VALUES:**

<table>
<thead>
<tr>
<th>( t/C )</th>
<th>( T/K )</th>
<th>Mole Fraction Ethene, ( x_1 )</th>
<th>Ostwald Coefficient, ( L/\text{cm}^3\text{gas} \text{(cm}^3\text{solvent})^{-1} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>273.15</td>
<td>0.0208</td>
<td>5.02</td>
</tr>
<tr>
<td>25</td>
<td>298.15</td>
<td>0.0146</td>
<td>3.72</td>
</tr>
<tr>
<td>50</td>
<td>323.15</td>
<td>0.0103</td>
<td>2.74</td>
</tr>
</tbody>
</table>

Mole fraction ethene, \( x_1 \), is for a gas partial pressure of 101.325 kPa.

**AUXILIARY INFORMATION**

**METHOD/APPARATUS/PROCEDURE:**
A glass apparatus equipped with a gas storage burette, a spiral tube for gas absorption, a miniature internal manometer and a solution storage burette was used. Degassed solvent was injected at a constant rate into the absorption spiral by means of a syringe-pump while the gas was displaced by mercury using a mechanical elevating device for a mercury bottle, at a rate required to keep the gas pressure constant. Readings of the volume of vapor-free gas consumed and volume of solvent required to achieve saturation were obtained from which the solubility was calculated. Constant temperature fluid was circulated through a jacket enclosing the burettes and absorption spiral.

**SOURCE AND PURITY OF MATERIALS:**
1. Ethene was CP grade from Matheson, 99.5 mole % minimum purity.
2. Tetrachloromethane was from J.T. Baker of 99.9 mole % purity.

**ESTIMATED ERROR:**
- \( \delta x_1 / x_1 = \pm 2\% \)
- \( \delta T/K = \pm 0.05 \)

**REFERENCES:**
COMPONENTS:
1. Ethene; C₂H₄; [74-85-1]
2. Tetrachloromethane (carbon tetrachloride); CCl₄; [56-23-5]

ORIGINAL MEASUREMENTS:
Leites, I.L.; Ivanovskii, F.P.

VARIABLES:
\[ T/K = 253.15, \]
\[ P/kPa = 101.325 \]

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>( z/C )</th>
<th>( T/K )</th>
<th>( \log_{10}(\text{H/ atm}))</th>
<th>( ^2 \text{Henry's Constant, } H/\text{atm (mole fraction)}^{-1} )</th>
<th>( ^2 \text{Mole Fraction Ethene, } x_1 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>-20</td>
<td>253.15</td>
<td>4.391</td>
<td>32.37</td>
<td>0.0309</td>
</tr>
</tbody>
</table>

This result was part of a study for the behavior of solubilities in two-component solvent solutions.

1 Only graphical results were available in this paper; a value of log of Henry's constant (\( H' \)) was read from an enlarged graph by the compiler.

2 Henry's constant (\( H \)) and mole fraction solubility (\( x_1 \)) were calculated by the compiler.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
A metal cryostat was cooled with dry-ice and acetone and controlled to a temperature to \( \pm 0.05 \text{ K} \). The equilibrium cell was mounted in the cryostat. The solvent was purified by fractional distillation and analyzed by chromatography. Details were not given.

SOURCE AND PURITY OF MATERIALS:
1. Ethene purity was stated to be 99.9%.
2. Tetrachloromethane was distilled and analyzed by chromatography. Actual purity not given.

ESTIMATED ERROR:
\[ \delta T/K = \pm 0.05 \]
\[ \delta x_1 / x_1 = \pm 0.01 \text{ (Authors)} \]

REFERENCES:
COMPONENTS:
1. Ethene; C₂H₄; [74-85-1]
2. Tetrachloromethane; CCl₄; [56-23-5]

ORIGINAL MEASUREMENTS:
Hannaert, H.; Haccuria, M.; Mathieu, M.P.

VARIABLES:
\( T / K = 258.15 - 293.15 \)
\( p_1 / \text{kPa} = 101.3 \)

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>( t / \text{C} )</th>
<th>( T / K )</th>
<th>( x_1 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>-15</td>
<td>258.15</td>
<td>0.0285</td>
</tr>
<tr>
<td>-10</td>
<td>263.15</td>
<td>0.0259</td>
</tr>
<tr>
<td>10</td>
<td>283.15</td>
<td>0.0184</td>
</tr>
<tr>
<td>20</td>
<td>293.15</td>
<td>0.0158</td>
</tr>
</tbody>
</table>

1 Mole fraction solubility calculated by compilers for a gas partial pressure of 101.3 kPa using the equation developed by the authors with \( v = 1 \), for the applicable temperature range:

\[
\log \left( K_T V \right) = 3.69 - \left( \frac{\Delta H / \text{cal mol}^{-1}}{2.3R(T/K)} \right)
\]

The authors' definitions are:

\( \Delta H = 2,530 \text{ cal mol}^{-1} \), Enthalpy of dissolution

\( K = y_1 / x_1 \) = mole fraction gas in gas phase
mole fraction gas in liquid phase

\( \pi / \text{atm} \) = total pressure

\( v \) = coefficient of fugacity

The function, \( K_T V / \text{atm} \), is equivalent to a Henry's constant in the form

\( H_{1,\pi} / \text{atm} = (f_1 / \text{atm}) / x_1 \), where \( f_1 \) is the fugacity.

METHOD/APPARATUS/PROCEDURE:

The authors describe several methods used; the one used in this case is the least accurate.

The apparatus is of glass and consists of a burette in which the gas is confined over mercury, two bulbs for the solvent, one above the other, a mercury manometer and a constant temperature bath. A measured volume of solvent is degassed in the top bulb at ambient temperature and charged to the absorption bulb in the bath. Gas is charged to the desired pressure. The quantity of gas added at constant pressure is measured. Agitation is manual.

SOURCE AND PURITY OF MATERIALS:
   Specified purity 99.9%
2. Tetrachloromethane. Merck.
   Vapor pressures at -15°C and 20°C are 14 and 90 mm Hg.
   Purity not given.

ESTIMATED ERROR:
\( \delta x_1 / x_1 = \pm 10 \) to 15% (authors)

REFERENCES:
COMPONENTS:

1. Ethene; \( \text{C}_2\text{H}_4 \); [74-85-1]
2. Tetrachloromethane (Carbon tetrachloride); \( \text{CCl}_4 \); [56-23-5]

VARIABLES:

\[ T/K = 298.2 \]
\[ P/kPa = 101.3 \]

EXPERIMENTAL VALUES:

\[ \ln \frac{H}{\text{atm}} \quad \text{Mole fraction of ethene in liquid}^\dagger, x_{\text{C}_2\text{H}_4} \]

4.23 \hspace{1cm} 0.01455

\[ x_{\text{C}_2\text{H}_4} = \frac{1}{H}. \]

\[ ^\dagger \text{at a partial pressure of 1 atmosphere, calculated by compiler, assuming } x_{\text{C}_2\text{H}_4} = \frac{1}{H}. \]

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Solubilities were determined by a volumetric method described as "the Ostwald method". No other details given.

SOURCE AND PURITY OF MATERIALS:

1. Linde Co. sample, purity 99.8 volume per cent.
2. Uvasol or analytical grade.

ESTIMATED ERROR:

\[ \delta T/K = \pm 0.1; \quad \delta H = \pm 1.25\%. \]

REFERENCES:
COMPONENTS:
1. Ethene; C₂H₄; [74-85-1]
2. Tetrachloromethane; CCl₄; [56-23-5]

ORIGINAL MEASUREMENTS:
Jadot, R.

VARIABLES:
\[ T/K = 298.15 \]
\[ P/kPa = 101.3 \]

PREPARED BY:
C.L. Young

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>( T/K )</th>
<th>Henry's Law Constant, ( H/\text{atm} )</th>
<th>Mole fraction(^*) at partial pressure of 101.3 ( \text{kPa} ), ( x_{\text{C}_2\text{H}_4} )</th>
<th>#( \Delta H^\infty ) (/cal mol(^{-1}))</th>
</tr>
</thead>
<tbody>
<tr>
<td>298.15</td>
<td>67.55</td>
<td>0.01480</td>
<td>598 (2502)</td>
</tr>
</tbody>
</table>

\(^*\) Calculated by compiler assuming \( x_{\text{C}_2\text{H}_4} = 1/H \).

\(^\#\) Excess partial molar enthalpy of solution at infinite dilution.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
The conventional gas chromatographic technique 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 no allowance was made for surface adsorption.

SOURCE AND PURITY OF MATERIALS:
No details given.

ESTIMATED ERROR:
\[ \delta T/K = \pm 0.05; \delta H = \pm 2\% \]

REFERENCES:
COMPONENTS:
1. Ethene; C₂H₄; [74-85-1]
2. Trichloromethane (chloroform); CHCl₃; [67-66-3]

ORIGINAL MEASUREMENTS:
Leites, I.L.; Ivanovskii, F.P.

VARIABLES:
\[ T/K = 243.15, \]
\[ P_1/kPa = 101.325 \]

PREPARED BY:
W. Hayduk

EXPERIMENTAL VALUES:
<table>
<thead>
<tr>
<th>t/C</th>
<th>T/K</th>
<th>( \log_{10}(H'/\text{mmHg}) )</th>
<th>( \text{Henry's Constant, } \frac{H}{\text{atm (mole fraction)}} )</th>
<th>( \text{Mole Fraction } )</th>
</tr>
</thead>
<tbody>
<tr>
<td>-30</td>
<td>243.15</td>
<td>4.257</td>
<td>23.67</td>
<td>0.0422</td>
</tr>
</tbody>
</table>

This result was part of a study for the behavior of solubilities in two-component solvent solutions.

\(^1\) Only graphical results were available in this paper; a value of \( \log \) of Henry's constant (\( H' \)) was read from an enlarged graph by the compiler.

\(^2\) Henry's constant (\( H \)) and mole fraction solubility \((x_1)\) were calculated by the compiler.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
A metal cryostat was cooled with dry-ice and acetone and controlled to a temperature to \( \pm 0.05 \) K. The equilibrium cell was mounted in the cryostat. The solvent was purified by fractional distillation and analyzed by chromatography. Details were not given.

SOURCE AND PURITY OF MATERIALS:
1. Ethene purity was stated to be 99.9%.
2. Trichloromethane was distilled and analyzed by chromatography. Actual purity not given.

ESTIMATED ERROR:
\[ \delta T/K = \pm 0.05 \]
\[ \delta x_1/x_1 = \pm 0.01 \text{ (Authors)} \]
COMPONENTS:
1. Ethene; C₂H₄; [74-85-1]
2. Trichloromethane (chloroform); CHCl₃; [67-66-3]

ORIGINAL MEASUREMENTS:
Camacho Rubio, F.; Delgado Diaz, S.; Alvaro Alvarez, R.
Revista Ing. Quím. (Spain) 1980, 18, 83-87.

VARIABLES:

\[
\frac{T}{K} = 293.15 - 308.15 \\
P₁/kPa = 101.325
\]

PREPARED BY:
W. Hayduk

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>t/C</th>
<th>T/K</th>
<th>(\log_{10} K_s)</th>
<th>(K_s/\text{mm Hg (mol/l)}^{-1})</th>
<th>(\text{Henry's Constant, } H/\text{atm (mol frac.)})¹</th>
<th>(\text{Ethene Mole Fraction, } x₁)</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>293.15</td>
<td>3.602</td>
<td>66.62</td>
<td>0.0150</td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>298.15</td>
<td>3.651</td>
<td>74.07</td>
<td>0.0135</td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>303.15</td>
<td>3.699</td>
<td>82.10</td>
<td>0.0122</td>
<td></td>
</tr>
<tr>
<td>35</td>
<td>308.15</td>
<td>3.746</td>
<td>90.66</td>
<td>0.0110</td>
<td></td>
</tr>
</tbody>
</table>

The ethene solubility in chloroform is shown as a straight-line graph only, with \(\log K_s\) versus \(1/T\) for an applicable temperature range from 293.15 to 308.15 K.

¹ Values of \(\log K_s\) were taken from an enlarged graph and fitted to an equation by the compiler as follows:

\[
\log_{10} K_s = 6.5583 - 866.67 (T/K)^{-1}
\]

²A more common Henry's constant (H) and mole fraction ethene solubility for a partial pressure of 101.3 kPa were calculated by the compiler.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
A glass vessel, 100 cm³ in volume, equipped with three ports and submerged in a constant temperature bath, is used for solubility determinations. One port is connected to a gas burette from which a known volume of gas can be charged using a mercury levelling bottle. Another port is for evacuation and the third is for temperature measurement. A magnetic stirrer is employed. A drying tube is used to ensure that the ethene is dry. Care is also taken to ensure that the purified solvent is not exposed to air.

SOURCE AND PURITY OF MATERIALS:
1. Ethene. Neither source nor purity specified.
2. Trichloromethane. The 1.5 parts ethanol stabilizer per 100 parts solvent (v/v) were removed by adsorption on activated silica. Purity not specified.

ESTIMATED ERROR:
\(\delta x₁/x₁ = \pm 4\%\) (compiler)

REFERENCES:
COMPONENTS:
1. Ethene; C\(_2\)H\(_4\); [74-85-1]
2. Chloroethene (vinyl chloride); C\(_2\)H\(_2\)Cl; [75-01-4]

ORIGINAL MEASUREMENTS:
Hannaert, H.; Haccuriai, M.; Mathieu, M.P.

VARIABLES:
\[ T/K = 213.15 - 243.15 \]
\[ P_1/kPa = 101.3 \]

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>( t/C )</th>
<th>( T/K )</th>
<th>( \text{Mole Fraction Ethene, } x_1 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>-60</td>
<td>213.15</td>
<td>0.110</td>
</tr>
<tr>
<td>-50</td>
<td>223.15</td>
<td>0.0829</td>
</tr>
<tr>
<td>-40</td>
<td>233.15</td>
<td>0.0641</td>
</tr>
<tr>
<td>-30</td>
<td>243.15</td>
<td>0.0507</td>
</tr>
</tbody>
</table>

'Mole fraction solubility calculated by compilers for a gas partial pressure of 101.3 kPa using the equation developed by the authors with \( v = 1 \), for the applicable temperature range:

\[
\log (K_T) = 3.68 - (\Delta H/\text{cal mol}^{-1})/(2.3R(T/K))
\]

The authors' definitions are:

\[
\Delta H = 2,650 \text{ cal mol}^{-1}, \text{ Enthalpy of dissolution}
\]

\[
K = y_1/x_1 = \text{mole fraction gas in gas phase} / \text{mole fraction gas in liquid phase}
\]

\[ \nu/\text{atm} = \text{total pressure} \]

\[ v = \text{coefficient of fugacity} \]

The function, \( K_T \nu/\text{atm} \), is equivalent to a Henry's constant in the form

\[
H_{1,2}/\text{atm} = (f_1/\text{atm})/x_1 \text{ where } f_1 \text{ is the fugacity.}
\]

SOURCE AND PURITY OF MATERIALS:
1. Ethene. Air Liquide. Specified purity 99.9%
2. Chloroethene. BASF. Densities at -40°C and -60°C reported as 1.016 and 1.0485 g cm\(^{-3}\). Specified purity 99.9%.

ESTIMATED ERROR:

\[ T/K = \pm 0.2 \]

\[ \delta x_1/x_1 = \pm 2 \text{ to } 5\% \]

\[ P/\text{mm Hg} = \pm 0.1 \text{ (authors) } \]
COMPONENTS:
1. Ethene; C₂H₄; [74-85-1]
2. 1,2-Dichloroethane; C₂H₂Cl₂; [107-06-2]

ORIGINA L MEASUREMENTS:
Hannaert, H.; Haccuria, M.; Mathieu, M.P.

VARIABLES:

\[ \frac{T}{K} = 273.15 - 313.15 \]
\[ p_1/kPa = 101.3 \]

PREPARED BY:
W. Hayduk
H.L. Clever

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>(\bar{\chi}/C)</th>
<th>(\frac{T}{K})</th>
<th>(1) Mole Fraction Ethene, (x_1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>273.15</td>
<td>0.0113</td>
</tr>
<tr>
<td>10</td>
<td>283.15</td>
<td>0.0102</td>
</tr>
<tr>
<td>20</td>
<td>293.15</td>
<td>0.0093</td>
</tr>
<tr>
<td>25</td>
<td>298.15</td>
<td>0.0089</td>
</tr>
<tr>
<td>40</td>
<td>313.15</td>
<td>0.0079</td>
</tr>
</tbody>
</table>

1 Mole fraction solubility calculated by compilers for a gas partial pressure of 101.3 kPa using the equation developed by the authors with \(\nu = 1\), for the applicable temperature range:

\[ \log \left( \frac{K_{TV}}{\atm} \right) = 3.166 - \left( \frac{\Delta H}{\text{cal mol}^{-1}} \right)/\left(2.3R\frac{T}{K}\right) \]

The authors' definitions are:

\[ \Delta H = 1,520 \text{ cal mol}^{-1}, \text{ Enthalpy of dissolution} \]

\[ K = \frac{y_1}{x_1} = \text{ mole fraction gas in gas phase} \]
\[ \text{ mole fraction gas in liquid phase} \]

\[ \pi/\text{atm} = \text{ total pressure} \]

\[ \nu = \text{ coefficient of fugacity} \]

The function, \(K_{TV}/\atm\), is equivalent to a Henry's constant in the form

\[ H_{1,2}/\atm = \left( \frac{f_1}{\atm} \right)/x_1 \]

where \(f_1\) is the fugacity.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The authors describe several methods used; the one used in this case was considered the most accurate.

The apparatus was of glass and consisted of a burette in which the gas was confined over mercury, an absorption vessel agitated electromagnetically, a turbine for circulating the gas, a mercury manometer and a constant temperature bath. The exposed tubing was minimized. The quantity of gas introduced into the absorption vessel was measured volumetrically.

SOURCE AND PURITY OF MATERIALS:

1. Ethene. Air Liquide. Specified purity 99.9%

2. 1,2-Dichloroethane. Produced by synthesis. Distilled and fractionally crystallized. Density at 20°C is 1.2627 g cm⁻³. Purity > 99.9% by spectroscopy and gas chromatography.

ESTIMATED ERROR:

\[ \frac{T}{K} = \pm 0.2 \]
\[ \delta x_1/x_1 = \pm 2 \text{ to } 5\% \]
\[ p/\text{mm Hg} = \pm 0.1 \text{ (authors)} \]

REFERENCES:
COMPONENTS:
1. Ethene; \( \text{C}_2\text{H}_4 \); [74-85-1]
2. Ethane, 1,2-Dichloro-
(ethylenedichloride); \( \text{C}_2\text{H}_4\text{Cl}_2 \); [107-06-2]

ORIGINAL MEASUREMENTS:
Choudhari, R.V.; Doraiswami, L.K.

VARIABLES:
\( T/\text{K} = 280.0-300.5 \)
\( P/\text{kPa} = 94.23 \)

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>( T/\text{K} )</th>
<th>Solubility at ( P = 94.23 ) (0.93 atm) ( s/\text{g(l)} )</th>
<th>(^1) Solubility at ( p = 101.325 ) kPa Mole Fraction, ( x_1 )</th>
<th>(^1) Henry's Constant ( H/\text{atm/(mole fraction)} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>280</td>
<td>3.67</td>
<td>0.01139</td>
<td>87.8</td>
</tr>
<tr>
<td>287</td>
<td>2.66</td>
<td>0.00854</td>
<td>117.1</td>
</tr>
<tr>
<td>292.5</td>
<td>2.43</td>
<td>0.00804</td>
<td>124.4</td>
</tr>
<tr>
<td>300.5</td>
<td>2.05</td>
<td>0.00718</td>
<td>139.2</td>
</tr>
</tbody>
</table>

\(^1\)Calculated by compiler; \( x_1 \) is for a gas partial pressure of 101.325 kPa.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
The glass absorption vessel was equipped with a stainless steel stirrer and a jacket through which constant temperature water was circulated. A volume of 400-500 cm\(^3\) of solvent was charged into the vessel, thermal equilibrium was established and then gas was bubbled through the solvent. Samples were withdrawn at 10-15 min. intervals for analysis using a chemical analysis for the olefin content. When the concentrations remained constant, equilibrium was established. Precautions were taken to exclude water vapor from the air from entering the vessel. Experiments were performed at atmospheric pressure, 0.93 atm (at Poona, India). Reference 1 refers to the method of olefin analysis.

SOURCE AND PURITY OF MATERIALS:
1. Ethene purity 99.0%.
2. 1,2-Dichloroethane purity 99.0%.

ESTIMATED ERROR:
\( T/\text{K} = \pm 0.05 \)
\( \delta s/s = \pm 2\% \)

REFERENCES:
1. Thomas, C.L.; Block, H.S.; Hockstra, J.
COMPONENTS:
1. Ethene; \( \text{C}_2\text{H}_4 \); [74-85-1]
2. 1,1,2,2-Tetrachloroethane; \( \text{C}_2\text{H}_4\text{Cl}_4 \); [79-34-5]

ORIGINAL MEASUREMENTS:
Velichko, S.M.; Treger, Yu.A.; Flid, R.M.

VARIABLES:
\( T/K = 273.15 - 298.15 \)
\( p_1/\text{kPa} = 101.325 \)

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>( t/\degree\text{C} )</th>
<th>( T/K )</th>
<th>( c, \text{ Moles per litre} )</th>
<th>( x_1 )</th>
<th>( \text{Ostwald Coefficient} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>273.15</td>
<td>0.250</td>
<td>0.0137</td>
<td>5.56</td>
</tr>
<tr>
<td>10</td>
<td>283.15</td>
<td>0.175</td>
<td>0.0097</td>
<td>4.04</td>
</tr>
<tr>
<td>25</td>
<td>298.15</td>
<td>0.132</td>
<td>0.0074</td>
<td>3.21</td>
</tr>
</tbody>
</table>

1 Only graphical results were available in this paper; the solubility, \( c \), was shown as a function of partial pressure, \( p_1 \), up to a partial pressure of 101.3 kPa showing that Henry's law was obeyed. Values of \( c \) for a partial pressure of 101.3 kPa were read from an enlarged graph by the compiler.

2 Calculated by the compiler.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
A known quantity of solvent was charged into a thermostated saturation vessel attached to a mechanical mixer. Ethene gas admixed with argon was allowed to flow into the saturation vessel at a controlled rate. The composition of the gas was monitored by chromatography. Saturation of the solvent continued until the content of ethene entering and leaving the saturation vessel was the same. The gas analysis was by means of chromatography using a thermal conductivity detector. Samples of saturated solution were withdrawn by means of a syringe and analyzed also by chromatography but using a flame ionization detector.

SOURCE AND PURITY OF MATERIALS:
Sources and purities not given.

ESTIMATED ERROR:
\( \Delta x_1 / x_1 = \pm 4\% \) (compiler)

REFERENCES:
**COMPONENTS:**

1. Ethene; $C_2H_4$; [74-85-1]
2. Chlorobenzene; $C_6H_5Cl$; [108-90-7]

**ORIGINAL MEASUREMENTS:**

Lopez, M.C.; Gallardo, M.A.; Urieta, J.S.; Gutierrez Losa, C.

**VARIABLES:**

$$\frac{T}{K} = 263.15 - 303.15$$

$$P_1/kPa = 101.32$$

**PREPARED BY:**

W. Hayduk

**EXPERIMENTAL VALUES:**

<table>
<thead>
<tr>
<th>$T/K$</th>
<th>Mole Fraction $x_1$</th>
<th>$^{1}$Ostwald Coefficient $\alpha$/$L/cm^3$</th>
<th>$^{1}$Bunsen Coefficient $\alpha$/$cm^3(STP)$ atm$^{-1}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>263.15</td>
<td>202</td>
<td>4.46</td>
<td>4.63</td>
</tr>
<tr>
<td>273.15</td>
<td>171</td>
<td>3.88</td>
<td>3.88</td>
</tr>
<tr>
<td>283.15</td>
<td>146</td>
<td>3.39</td>
<td>3.27</td>
</tr>
<tr>
<td>293.15</td>
<td>126.5</td>
<td>3.01</td>
<td>2.80</td>
</tr>
<tr>
<td>303.15</td>
<td>110.5</td>
<td>2.69</td>
<td>2.42</td>
</tr>
</tbody>
</table>

$^1$The Bunsen and Ostwald coefficients were calculated by the compiler.

The authors fitted their data to the equation:

$$\ln x_1 = -10.1836 + 1274.115(T/K) + 0.2581 \ln (T/K)$$

They also obtained $\Delta H/kJ mol^{-1} = -9.95$ and $\Delta S/J K^{-1} mol^{-1} = -70$ for the transfer of one mole of ethene from the gas phase at 101.32 kPa to the hypothetical unit mole fraction solution.

**AUXILIARY INFORMATION**

**METHOD/APPARATUS/PROCEDURE:**

The apparatus was similar to that used by Ben Nairn and Baer (ref.1) and is described in ref.2. The apparatus consists of a burette system for the gas, a mercury manometer and a solution vessel. The mole fraction of dissolved gas is estimated from the volume change at constant pressure of saturated gas in the burettes, and the mass of the solvent in the solution vessel determined by weighing.

**SOURCE AND PURITY OF MATERIALS:**

1. Ethene. Sociedad Española del Oxigeno. Specified purity 99.9%.
2. Chlorobenzene. Merck. Specified purity 99.5%

**ESTIMATED ERROR:**

$$\delta x_1/x_1 = \pm 0.01$$ (authors)

**REFERENCES:**

1. Ben Nairn, A.; Baer, S.
2. Carnicer, J.; Gibanel, F.; Urieta, J.S.; Gutierrez Losa, C.
### COMPONENTS:
1. Ethene or ethylene; \( \text{C}_2\text{H}_4; \) [74-85-1]
2. Chlorobenzene; \( \text{C}_6\text{H}_5\text{Cl}; \) [108-90-7]

### ORIGINAL MEASUREMENTS:
Horiuti, J.

### VARIABLES:
- \( T/\text{K}: \) 273.15 - 363.15
- \( P_1/\text{kPa}: \) 101.325 (1 atm)

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

### EXPERIMENTAL VALUES:
See following page

### AUXILIARY INFORMATION

#### 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. Ethene. Prepared by dropping ethanol into orthophosphoric acid. The gas was cooled, passed through several wash solutions, dried, and fractionated from liquid air several times.
2. Chlorobenzene. Kahlbaum. Dried and distilled. Boiling point (760 mmHg) 131.96°C.

#### ESTIMATED ERROR:
- \( \delta T/\text{K} = 0.05 \)
- \( \delta x_1/x_1 = 0.01 \)

#### REFERENCES:
COMPONENTS:
(1) Ethene or ethylene; C\textsubscript{2}H\textsubscript{4}; [74-85-1]
(2) Chlorobenzene; C\textsubscript{6}H\textsubscript{5}Cl; [108-90-7]

ORIGINAL MEASUREMENTS:
Horiuti, J.

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\textsuperscript{3}x_j</td>
<td>(\alpha/(cm\textsuperscript{3}(STP))\textsuperscript{cm}\textsuperscript{-3}\textsuperscript{atm}\textsuperscript{-1})</td>
<td>(L/cm\textsuperscript{3}\textsuperscript{cm}\textsuperscript{-3})</td>
</tr>
<tr>
<td>273.15</td>
<td>16.99</td>
<td>3.882</td>
<td>3.882</td>
</tr>
<tr>
<td>278.15</td>
<td>15.74</td>
<td>3.575</td>
<td>3.640</td>
</tr>
<tr>
<td>283.15</td>
<td>14.63</td>
<td>3.304</td>
<td>3.425</td>
</tr>
<tr>
<td>288.15</td>
<td>13.60</td>
<td>3.053</td>
<td>3.221</td>
</tr>
<tr>
<td>293.15</td>
<td>12.60</td>
<td>2.812</td>
<td>3.018</td>
</tr>
<tr>
<td>298.15</td>
<td>11.92</td>
<td>2.645</td>
<td>2.887</td>
</tr>
<tr>
<td>303.15</td>
<td>11.08</td>
<td>2.445</td>
<td>2.714</td>
</tr>
<tr>
<td>308.15</td>
<td>10.41</td>
<td>2.283</td>
<td>2.576</td>
</tr>
<tr>
<td>313.15</td>
<td>9.838</td>
<td>2.146</td>
<td>2.460</td>
</tr>
<tr>
<td>318.15</td>
<td>9.339</td>
<td>2.026</td>
<td>2.360</td>
</tr>
<tr>
<td>323.15</td>
<td>8.876</td>
<td>1.915</td>
<td>2.265</td>
</tr>
<tr>
<td>328.15</td>
<td>8.380</td>
<td>1.798</td>
<td>2.160</td>
</tr>
<tr>
<td>333.15</td>
<td>8.009</td>
<td>1.709</td>
<td>2.084</td>
</tr>
<tr>
<td>338.15</td>
<td>7.639</td>
<td>1.621</td>
<td>2.007</td>
</tr>
<tr>
<td>343.15</td>
<td>7.288</td>
<td>1.538</td>
<td>1.932</td>
</tr>
<tr>
<td>348.15</td>
<td>6.989</td>
<td>1.467</td>
<td>1.870</td>
</tr>
<tr>
<td>353.15</td>
<td>6.725</td>
<td>1.404</td>
<td>1.815</td>
</tr>
<tr>
<td>358.15</td>
<td>6.459</td>
<td>1.341</td>
<td>1.758</td>
</tr>
<tr>
<td>363.15</td>
<td>6.218</td>
<td>1.284</td>
<td>1.707</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.

Smoothed Data: For use between 273.15 and 363.16 K.

\[ \ln x_j = -13.9824 + 19.6322/(T/100K) + 2.7104 \ln (T/100K) \]

The standard error about the regression line is 3.75 x 10\textsuperscript{-5}.
COMPONENTS:
1. Ethene; $C_2H_4$; [74-85-1]
2. Chlorobenzene; $C_6H_5Cl$; [108-90-7]

ORIGINAL MEASUREMENTS:
Sahgal, A.; La, H.M.; Hayduk, W.

VARIABLES:
$T/K = 273-323$
$P/kPa = 101.325$

PREPARED BY:
W. Hayduk

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>$t/°C$</th>
<th>$T/K$</th>
<th>Ethene,$x_1$</th>
<th>$L/cm^3$ gas /$cm^3$ solvent</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>273.15</td>
<td>0.0173</td>
<td>3.92</td>
</tr>
<tr>
<td>25</td>
<td>298.15</td>
<td>0.0120</td>
<td>2.90</td>
</tr>
<tr>
<td>50</td>
<td>323.15</td>
<td>0.00893</td>
<td>2.27</td>
</tr>
</tbody>
</table>

Mole fraction ethene, $x_1$, is for a gas partial pressure of 101.325 kPa.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
A glass apparatus equipped with a gas storage burette, a spiral tube for gas absorption, a miniature internal manometer and a solution storage burette was used. Degassed solvent was injected at a constant rate into the absorption spiral by means of a syringe-pump while the gas was displaced by mercury using a mechanical elevating device for a mercury bottle, at a rate required to keep the gas pressure constant. Readings of the volume of vapor-free gas consumed and volume of solvent required to achieve saturation were obtained from which the solubility was calculated. Constant temperature fluid was circulated through a jacket enclosing the burettes and absorption spiral.

SOURCE AND PURITY OF MATERIALS:
1. Ethene was CP grade from Matheson, 99.5 mole % minimum purity.
2. Chlorobenzene was from Fisher of 99.9 mole % purity.

ESTIMATED ERROR:
$\delta x_1/x_1 = \pm 2\%$
$\delta T/K = \pm 0.05$

REFERENCES:
COMPONENTS:
1. Ethene; C₂H₄; [74-85-1]
2. Bromobenzene; C₆H₅Br; [108-86-1]

ORIGINAL MEASUREMENTS:
Lopez, M.C.; Gallardo, M.A.; Urieta, J.S.; Gutierrez Losa, C.

VARIABLES:

\[ \frac{T}{K} = 263.15 - 303.15 \]
\[ \frac{p}{kPa} = 101.32 \]

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>Mole Fraction</th>
<th>(^1)Ostwald Coefficient</th>
<th>(^1)Bunsen Coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(10^3 \times_1)</td>
<td>L/cm(^3)cm(^{-3})</td>
<td>(\alpha/cm^3(\text{STP}) \text{cm}^3\text{atm}^{-1})</td>
</tr>
<tr>
<td>263.15</td>
<td>174</td>
<td>3.70</td>
<td>3.84</td>
</tr>
<tr>
<td>273.15</td>
<td>147</td>
<td>3.21</td>
<td>3.21</td>
</tr>
<tr>
<td>283.15</td>
<td>126.2</td>
<td>2.83</td>
<td>2.73</td>
</tr>
<tr>
<td>293.15</td>
<td>109.4</td>
<td>2.52</td>
<td>2.34</td>
</tr>
<tr>
<td>303.15</td>
<td>96.5</td>
<td>2.27</td>
<td>2.05</td>
</tr>
</tbody>
</table>

\(^1\)The Bunsen and Ostwald coefficients were calculated by the compiler.

The authors fitted their data to the equation:

\[ \ln x_1 = -17.9492 + 1581.0929 (T/K)^{-1} + 1.4158 \ln(T/K) \]

They also obtained \(\Delta H/\text{kJ mol}^{-1} = -9.64\) and \(\Delta S/\text{J K}^{-1} \text{mol}^{-1} = -70\) for the transfer of one mole of ethene from the gas phase at 101.32 kPa to the hypothetical unit mole fraction solution.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
The apparatus was similar to that used by Ben Naim and Baer (ref.1) and is described in ref.2. The apparatus consists of a burette system for the gas, a mercury manometer and a solution vessel. The mole fraction of dissolved gas is estimated from the volume change at constant pressure of saturated gas in the burettes, and the mass of the solvent in the solution vessel determined by weighing.

SOURCE AND PURITY OF MATERIALS:
1. Ethene. Sociedad Espanol del Oxigeno. Specified purity 99.9%.
2. Bromobenzene. Fluka. Specified purity 99.5%

ESTIMATED ERROR:

\[ \delta x_1 / x_1 = \pm 0.01 \] (authors)

REFERENCES:
1. Ben Naim, A.; Baer, S.
2. Carnicer, J.; Gibanel, F.; Urieta, J.S.; Gutierrez Losa, C.
COMPONENTS:
1. Ethene; C₂H₆; [74-85-1]
2. Chlorocyclohexane; C₆H₁₁Cl; [542-18-7]

ORIGINAL MEASUREMENTS:
Lopez, M.C.; Gallardo, M.A.; Urieta, J.S.; Gutierrez Losa, C.

VARIABLES: $T/K = 263.15 - 303.15$
$P/kPa = 101.32$

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>$T/K$</th>
<th>Mole Fraction $10^4 x_1$</th>
<th>¹Ostwald Coefficient $L/cm^3 \text{cm}^{-3}$</th>
<th>¹Bunsen Coefficient $a/cm^3(\text{STP}) cm^{-3} \text{atm}^{-1}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>263.15</td>
<td>237</td>
<td>4.51</td>
<td>4.68</td>
</tr>
<tr>
<td>273.15</td>
<td>200</td>
<td>3.90</td>
<td>3.90</td>
</tr>
<tr>
<td>283.15</td>
<td>171</td>
<td>3.42</td>
<td>3.30</td>
</tr>
<tr>
<td>293.15</td>
<td>148</td>
<td>3.03</td>
<td>2.82</td>
</tr>
<tr>
<td>303.15</td>
<td>129</td>
<td>2.70</td>
<td>2.43</td>
</tr>
</tbody>
</table>

¹The Bunsen and Ostwald coefficients were calculated by the compiler.

The authors fitted their data to the equation:

$$\ln x_1 = -11.6539 + 1348.0(T/K)^{-1} + 0.5004 \ln(T/K)$$

$$x_1/\text{mole fraction; } T/K$$

They also obtained $\Delta H/\text{kJ mol}^{-1} = -9.98$ and $\Delta S/\text{J K}^{-1} \text{ mol}^{-1} = -69$ for the transfer of one mole of ethene from the gas phase at 101.32 kPa to the hypothetical unit mole fraction solution.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
The solubility apparatus used is similar to that used by Ben Naim and Baer (ref.1) and is described in detail elsewhere (ref.2). It consists of a system of burettes, a mercury manometer and a solution vessel. The mole fraction of the dissolved gas is estimated from the volume change at constant pressure of saturated gas in the burettes, and the mass of solvent in the solution vessel determined by weighing.

Density and vapor pressure of the solvent were measured:

$$\rho/\text{g cm}^{-3} = 1.2856 - 0.000977\cdot T/K$$

$$\ln(P_2/kPa) = -5240.7 \cdot (T/K)^{-1} + 13.07$$

SOURCE AND PURITY OF MATERIALS:
1. Ethene. Sociedad Española del Oxígeno. Specified purity 99.9%.
2. Chlorocyclohexane. Merck. Purity checked by GLC to be > 98.5%.

ESTIMATED ERROR:
$\delta T/K = \pm 0.1$ (authors)
$\delta x_1/x_1 = \pm 2\%$ (compiler)

REFERENCES:
COMPONENTS:
1. Ethene; C₂H₄; [74-85-1]
2. Bromocyclohexane; C₆H₁₁Br; [108-85-0]

ORIGINAL MEASUREMENTS:
Lopez, M.C.; Gallardo, M.A.; Urieta, J.S.; Gutierrez Losa, C.

VARIABLES:

\[ T/K = 263.15 - 303.15 \]
\[ p_1/kPa = 101.32 \]

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>Mole Fraction</th>
<th>(^1)Ostwald Coefficient</th>
<th>(^1)Bunsen Coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>((x_1)\times 10^3)</td>
<td>L/cm³ cm⁻³</td>
<td>cm⁻³ (STP) cm⁻³ atm⁻¹</td>
</tr>
<tr>
<td>263.15</td>
<td>209</td>
<td>3.84</td>
<td>3.99</td>
</tr>
<tr>
<td>273.15</td>
<td>176</td>
<td>3.32</td>
<td>3.32</td>
</tr>
<tr>
<td>283.15</td>
<td>151</td>
<td>2.92</td>
<td>2.82</td>
</tr>
<tr>
<td>293.15</td>
<td>131.7</td>
<td>2.61</td>
<td>2.43</td>
</tr>
<tr>
<td>303.15</td>
<td>115.6</td>
<td>2.43</td>
<td>2.11</td>
</tr>
</tbody>
</table>

\(^1\)The Bunsen and Ostwald coefficients were calculated by the compiler.

The authors fitted their data to the equation:

\[ \ln x_1 = -17.0486 + 1545.9236(T/K)^{-1} + 1.3105 \ln(T/K) \]

They also obtained \(\Delta H/kJ \text{ mol}^{-1} = -9.44\) and \(\Delta S/J \text{ K}^{-1} \text{ mol}^{-1} = -68\) for the transfer of one mole of ethene from the gas phase at 101.32 kPa to the hypothetical unit mole fraction solution.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The solubility apparatus is described elsewhere (ref.1); it is based on that proposed by Ben Naim and Baer (ref.2). The set-up consists of a burette system, a mercury manometer and a solution vessel. Mole fraction of the dissolved gas is estimated from the volume change at constant pressure of saturated gas in the burettes, and the mass of liquid in the solution vessel determined by weighing.

Density and vapor pressure of the solvent were measured and correlated:

\[ \rho/kg \text{ m}^{-3} = -1.222(T/K) + 1693 \]
\[ \ln (p_2/kPa) = -5714.3(T/K)^{-1} + 18.2730 \]

SOURCE AND PURITY OF MATERIALS:

1. Ethene. Sociedad Española del Oxigeno. Specified purity 99.9%.
2. Bromocyclohexane. Fluka. Purity checked by GLC to be >99%.

ESTIMATED ERROR:

\[ \delta T/K = \pm 0.01 \]
\[ \delta x_1 / x_1 = \pm 0.01 \text{ (authors)} \]

REFERENCES:
COMPONENTS:
1. Ethene; C₂H₄; [74-85-1]
2. Trichloromethane (chloroform); CHCl₃; [67-66-3]
3. 2-Propanone (acetone); C₃H₆O; [67-64-1]

VARIABLES:
T/K = 243.15,
Pᵢ/kPa = 101.325
x₁ = 0 - 1.0

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>t/°C</th>
<th>T/K</th>
<th>Toluene</th>
<th>H'/mm Hg</th>
<th>H/atm</th>
<th>Ethene, x₁</th>
</tr>
</thead>
<tbody>
<tr>
<td>-30</td>
<td>243.15</td>
<td>4.257</td>
<td>23.78</td>
<td>0.0421</td>
<td></td>
</tr>
<tr>
<td>0.25</td>
<td></td>
<td>4.384</td>
<td>31.86</td>
<td>0.0314</td>
<td></td>
</tr>
<tr>
<td>0.50</td>
<td></td>
<td>4.439</td>
<td>36.16</td>
<td>0.0277</td>
<td></td>
</tr>
<tr>
<td>0.75</td>
<td></td>
<td>4.446</td>
<td>36.74</td>
<td>0.0272</td>
<td></td>
</tr>
<tr>
<td>1.0</td>
<td>(acetone)</td>
<td>4.423</td>
<td>34.85</td>
<td>0.0287</td>
<td></td>
</tr>
</tbody>
</table>

1 Compositions of two-component solvent solutions are given on a solute-free basis.
2 Only graphical results were available; values of log Henry's constant (H') were read from an enlarged graph by the compiler.
3 Values of Henry's constant (H) and mole fraction solubility (x₁) were calculated by the compiler.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
A metal cryostat was cooled with dry-ice and acetone and the temperature was controlled to ± 0.05 K. The equilibration cell was mounted in the cryostat. The solvents were purified by fractional distillation and analyzed by chromatography. Details were not given.

SOURCE AND PURITY OF MATERIALS:
1. Ethene purity was stated to be 99.9%.
2. Trichloromethane was distilled and analyzed by chromatography. Purity not specified.
3. Propanone was distilled and analyzed by chromatography. Purity not specified.

ESTIMATED ERROR:
δT/K = ± 0.05
δx₁/x₁ = ± 0.01 (Authors)

REFERENCES:

ORIGINAL MEASUREMENTS:
Leites, I.L.; Ivanovskii, F.P.

PREPARED BY:
W. Hayduk
COMPONENTS:
1. Ethene; C₂H₄; [74-85-1]
2. Trichloromethane (chloroform); CHCl₃; [67-66-3]
3. Methylbenzene (toluene); C₇H₈; [108-88-3]

VARIABLES:
T/K = 243.15,
P/kPa = 101.325
x₃ = 0 - 1.0

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>t/C</th>
<th>T/K</th>
<th>Mole Fraction</th>
<th>H'/mm Hg</th>
<th>H/atm</th>
<th>Ethene, x₁</th>
</tr>
</thead>
<tbody>
<tr>
<td>-30</td>
<td>243.15</td>
<td>0 (chloroform)</td>
<td>4.257</td>
<td>23.67</td>
<td>0.0432</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.25</td>
<td>4.295</td>
<td>25.95</td>
<td>0.0385</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.50</td>
<td>4.319</td>
<td>27.43</td>
<td>0.0365</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.75</td>
<td>4.324</td>
<td>27.75</td>
<td>0.0360</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.0 (toluene)</td>
<td>4.304</td>
<td>26.50</td>
<td>0.0377</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(mole fraction)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1Compositions of two-component solvent solutions are given on a solute-free basis.

2Only graphical results were available; values of log Henry's constant (H') were read from an enlarged graph by the compiler.

3Values of Henry's constant (H) and mole fraction solubility (x₁) were calculated by the compiler.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
A metal cryostat was cooled with dry-ice and acetone and the temperature was controlled to ± 0.05 K. The equilibration cell was mounted in the cryostat. The solvents were purified by fractional distillation and analyzed by chromatography. Details were not given.

SOURCE AND PURITY OF MATERIALS:
1. Ethene purity was stated to be 99.9%.
2. Trichloromethane was distilled and analyzed by chromatography. Purity not specified.
3. Methylbenzene was distilled and analyzed by chromatography. Purity not specified.

ESTIMATED ERROR:
δT/K = ± 0.05
δx₁/x₁ = ± 0.01 (Authors)

REFERENCES:
COMPONENTS:

1. Ethene; \( \text{C}_2\text{H}_4 \); [74-85-1]

2. Tetrachloromethane (carbon tetrachloride); \( \text{CCl}_4 \); [56-23-5]

3. Heptane; \( \text{C}_7\text{H}_{16} \); [142-82-5]

ORIGINAL MEASUREMENTS:
Leites, I.L.; Ivanovskii, F.P.


VARIABLES:
\[ T/K = 253.15, \]
\[ p/kPa = 101.325 \]
\[ x_3 = 0 - 1.0 \]

PREPARED BY:
W. Hayduk

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>( T/K )</th>
<th>( x_3 ), Mole Fraction</th>
<th>( \log_{10} H' )</th>
<th>( \text{Henry's Constant} )</th>
<th>( \text{Mole Fraction Ethene, } x_1 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>-20</td>
<td>(CCl(_4))</td>
<td>4.391</td>
<td>32.37</td>
<td>0.0309</td>
</tr>
<tr>
<td>0.25</td>
<td>4.319</td>
<td>27.43</td>
<td>0.0365</td>
<td></td>
</tr>
<tr>
<td>0.50</td>
<td>4.282</td>
<td>25.19</td>
<td>0.0397</td>
<td></td>
</tr>
<tr>
<td>0.75</td>
<td>4.258</td>
<td>23.83</td>
<td>0.0420</td>
<td></td>
</tr>
<tr>
<td>1.0 (heptane)</td>
<td>4.243</td>
<td>23.02</td>
<td>0.0434</td>
<td></td>
</tr>
</tbody>
</table>

1 Compositions of two-component solvent solutions are given on a solute-free basis.

2 Only graphical results were available; values of \( \log \text{Henry's Constant} (H') \) were read from an enlarged graph by the compiler.

3 Values of \( \text{Henry's Constant} (H) \) and mole fraction solubility \( (x_1) \) were calculated by the compiler.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

A metal cryostat was cooled with dry-ice and acetone and the temperature was controlled to ± 0.05 K. The equilibration cell was mounted in the cryostat. The solvents were purified by fractional distillation and analyzed by chromatography. Details were not given.

SOURCE AND PURITY OF MATERIALS:

1. Ethene purity was stated to be 99.9%.

2. Tetrachloromethane was distilled and analyzed by chromatography. Purity not specified.

3. Heptane was distilled and analyzed by chromatography. Purity not specified.

ESTIMATED ERROR:

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

\[ \delta x_1/x_1 = \pm 0.01 \text{ (Authors)} \]

REFERENCES:
COMPONENTS:
1. Ethene; C₂H₄; [74-85-1]
2. Benzene; C₆H₆; [71-43-2]
3. Tetrachloromethane; CCl₄; [56-23-5]

ORIGINAL MEASUREMENTS:
Narasimhan, S.; Nageshwar, G.W.
Chem. Petro-Chern. J. (India)

VARIABLES: T/K = 293.15
p/kPa = 101.325
Concentration/xₜ = 0.1-0.9

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>Mole Fraction CCl₄</th>
<th>Ethene Solubility for:</th>
<th>²Ostwald Coefficient in Mixed Solvent, x₁</th>
<th>p/kPa = 101.325</th>
<th>L/cm³ gas/cm³ solvent</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.1059</td>
<td>0.01266</td>
<td>0.01406</td>
<td>3.80</td>
<td></td>
</tr>
<tr>
<td>0.2054</td>
<td>0.01279</td>
<td>0.01444</td>
<td>3.87</td>
<td></td>
</tr>
<tr>
<td>0.3030</td>
<td>0.01332</td>
<td>0.01486</td>
<td>3.96</td>
<td></td>
</tr>
<tr>
<td>0.4141</td>
<td>0.01366</td>
<td>0.01528</td>
<td>4.03</td>
<td></td>
</tr>
<tr>
<td>0.5006</td>
<td>0.01402</td>
<td>0.01572</td>
<td>4.12</td>
<td></td>
</tr>
<tr>
<td>0.6201</td>
<td>0.01446</td>
<td>0.01625</td>
<td>4.22</td>
<td></td>
</tr>
<tr>
<td>0.7002</td>
<td>0.01480</td>
<td>0.01666</td>
<td>4.29</td>
<td></td>
</tr>
<tr>
<td>0.8107</td>
<td>0.01521</td>
<td>0.01717</td>
<td>4.38</td>
<td></td>
</tr>
<tr>
<td>0.9046</td>
<td>0.01570</td>
<td>0.01776</td>
<td>4.51</td>
<td></td>
</tr>
</tbody>
</table>

¹Although not specifically stated in the paper, it is assumed that the mole fraction solubility, x₁, is for a total pressure of 101.325 kPa.

²Calculated by compiler; a gas molar volume of 23910 cm³/mole was used at 293.15 K and 101.325 kPa for the calculation of L₁, and Henry's law was assumed to apply for the calculation of x₁.

It was confirmed by personal communication that the solubilities were measured at atmospheric pressure.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
The solvent was held in a jacketed burette. Constant temperature water was circulated through the jacket. Gas was bubbled through the solvent until saturated. The dissolved gas content was determined by an electrometric dead-stop titration technique which yielded the bromine number. The electrometric titrator was based on a design given in reference 1.

The burettes containing the mixed solvent were saturated with gas in series. Thus evaporation of solvent from the second burette was minimized.

Actual purities and sources of solvents not given.

SOURCE AND PURITY OF MATERIALS:
1. Ethene prepared by catalytic dehydration of ethanol over activated alumina at 350-400 °C and analyzed by chromatography. Purity not given.
2. Benzene was distilled twice in a laboratory packed column.
3. Tetrachloromethane was distilled twice in a laboratory packed column.

ESTIMATED ERROR:

δx₁/x₁ = ± 3% (Estimated by compiler)

REFERENCES:
1. Dubois, H.D.; Skoog, D.A.
Critical Evaluation of Ethene Solubilities in Organic Halides (mainly Alkyl Halides) for Pressures greater than 0.20 MPa

Ethene solubilities in organic halide solvents were reported by seven groups of researchers (1-7) for pressures ranging from 0.2 MPa to 11.7 MPa. For these data, in every case, only one research group reported their results for any one solvent; hence, a comparison of data from two or more sources was not possible. Instead, it was only possible to check the consistency of the data. For that purpose graphs of log \( x \) (mole fraction solubility) versus log \( p \) (gas partial pressure) were drawn with the solubilities shown as a function of temperature as a parameter. For several of the solvents it was possible to express the data, especially for relatively low pressures, using an equation of the form shown below, with the constant \( C \) being nearly equal to one when Henry's law applied:

\[
\log x = A + \frac{B}{T} + C \log p
\]  

The solubilities in the individual solvents will now be considered.

**Bromochloromethane; CH₂BrCl; [74-97-5]**

Lebedeva et al. (1) reported ethene solubilities in bromochloromethane at 323.15 K, 373.15 K and 423.15 K at pressures ranging from 1.013 MPa to 11.73 MPa. At the lower pressures, up to 10 MPa, Henry's law is approximately obeyed and the corresponding Henry's constants have been tabulated on the data sheet. There are a number of apparently anomalous results. These data are classified as tentative.

**Trichloromethane (chloroform); CHCl₃; [67-66-3]**

The solubilities of ethene in trichloromethane were reported by Shim and Kohn (2) for pressures ranging from 1.013 MPa to the critical pressures and for five temperatures ranging from 273.15 K to 373.15 K. Except for one result at a temperature of 373.15 K and a pressure of 1.013 MPa, the data appear consistent. They are well represented by the following correlating equation which relates the mole fraction ethene at equilibrium, the temperature, and ethene partial pressure:

\[
\log x_p = 522.32\frac{(T/K)}{-1} + 0.9600 \log (p/\text{MPa}) - 2.5371
\]  

Equation (2) is limited to pressures 0.6 MPa < \( p < 6.0 \) MPa. For the indicated pressure range it yields an average, and a maximum deviation from the data of 3.1%, and 9.2%, respectively. Equation (2) and the data on which it is based, are shown in Figure 1. It is noted that equation (2) yields a value about 35% too high when extrapolated to 0.1013 MPa pressure at 298.15 K; hence, it is evident that this equation cannot be used outside the range of the data on which it is based.

The results of Shim and Kohn (2) are classified as tentative.

**Tetrachloromethane (carbon tetrachloride); CCl₄; [56-23-5]**

Konobeev and Lyapin (3) reported solubility data for ethene in tetrachloromethane at 293.15 K, 313.15 K and 333.15 K and pressures from 0.29 MPa to 3.38 MPa. For the purpose of estimating the partial pressure of ethene in the gas phase, Raoult's law was assumed and the pure solvent vapor pressures of 0.0122, 0.0284 and 0.059 MPa were used for the temperatures of 293.15, 313.15 and 333.15 K, respectively. The solubilities over the temperature and pressure range of the data are then well represented by the following equation:
Components:
1. Ethene; C\textsubscript{2}H\textsubscript{4}; [74-85-1]
2. Organic halides, pressures greater than 0.2 MPa (2 atm)

Evaluator:
Walter Hayduk
Department of Chemical Engineering
University of Ottawa
Ottawa, ON
Canada K1N 6N5
January, 1994

Critical Evaluation:

Equation (3) has average, and maximum deviations from the experimental results of 3.9%, and 9.9%, respectively. Here also, it is cautioned that equation (3) cannot be accurately extrapolated for solubilities at 0.1013 MPa pressure; deviations of approximately 20% are observed.

The data of Konobeev and Lyapin for solubilities in tetrachloromethane are classified as tentative.

1,2-Dichloroethane; C\textsubscript{2}H\textsubscript{4}Cl\textsubscript{2}; [107-06-2]

Konobeev and Lyapin (3) also provided ethene solubilities in 1,2-dichloroethane for pressures ranging from 0.29 MPa to 3.11 MPa and for the temperatures 293.15 K, 313.15 K and 333.15 K. As for the solvent tetrachloromethane, the pure solvent vapor pressures were used along with Raoult's law to estimate ethene partial pressures. The resulting relation between ethene partial pressure, \(p\), temperature, \(T\), and the mole fraction of ethene, \(x\), may be expressed, to a first approximation, by:

\[
\log x_p = 521.68 (T/K)^{-1} + 1.047 \log (p/\text{MPa}) - 2.6314
\]

\(\text{Eqn. (3)}\)
COMPONENTS:
1. Ethene; \( \text{C}_2\text{H}_4; [74-85-1] \)
2. Organic halides, pressures greater than 0.2 MPa (2 atm)

EVALUATOR:
Walter Hayduk
Department of Chemical Engineering
University of Ottawa
Ottawa, ON
Canada K1N 6N5
January, 1994

CRITICAL EVALUATION:

The fraction, \( x_p \), is entirely consistent and is well expressed by the following equation:

\[
\log x_p = 446.77 \frac{(T/K)^{-1}}{} + 1.052 \log \left( \frac{p}{\text{MPa}} \right) - 2.5285 \quad (4)
\]

The average, and maximum deviations of the data from the correlating equation are 2.1%, and 4.5%, respectively.

The data of Konobeev and Lyapin for solubilities in 1,2-dichloroethane are classified as tentative.

Ethane, 1,1,2-trichloro-1,2,2-trifluoro-(Freon 113); \( \text{C}_3\text{Cl}_3\text{F}_3; [76-13-1] \)

Sokolov and Konshin (4) reported data for ethene solubilities in Freon 113 at the temperatures, 300.15 K, 343.15 K and 363.15 K for pressures ranging from 0.20 MPa to 1.11 MPa. No gas phase compositions were available; hence, Raoult's law was used to estimate the solvent partial pressure in the gas phase. It became apparent that the gas contained significant concentrations of solvent vapor especially at the two higher temperatures, estimated to be more than 50% for a number of the results. Thus, because highly accurate results are difficult to obtain with volatile solvents there are some inconsistencies in these results.

Omitting the data point corresponding to a total pressure of 0.31 MPa at 343.15 K, an equation for the remaining data was derived:

\[
\log x_p = 531.24 \left( \frac{T}{K} \right)^{-1} + 1.070 \log \left( \frac{p}{\text{MPa}} \right) - 2.4376 \quad (5)
\]

The average, and maximum deviations of the data from equation (5) are 3.4%, and 10%, respectively. It is cautioned that the application of Raoult's law is unlikely to be accurate at high vapor concentrations, so that equation (5) is approximate only.

The data of Sokolov and Konshin for ethene solubilities in Freon 113 are classified as tentative.

3,3,3-Trifluoro, 1-propene (trifluoropropylene); \( \text{C}_3\text{H}_3\text{F}_3; [677-21-4] \)

Zernov et al. (5) reported solubilities in 3,3,3-trifluoro 1-propene at temperatures from 283.1 K to 363.1 K and pressures from 0.393 MPa to 5.88 MPa. Henry's law is only approximately obeyed for the temperatures below 333.1 K. The data at the higher temperatures (at 353.1 K and 363.1 K) appear to be inconsistent with those at the lower temperature.

These data are classified as tentative.

Acetic acid, trichloro-ethyl ester (ethyltrichloroacetate); \( \text{C}_4\text{H}_5\text{Cl}_3\text{O}_2; [515-84-4] \)

The results of Kristesashvili et al. (6) for solubilities in acetic acid, trichloro-ethyl ester were shown for the temperatures 363.15 K and 373.15 K and pressures up to 8.1 MPa only in graphical form. Approximate Henry's constants were obtained from the graphs.

These data for acetic acid, trichloro-ethyl ester are classified as tentative.

1-Propene,1,1,2,3,3-pentafluoro-3 trifluoroethenloxy-(perfluoropropylene vinyl ether); \( \text{C}_3\text{F}_8\text{O}; [64080-43-9] \)

Sokolov and Konshin (4) reported solubilities of ethene in 1,1,2,3,3-pentafluoro-3 trifluoroethenloxy-1-propene at temperatures ranging from
COMPONENTS:
1. Ethene; C₂H₄; [74-85-1]
2. Organic halides, pressures greater than 0.2 MPa (2 atm)

CRITICAL EVALUATION:

298.15 K to 353.15 K and pressures from 0.20 MPa to 1.11 MPa. These data were reported as distribution constants in the form of ratios of concentrations in the liquid phase to those in the gas phase. In addition, the solubilities were expressed in moles per litre and as Henry's constants. It was not possible to calculate mole fraction solubilities because neither solution densities nor gas phase compositions could be estimated. Nor could the tabulated results be checked for consistency. These data are classified as tentative.

Efremova and Kovpakova (7) reported ethene solubilities in the four tetrachloroalkanes in graphical form only, for temperatures ranging from 273.35 K to 373.15 K and for pressures from about 1 MPa to the critical pressures. From these graphs approximate Henry's constants were estimated because Henry's law was obeyed for ethene concentrations of up to about 0.4 mole fraction. When tested for consistency with respect to temperature, it was noted that the ethene solubility in tetrachloropropane solvent was only marginally different than that in tetrachloropentane. It is not clear whether or not this is anomalous because no clear consistency test is available. One might have expected lower solubilities in tetrachloropropane to be consistent with those of the other three solvents.

These approximate results for solubilities in the tetrachloroalkanes are classified as tentative.

References
COMPONENTS:
1. Ethene; C₂H₄ [74-85-1]
2. Bromochloromethane; CH₂BrCl; [74-97-5]

ORIGINAL MEASUREMENTS:
Lebedeva, E.S.; Kashirina, A.S.; Grokholskaya, V.P.

VARIABLES:
T/K = 323.15 - 423.15
P/MPa = 1.013 - 11.73

EXPERIMENTAL VALUES:

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<th>Mole Fraction Ethene in Liquid, and Gas, x₁, y₁</th>
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Only interpolated or smoothed data above, given in this paper.

¹Calculated by compiler.
²Critical conditions.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
Experiments are described in reference 1. A steel vessel was used along with a heating block, thermostat and pressure gauge for measuring the P - T - x data. Approximate Henry's constants and ethene solubilities, corresponding to a gas partial pressure of 101.3 kPa were calculated by the compiler for pressures to 2.9 MPa at 50°C, and 5.0 MPa at 100°C and 150°C.

Brandon mol 1900 408.5 272
fraction⁻¹
x₁/mole 0.00053 0.0029 0.0037
fraction

SOURCE AND PURITY OF MATERIALS:
1. Ethene. Source and purity not specified.
2. Bromochloromethane. Source and purity not specified. Densities and vapor pressures given in paper. Approximate equation for vapor pressures (compiler) based on data given:

\[ \log (P/\text{atm}) = 4.4726 - 1521.3/(T/K) \]

ESTIMATED ERROR:

\[ \delta T/K = \pm 0.1 \text{ (authors)} \]

\[ \delta x_1/x_1 = \pm 2\% \text{ (compiler)} \]

REFERENCES:
**COMPONENTS:**

1. Ethene; $C_2H_4; [74-85-1]$

2. Trichloromethane (chloroform); $CHCl_3; [67-66-3]$

**ORIGINAL MEASUREMENTS:**

Shim, J.; Kohn, J.P.


**VARIABLES:** $T/K = 273-373$

$P/MPa = 1.0-10.2$ (10-100 atm)

**PREPARED BY:**

W. Hayduk

**EXPERIMENTAL VALUES:**

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<th>$T/K$</th>
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$^1$Calculated by compiler.  $^2$Interpolated by authors.  $^3$Critical conditions as indicated by authors. Liquid phase and gas phase molar volumes also given in this paper.  continued ...

**AUXILIARY INFORMATION**

**METHOD/APPARATUS/PROCEDURE:**

Calibrated borosilicate glass cells were used in two sizes: 12-cm$^3$ for pressures to 70 atm and 5-cm$^3$ for pressures from 70-100 atm. The cell was initially almost filled with solvent then evacuated to the solvent vapor pressure. The initial solvent volume was obtained. Gas was volumetrically charged from a high pressure reservoir by displacement with mercury. Gas absorption was facilitated using a magnetically actuated stainless steel ball. At the highest pressure the cell was essentially completely filled with solution. The change in solution volume was noted with each increment of gas. The corresponding gas phase compositions were obtained using separate experiments and measuring the small volume of solvent necessary to saturate the gas. Details in reference 1.

**SOURCE AND PURITY OF MATERIALS:**

1. Ethene was from Matheson; purity 99.5%. Gas dried at 50 atm pressure using silica gel.

2. Chloroform was the spectro grade from Matheson Coleman Bell; no purity given.

**ESTIMATED ERROR:**

\[ \frac{\delta P}{P} = \pm 0.01 \quad \frac{\delta T}{T} = \pm 0.07 \]

\[ \frac{\delta x_1}{x_1} = \pm 0.01 \]

**REFERENCES:**

1. Shim, J.; Kohn, J.P.

### COMPONENTS:

1. Ethene; \( \text{C}_2\text{H}_4; [74-85-1] \)

2. Trichloromethane (chloroform); \( \text{CHCl}_3; [67-66-3] \)

### ORIGINAL MEASUREMENTS:

Shim, J.; Kohn, J.P.  

### VARIABLES:

\( T/K = 273-373 \)

\( P/\text{MPa} = 1.0-10.2 \) (10-100 atm)

### PREPARED BY:

W. Hayduk

### EXPERIMENTAL VALUES:

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<sup>1</sup>Calculated by compiler.  
<sup>2</sup>Interpolated by authors.  
<sup>3</sup>Critical conditions as indicated by authors.  
Liquid phase and gas phase molar volumes also given in this paper.

### AUXILIARY INFORMATION

**METHOD/APPARATUS/PROCEDURE:**

Calibrated borosilicate glass cells were used in two sizes: 12-cm\(^3\) for pressures to 70 atm and 5-cm\(^3\) for pressures from 70-100 atm. The cell was initially almost filled with solvent then evacuated to the solvent vapor pressure. The initial solvent volume was obtained. Gas was volumetrically charged from a high pressure reservoir by displacement with mercury. Gas absorption was facilitated using a magnetically actuated stainless steel ball. At the highest pressure the cell was essentially completely filled with solution. The change in solution volume was noted with each increment of gas. The corresponding gas phase compositions were obtained using separate experiments and measuring the small volume of solvent necessary to saturate the gas. Details in reference 1.

**SOURCE AND PURITY OF MATERIALS:**

1. Ethene was from Matheson; purity 99.5%. Gas dried at 50 atm pressure using silica gel.

2. Chloroform was the spectro grade from Matheson Coleman Bell; no purity given.

**ESTIMATED ERROR:**

\[ \delta P/P = \pm 0.01 \]
\[ \delta T/K = \pm 0.07 \]
\[ \delta x_1/x_1 = \pm 0.01 \]

**REFERENCES:**

1. Shim, J.; Kohn, J.P.  
**COMPONENTS:**

1. Ethene; \( \text{C}_2\text{H}_4; [74-85-1] \)
2. Tetrachloromethane (Carbon Tetrachloride); \( \text{CCl}_4; [56-23-5] \)

**VARIABLES:**

- \( T/\text{K} = 293.15 - 333.15 \)
- \( P/\text{MPa} = 0.29 - 3.18 \)

**EXPERIMENTAL VALUES:**

<table>
<thead>
<tr>
<th>( T/\text{K} )</th>
<th>( P/10^5\text{Pa} )</th>
<th>Mole fraction of ethene in liquid ( x_{\text{C}_2\text{H}_4} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>293.15</td>
<td>2.857</td>
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<td>8.299</td>
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<tr>
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<td></td>
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<td>313.15</td>
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<tr>
<td></td>
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<tr>
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<td>17.63</td>
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<td>31.02</td>
<td>0.276</td>
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</table>

**AUXILIARY INFORMATION**

**METHOD/APPARATUS/PROCEDURE:**

Static equilibrium cell fitted with magnetic stirrer. Samples analysed by gas chromatography. Details in source.

**SOURCE AND PURITY OF MATERIALS:**

1. Purity better than 99.6 mole per cent.
2. No details given.

**ESTIMATED ERROR:**

\( \delta T/\text{K}=\pm 0.1; \delta P=\pm 0.5\%; \delta x_{\text{C}_2\text{H}_4}=\pm 0.002 \)

(estimated by compiler)

**REFERENCES:**
COMPONENTS:
1. Ethene; C\textsubscript{2}H\textsubscript{4}; [74-85-1]
2. 1,2-Dichloroethane; C\textsubscript{2}H\textsubscript{4}Cl\textsubscript{2}; [107-06-2]

ORIGINAL MEASUREMENTS:
Konobeev, B.I.; Lyapin, V.V.

VARIABLES:
\(T/K = 293.15 - 333.15\)
\(P/\text{MPa} = 0.29 - 3.11\)

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>(T/K)</th>
<th>(P/10^5\text{Pa})</th>
<th>(x_{\text{C}_2\text{H}_4})</th>
</tr>
</thead>
<tbody>
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AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
Static equilibrium cell fitted with magnetic stirrer. Samples analysed by gas chromatography. Details in source.

SOURCE AND PURITY OF MATERIALS:
1. Purity better than 99.6 mole per cent.
2. No details given.

ESTIMATED ERROR:
\(\delta T/K = \pm 0.1\); \(\delta P = \pm 0.5\%\); \(\delta x_{\text{C}_2\text{H}_4} = \pm 0.002\) (estimated by compiler)

REFERENCES:
COMPONENTS:
1. Ethene; \( \text{C}_2\text{H}_4; [74-85-1] \)
2. Ethane, 1,1,2-trichloro-1,2,2-trifluoro-(Freon 113); \( \text{C}_2\text{Cl}_3\text{F}_3; [76-13-1] \)

ORIGINAL MEASUREMENTS:
Sokolov, Yu. P.; Konshin, A.I.

VARIABLES:
\( T/\text{K} = 300.15 - 363.15 \)
\( P/\text{MPa} = 0.20 - 1.11 \)

PREPARED BY:
W. Hayduk

EXPERIMENTAL VALUES:

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<thead>
<tr>
<th>( t/\circ\text{C} )</th>
<th>( T/\text{K} )</th>
<th>( P/\text{MPa} )</th>
<th>( C_1, \text{mol/litre} )</th>
<th>( x_1, \text{mol fraction} )</th>
<th>( H/\text{MPa(mol fraction)} )</th>
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</thead>
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\(^1\text{Calculated by Compiler.}\)

\(^2\text{Stated by authors to be } \lim (P_1/x_1) \text{ for } P_1 = \text{partial pressure of gas.}\)

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
The solubilities were measured using a stirred reactor with a magnetic drive having a volume of 250 cm\(^3\) and equipped with a pressure gauge and a surrounding jacket for temperature control. Gas and sample handling systems were attached. A volume of 100-200 cm\(^3\) of deaerated solvent was charged to the reactor and equilibrated. A small liquid sample chamber was used to confine a known volume of saturated solution. The sample was then completely evaporated into a much larger vessel. Helium carrier gas was used to increase the pressure of the vapor-gas mixture to about 0.12 MPa. The sample was then analyzed by gas chromatography. Details are in Ref. 1.

SOURCE AND PURITY OF MATERIALS:
No information about gas and solvent source or purity was supplied.

ESTIMATED ERROR:
\( \delta C_1 = \pm 3\% \text{ (Compiler)} \)

REFERENCES:
1. Sokolov, Yu. A.; Konshin, A.I.
## EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>Total Pressure P/Mpa</th>
<th>Ethene Partial Pressure p1/Mpa</th>
<th>Ethene Mole Fraction Liquid, x1</th>
<th>Ethene Mole Fraction Gas, y1</th>
<th>Molar Volume/cm³/(mole)⁻¹ Liquid</th>
<th>Molar Volume/cm³/(mole)⁻¹ Gas</th>
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<td>283.1</td>
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<td>103.2</td>
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<tr>
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</tbody>
</table>

1 Calculated by compiler; ethene partial pressure is based on the gas phase composition, y1. Mole percent solvent was given in the paper.

The first pressure for each different temperature is the solvent vapor pressure.

## AUXILIARY INFORMATION

### METHOD/APPARATUS/PROCEDURE:

The apparatus consisted of two graduated thick-walled glass tubes 5 mm in diameter and 60 cm in length sealed in a temperature-controlled jacket. Mercury could be independently charged to the bottom of each tube. The saturation tube was equipped with an electromagnetic vibrator immersed in the mercury to aid in equilibration of the phases. A separate mercury reservoir was pressurized with nitrogen whose pressure could be regulated. Ethylene was stored in one tube, while the solvent was condensed in the equilibration tube. The ethylene was transferred to the solvent tube as required. The solubility method was thus a volumetric one. The densities of the liquefied solvent as well as critical properties of the solutions are also given in the paper.

### SOURCE AND PURITY OF MATERIALS:

1. Ethene was 99.3 mole % pure.

2. Trifluoropropylene was 99.96% pure and had a normal boiling point of 248 K.

### ESTIMATED ERROR:

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

\[ \delta x/x = \pm 0.02 \]

(.compiler)

### REFERENCES:
COMPONENTS:
1. Ethene; C2H4; [74-85-1]
2. 3,3,3-Trifluoro, 1-Propene (Trifluoropropylene); C3H5F3; [677-21-4]

VARIABLES:
T/K = 283.1-363.1
P/MPa = 0.393-5.88, (3.9-58.0 atm)

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>Total Pressure P/MPa</th>
<th>Ethene Partial Pressure p1/MPa</th>
<th>Ethene Mole Fraction Liquid, x1</th>
<th>Ethene Mole Fraction Gas, y1</th>
<th>Molar Volume/cm3(mole)-1 Liquid</th>
<th>Molar Volume/cm3(mole)-1 Gas</th>
</tr>
</thead>
<tbody>
<tr>
<td>303.1</td>
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</tr>
</tbody>
</table>

1Calculated by compiler; ethene partial pressure is based on the gas phase composition, y1. Mole percent solvent was given in the paper.

The first pressure for each different temperature is the solvent vapor pressure.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
The apparatus consisted of two graduated thick-walled glass tubes 5 mm in diameter and 60 cm in length sealed in a temperature-controlled jacket. Mercury could be independently charged to the bottom of each tube. The saturation tube was equipped with an electromagnetic vibrator immersed in the mercury to aid in equilibration of the phases. A separate mercury reservoir was pressurized with nitrogen whose pressure could be regulated. Ethylene was stored in one tube, while the solvent was condensed in the equilibration tube. The ethylene was transferred to the solvent tube as required. The solubility method was thus a volumetric one. The densities of the liquefied solvent as well as critical properties of the solutions are also given in the paper.

SOURCE AND PURITY OF MATERIALS:
1. Ethene was 99.3 mole % pure.
2. Trifluoropropylene was 99.96% pure and had a normal boiling point of 248 K.

ESTIMATED ERROR: δT/K = ± 0.05
δx1 / x1 = ± 0.02

REFERENCES:
COMPONENTS:
1. Ethene; C₂H₄; [74-85-1]
2. 3,3,3-Trifluoro, 1-Propene (Trifluoropropylene); C₃H₃F₃; [677-21-4]

VARIABLES:
- T/K = 283.1-363.1
- P/MPa = 0.393-5.88, (3.9-58.0 atm)

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>P/MPa</th>
<th>p₁/MPa</th>
<th>z₁₁</th>
<th>z₁₂</th>
<th>Molar Volume/cm³ (mole)⁻¹</th>
</tr>
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<tbody>
<tr>
<td>353.1</td>
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<td>0</td>
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<td>136.0</td>
</tr>
<tr>
<td></td>
<td>5.88</td>
<td>2.56</td>
<td>0.310</td>
<td>0.435</td>
<td>153.5</td>
</tr>
</tbody>
</table>

CALCULATED BY COMPILER; ETHENE PARTIAL PRESSURE IS BASED ON THE GAS PHASE COMPOSITION, y₁. MOLE PERCENT SOLVENT WAS GIVEN IN THE PAPER.

The first pressure for each different temperature is the solvent vapor pressure.

AUXILIARY INFORMATION

METHOD/APPROATUS/PROCEDURE:
The apparatus consisted of two graduated thick-walled glass tubes 5 mm in diameter and 60 cm in length sealed in a temperature-controlled jacket. Mercury could be independently charged to the bottom of each tube. The saturation tube was equipped with an electromagnetic vibrator immersed in the mercury to aid in equilibrium of the phases. A separate mercury reservoir was pressurized with nitrogen whose pressure could be regulated. Ethylene was stored in one tube, while the solvent was condensed in the equilibration tube. The ethylene was transferred to the solvent tube as required. The solubility method was thus a volumetric one. The densities of the liquefied solvent as well as critical properties of the solutions are also given in the paper.

SOURCE AND PURITY OF MATERIALS:
1. Ethene was 99.3 mole % pure.
2. Trifluoropropylene was 99.96% pure and had a normal boiling point of 248 K.

ESTIMATED ERROR:

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

\[ \delta z_1 / z_1 = \pm 0.02 \] (compiler)

REFERENCES:
COMPONENTS:

1. Ethene; C₂H₄; [74-85-1]
2. 1-Propene,1,1,2,3,3-pentafluoro-3-trifluoroethenlyoxy- or perfluoro (propylene vinyl) ether; C₅F₈O; [64080-43-9]

ORIGINAL MEASUREMENTS:
Sokolov, Yu. P.; Konshin, A.I.

VARIABLES:

*T/K = 298.15 - 353.15
P/MPa = 0.20 - 1.32

PREPARED BY:
W. Hayduk

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>t/°C</th>
<th>T/K</th>
<th>Pressure P/MPa</th>
<th>Solubility C₁/mol/litre</th>
<th>^2 Distribution Constant, K_d</th>
<th>^3 Henry's Constant H/MPa/mol fraction</th>
</tr>
</thead>
<tbody>
<tr>
<td>25</td>
<td>298.15</td>
<td>0.20</td>
<td>0.08</td>
<td>3.40</td>
<td>5.79</td>
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<td></td>
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<td>0.31</td>
<td>0.23</td>
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<td></td>
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<td>0.51</td>
<td>0.52</td>
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<td></td>
</tr>
<tr>
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<td>0.71</td>
<td>0.80</td>
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</tr>
<tr>
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<td>0.97</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
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<td>1.11</td>
<td>1.34</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.32</td>
<td>1.62</td>
<td></td>
<td></td>
</tr>
<tr>
<td>50</td>
<td>323.15</td>
<td>0.51</td>
<td>0.31</td>
<td>2.76</td>
<td>7.11</td>
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<td>0.47</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.91</td>
<td>0.71</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.11</td>
<td>0.87</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.32</td>
<td>1.12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>70</td>
<td>343.15</td>
<td>0.71</td>
<td>0.37</td>
<td>2.64</td>
<td>8.58</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.91</td>
<td>0.51</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.11</td>
<td>0.76</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.32</td>
<td>0.95</td>
<td></td>
<td></td>
</tr>
<tr>
<td>80</td>
<td>353.15</td>
<td>0.71</td>
<td>0.23</td>
<td>1.66</td>
<td>11.30</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.91</td>
<td>0.32</td>
<td></td>
<td></td>
</tr>
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<td></td>
<td></td>
<td>1.11</td>
<td>0.46</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

^1Calculated by Compiler.
^2Distribution constant K_d = C_l/C_g where C_l = mol/litre in liquid, C_g = mol/litre in gas.
^3Stated by authors to be \( \lim_{\pi_1 \to 0} (p_1/\pi_1) \) for \( p_1 \) = partial pressure of gas.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
The solubilities were measured using a stirred reactor with a magnetic drive having a volume of 250 cm³ and equipped with a pressure gauge and a surrounding jacket for temperature control. Gas and sample handling systems were attached. A volume of 100-200 cm³ of deaerated solvent was charged to the reactor and equilibrated. A small liquid sample chamber was used to confine a known volume of saturated solution. The sample was then completely evaporated into a much larger vessel. Helium carrier gas was used to increase the pressure of the vapor-gas mixture to about 0.12 MPa. The sample was then analyzed by gas chromatography. Details are in Ref. 1.

SOURCE AND PURITY OF MATERIALS:
No information about gas and solvent source or purity was supplied.

ESTIMATED ERROR:
\( \delta C_1 = \pm 3\% \) (Compiler)

REFERENCES:
1. Sokolov, Yu. A.; Konshin, A.I.
COMPONENTS:
1. Ethene; \( \text{C}_2\text{H}_4; [74-85-1] \)
2. Propane, \( 1,1,1,3\)-Tetrachloro-; \( \text{C}_3\text{H}_6\text{Cl}_4; [1070-78-6] \)

ORIGINAL MEASUREMENTS:
Efremova, G.D.; Kovpakova, P.F.

VARIABLES:
\[ T/K = 273.35 - 373.15 \]
\[ p/\text{MPa} = 1.013 - 10.13 \]

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>( T/C )</th>
<th>( H/\text{Atm (mole fraction)}^{1} )</th>
<th>( x_{1} ) for ( p_1 = 101.3 \text{ kPa} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.2</td>
<td>273.35</td>
<td>70</td>
</tr>
<tr>
<td>25</td>
<td>298.15</td>
<td>104</td>
</tr>
<tr>
<td>50</td>
<td>323.15</td>
<td>133</td>
</tr>
<tr>
<td>75</td>
<td>348.15</td>
<td>160</td>
</tr>
<tr>
<td>100</td>
<td>373.15</td>
<td>188</td>
</tr>
</tbody>
</table>

\(^{1}\text{Henry's law constants and mole fraction solubilities at 101.3 kPa were evaluated by the compiler from enlarged graphs only; there were no numerical solubility data. Henry's law was observed to fit the data closely up to about 0.40 mole fraction ethene for all temperatures.}\

Phase equilibrium compositions of ethene in liquid solutions are graphically shown as a function of pressure over the complete ethene composition range to 99 mole percent ethene. Critical phenomena are reported for high concentrations of ethene at high pressures.\

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
The apparatus and procedure are described in ref. 1. The equilibrium device is a capillary tube 1 mm in diameter containing an internal mixer which is moved up and down by means of an external, motor-driven magnet. The capillary tube is sealed in a vertical position and connected to a gas and liquid charging system, pressure gauges, as well as a volume regulator to maintain a constant pressure and to determine the volume of gas charged.

Graphs of liquid solution molar volumes are also given as a function of solution compositions, including those for critical values at high pressures.

SOURCE AND PURITY OF MATERIALS:
1. Ethene purity 97.5% by analysis.
2. Tetrachloro-propane vacuum distilled. Actual purity not given. Density and refractive index at 20°C:
   \[ \rho = 1.4325 \text{ g cm}^{-1}, \]
   \[ n_D = 1.4806 \]

ESTIMATED ERROR:
\[ \delta x_1/x_1 = \pm 4\% \text{ (compiler)} \]

REFERENCES:
1. Kritchevskii, I.R.; Efremova, G.D.
COMPONENTS:
1. Ethene; \( \text{C}_2\text{H}_4; \) [74-85-1].
2. Pentane, 1,1,1,5-Tetrachloro-; \( \text{C}_5\text{H}_5\text{Cl}_5; \) [2467-10-9].

ORIGINAL MEASUREMENTS:
Efremova, G.D.; Kovpakova, P.F.

VARIABLES:
\( T/K = 273.35 - 373.15 \)
\( p_1/\text{MPa} = 1.013 - 10.13 \)

PREPARED BY:
W. Hayduk

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>( t/C )</th>
<th>( T/K )</th>
<th>( H/\text{Atm (mole fraction)}^{-1} ) for ( p_1 = 101.3 \text{ kPa} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.2</td>
<td>273.35</td>
<td>74</td>
</tr>
<tr>
<td>25</td>
<td>298.15</td>
<td>108</td>
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<td>50</td>
<td>323.15</td>
<td>133</td>
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<tr>
<td>75</td>
<td>348.15</td>
<td>162</td>
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<tr>
<td>100</td>
<td>373.15</td>
<td>192</td>
</tr>
</tbody>
</table>

Henry's law constants and mole fraction solubilities at 101.3 kPa were evaluated by the compiler from enlarged graphs only; there were no numerical solubility data. Henry's law was observed to fit the data closely up to about 0.40 mole fraction ethene for all temperatures.

Phase equilibrium compositions of ethene in liquid solutions are graphically shown as a function of pressure over the complete ethene composition range to 99 mole percent ethene. Critical phenomena are reported for high concentrations of ethene at high pressures.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
The apparatus and procedure are described in ref. 1. The equilibration device is a capillary tube 1 mm in diameter containing an internal mixer which is moved up and down by means of an external, motor-driven magnet. The capillary tube is sealed in a vertical position and connected to a gas and liquid charging system, pressure gauges, as well as a volume regulator to maintain a constant pressure and to determine the volume of gas charged.

Graphs of liquid solution molar volumes are also given as a function of solution compositions, including those for critical values at high pressures.

SOURCE AND PURITY OF MATERIALS:
1. Ethene purity 97.5% by analysis.
2. Tetrachloro-pentane, vacuum distilled. Actual purity not given. Density and refractive index at 20°C:
\( \rho = 1.3455 \text{ g cm}^{-3} \),
\( n_D = 1.4879 \)

ESTIMATED ERROR:
\( \delta \frac{x_1}{x_1} = \pm 4\% \) (compiler)

REFERENCES:
1. Kritchevskii, I.R.; Efremova, G.D.
COMPONENTS: ORIGINAL MEASUREMENTS:

1. Ethene; \( \text{C}_2\text{H}_4 \); [74-85-1]
2. Heptane, 1,1,1,7-Tetrachloro-; \( \text{C}_7\text{H}_{12}\text{Cl}_4 \); [3922-36-9]

Efremova, G.D.; Kovpakova, P.F.

VARIABLES:

\[
\frac{T}{K} = 273.35 - 373.15 \\
\frac{p}{\text{MPa}} = 1.013 - 10.13
\]

PREPARED BY:

W. Hayduk

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>( t/\text{C} )</th>
<th>( T/\text{K} )</th>
<th>( \frac{1}{H/\text{Atm (mole fraction)}} )</th>
<th>( \frac{1}{\text{Mole Fraction Ethene, } x_1} ) for ( p_1 = 101.3 \text{ kPa} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.2</td>
<td>273.35</td>
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<td>0.0143</td>
</tr>
<tr>
<td>25</td>
<td>298.15</td>
<td>93</td>
<td>0.0108</td>
</tr>
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<td>50</td>
<td>323.15</td>
<td>117</td>
<td>0.0085</td>
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<tr>
<td>75</td>
<td>348.15</td>
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<td>0.0072</td>
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<tr>
<td>100</td>
<td>373.15</td>
<td>164</td>
<td>0.0061</td>
</tr>
</tbody>
</table>

*Henry's law constants and mole fraction solubilities at 101.3 kPa were evaluated by the compiler from enlarged graphs only; there were no numerical solubility data. Henry's law was observed to fit the data closely up to about 0.40 mole fraction ethene for all temperatures.*

Phase equilibrium compositions of ethene in liquid solutions are graphically shown as a function of pressure over the complete ethene composition range to 99 mole percent ethene. Critical phenomena are reported for high concentrations of ethene at high pressures.

AUXILIARY INFORMATION

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The apparatus and procedure are described in ref. 1. The equilibration device is a capillary tube 1 mm in diameter containing an internal mixer which is moved up and down by means of an external, motor-driven magnet. The capillary tube is sealed in a vertical position and connected to a gas and liquid charging system, pressure gauges, as well as a volume regulator to maintain a constant pressure and to determine the volume of gas charged.

Graphs of liquid solution molar volumes are also given as a function of solution compositions, including those for critical values at high pressures.

SOURCE AND PURITY OF MATERIALS:

1. Ethene purity 97.5% by analysis.
2. Tetrachloro-heptane, vacuum distilled. Actual purity not given. Density and refractive index at 20°C:

\[
\rho = 1.2509 \text{ g cm}^{-3}, \\
n_D = 1.4843
\]

ESTIMATED ERROR:

\[ \delta \frac{x_1}{x_1} = \pm 4\% \text{ (compiler)} \]

REFERENCES:

1. Kritchevskii, I.R.; Efremova, G.D.
COMPONENTS:
1. Ethene, \( \text{C}_2\text{H}_4 \); [74-85-1]
2. Nonane, 1,1,1,9-Tetrachloro-; \( \text{C}_9\text{H}_{16}\text{Cl}_4 \); [1561-48-4]

ORIGINAL MEASUREMENTS:
Efremova, G.D.; Kovpakova, P.F.

VARIABLES:
\[
\begin{align*}
T/K & = 273.35 - 373.15 \\
P_f/\text{MPa} & = 1.013 - 10.13
\end{align*}
\]

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>( t/\degree C )</th>
<th>( T/K )</th>
<th>( \text{H/Atm (mole fraction)}^{-1} )</th>
<th>( \text{Mole Fraction Ethene, } x_1 ) for ( P_f = 101.3 , \text{kPa} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.2</td>
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</tr>
<tr>
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<td>82</td>
<td>0.0122</td>
</tr>
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<td>50</td>
<td>323.15</td>
<td>105</td>
<td>0.0095</td>
</tr>
<tr>
<td>75</td>
<td>348.15</td>
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<tr>
<td>100</td>
<td>373.15</td>
<td>154</td>
<td>0.0065</td>
</tr>
</tbody>
</table>

\(^1\)Henry's law constants and mole fraction solubilities at 101.3 kPa were evaluated by the compiler from enlarged graphs only; there were no numerical solubility data. Henry's law was observed to fit the data closely up to about 0.40 mole fraction ethene for all temperatures.

Phase equilibrium compositions of ethene in liquid solutions are graphically shown as a function of pressure over the complete ethene composition range to 99 mole percent ethene. Critical phenomena are reported for high concentrations of ethene at high pressures.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
The apparatus and procedure are described in ref. 1. The equilibration device is a capillary tube 1 mm in diameter containing an internal mixer which is moved up and down by means of an external, motor-driven magnet. The capillary tube is sealed in a vertical position and connected to a gas and liquid charging system, pressure gauges, as well as a volume regulator to maintain a constant pressure and to determine the volume of gas charged.

Graphs of liquid solution molar volumes are also given as a function of solution compositions, including those for critical values at high pressures.

SOURCE AND PURITY OF MATERIALS:
1. Ethene purity 97.5% by analysis.
2. Tetrachloro-nonane, vacuum distilled. Actual purity not given. Density and refractive index at 20 °C:
\[
\rho = 1.1913 \, \text{g cm}^{-3},
\]
\[
n_D = 1.4827
\]

ESTIMATED ERROR:
\[
\delta \frac{x_1}{x_1} = \pm 4\% \text{ (compiler)}
\]

REFERENCES:
1. Kritchevskii, I.R.; Efremova, G.D.
COMPONENTS:
1. Ethene, \( \text{C}_2\text{H}_4 \); [74-85-1]
2. Acetic acid, trichloro-ethyl ester (ethyltrichloroacetate); \( \text{C}_4\text{H}_2\text{Cl}_3\text{O}_2 \); [515-84-4]

ORIGINAL MEASUREMENTS:
Kristesashvili, L.V.; Chkhubianishvili, N.G.; Tatenashvili, M.Kh.

VARIABLES:
\( T / \text{K} = 363.15, 373.15 \)
\( p_1 / \text{MPa} = 0.1 - 8.1 \)

EXPERIMENTAL VALUES:

\[ \begin{array}{ccc}
 t / \text{C} & T / \text{K} & H' / \text{atm (mole fraction)}^{-1} & H / \text{MPa (mol fraction)}^{-1} & \text{Ethene, } x_1 \\
 90 & 363.15 & 117.5 & 11.9 & 0.0085 \\
 100 & 373.15 & 140 & 14.2 & 0.0071 \\
\end{array} \]

Only a graph showing ethene mole fractions as a function of ethene partial pressure to pressures up to 80 atm (8.11 MPa) was available. Henry's law was stated to be followed.

\(^1\)Henry's constants and mole fractions solubility for an ethene partial pressure of 101.3 kPa (\( x_1 \)) were calculated by the compiler based on an enlarged graph showing the data.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
The equipment consisted of a stainless steel autoclave containing a magnetic stirrer and immersed in a constant temperature bath. The autoclave was attached to a second stainless steel vessel, in a constant temperature bath, used as a gas supply vessel. Attached also was a vacuum system and a pressure gauge. A known quantity of solvent was degassed. The drop in pressure in the second vessel was used as a measure of the quantity of ethene dissolved.

SOURCE AND PURITY OF MATERIALS:
Sources and purities not specified.

ESTIMATED ERROR:
\( \delta' x_1 / x_1 = \pm 3\% \) (compiler)

REFERENCES:
COMPONENTS:
1. Ethene; C₂H₄; [74-85-1]
2. Solvents, other than alcohols, containing carbon, oxygen and hydrogen

CRITICAL EVALUATION:

Critical evaluation of the solubility of ethene at a partial pressure not
greater than 101.3 kPa in solvents, other than alcohols, containing carbon,
oxygen and hydrogen.

It is often helpful to compare experimental values of mole fraction
solubilities \(x_i\) of a gas at a particular temperature with reference values
from the Raoult's law equation

\[ x_i = \frac{p_i}{p_v} \]

where \(p_v\) is the vapour pressure of liquefied gas at the temperature in
question. The variation with temperature of \(p_i/p_v\) provides a reference line
for comparison of solubilities. The critical temperature of ethene is
282.4 K but it is convenient to extrapolate the vapour pressure of ethene
to temperatures above the critical temperature to calculate a reference
line and hence facilitate qualitative comparison of experimental
solubilities. Mole fraction solubilities in most solvents containing
oxygen fall below the reference line and are low compared with solubility
in straight chain hydrocarbons.

2-Propanone; C₃H₆O; [67-64-1]

Solubility in 2-propanone has been measured by Horiuti (1), Hannaert et
al. (2), Leites and Ivanovskii (3), and by McDaniel (4). McDaniel's values
for a partial pressure of 101.3 kPa fall appreciably below those given by
Horiuti and can be disregarded because other measurements by McDaniel have
been found to be significantly lower than measurements carried out more
recently. Solubility values calculated from equations given by Hannaert
for 283.15 K and 293.15 K are, respectively, about 18% and 14% above values
given by Horiuti. Horiuti's data for the temperature range of 273.15 to
313.15 K are likely to be the more reliable. Measurements carried out by
this author on other systems is often in close agreement with more recent
precision measurements. Horiuti's data can be fitted to the equation:

\[ \ln x_i = -1.3472 + 795.05/(T/K) - 1.0247 \ln(T/K) \]

where \(x_i\) is the mole fraction solubility at \(p_i = 101.3\) kPa
standard deviation in values of \(x_i = 2.0 \times 10^{-5}\) temp. range 273-313 K
This equation may be accepted on a tentative basis.

The following equation is based upon Horiuti's measurements from 273.15 to
313.15 K, on Hannaert's measurements from 243.15 to 293.15 K and on the
single value at 243.15 K given by Leites and Ivanovskii.

\[ \ln x_i = -8.5070 + 1195.3/(T/K) \]

standard deviation in values of \(x_i = 8.5 \times 10^{-4}\) temp. range 243-313 K
This equation is recommended on a tentative basis for temperatures below
273 K.

Methyl acetate; C₃H₆O₂; [79-20-9]

Horiuti (1) also measured solubility in methyl acetate. Mole fraction
solubilities at a partial pressure of 101.3 kPa fit the equation

\[ \ln x_i = 3.2620 + 569.63/(T/K) - 1.6935 \ln(T/K) \]

standard deviation in values of \(x_i = 3.4 \times 10^{-5}\) temp. range 273-313 K
Horiuti's data for methyl acetate are classified as tentative.

Cyclopentanone; C₅H₈O; [120-92-3]
Cyclohexanone; C₆H₁₀O; [108-94-1]
2-Methylcyclohexanone; C₇H₁₂O; [583-60-8]
2,6-Dimethylcyclohexanone; C₇H₁₄O; [2816-57-1]
Cycloheptanone; C₇H₁₂O; [502-42-1]

Solubility in cyclic ketones has been measured by Gallardo and co-workers
(5-9) at a partial pressure of ethene of 101.3 kPa in the temperature range
273.15 to 303.15 K. Mole fraction solubilities at the same temperature in
<table>
<thead>
<tr>
<th>COMPONENTS:</th>
<th>EVALUATOR:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Ethene; C₂H₄; [74-85-1]</td>
<td>Peter G.T. Fogg</td>
</tr>
<tr>
<td>2. Solvents, other than Alcohols, containing Carbon, Oxygen and Hydrogen</td>
<td>School of Applied Chemistry</td>
</tr>
<tr>
<td></td>
<td>University of North London</td>
</tr>
<tr>
<td></td>
<td>Holloway Road, London, N7 8DB, U.K.</td>
</tr>
<tr>
<td></td>
<td>November, 1993</td>
</tr>
<tr>
<td>CRITICAL EVALUATION:</td>
<td></td>
</tr>
<tr>
<td>these solvents are in the order 2,6-dimethylcyclohexanone &gt; 2-methylcyclohexanone &gt; cycloheptanone &gt; cyclohexanone &gt; cyclopentanone. Sets of measurements are consistent with each other (see fig. 1) and all fall below the reference line based on Raoult's law in this temperature range. Solubilities at a partial pressure of gas of 101.3 kPa may be fitted to the following equations derived by the evaluator. These give slightly better fit than equations given by the authors.</td>
<td></td>
</tr>
</tbody>
</table>

2,6-dimethylcyclohexanone

\[ \ln x_1 = -8.5574 + 1294.9/(T/K) \]

standard deviation in values of \( x_1 = 3.4 \times 10^{-5} \)

2-methylcyclohexanone

\[ \ln x_1 = 41.885 - 980.94/(T/K) - 7.5339 \ln(T/K) \]

standard deviation in values of \( x_1 = 5.9 \times 10^{-5} \)

cycloheptanone

\[ \ln x_1 = -22.106 + 1764.3/(T/K) + 2.0544 \ln(T/K) \]

standard deviation in values of \( x_1 = 2.4 \times 10^{-5} \)

cyclohexanone

\[ \ln x_1 = 35.451 - 773.66/(T/K) - 6.5627 \ln(T/K) \]

standard deviation in values of \( x_1 = 2.9 \times 10^{-5} \)

cyclopentanone

\[ \ln x_1 = 25.679 - 337.58/(T/K) - 5.1162 \ln(T/K) \]

standard deviation in values of \( x_1 = 1.4 \times 10^{-5} \)

These equations may be accepted on a tentative basis for the temperature range 273.15 to 303.15 K.

4-Methyl-1,3-dioxolan-2-one (propylene carbonate); C₄H₆O₃; [108-32-7]

Henry's constants for dissolution of ethene in 4-methyl-1,3-dioxolan-2-one was measured by a chromatographic method at 298.2-343.2 K by Lenoir et al. (10). Mole fraction solubility at 298.2 K and a partial pressure of 101.3 kPa, calculated on the assumption of a linear variation of mole fraction solubility with partial pressure, is 0.00821 compared with 0.00421 from measurements by Brückl and Kim (11). Solubilities reported by Lenoir et al. for some of the other systems which they have studied are high compared with measurements by other groups. This is probably due to limitations of the chromatographic method. Further measurements on this system are required.

1,2-Epoxyhexane; C₆H₁₂O; [592-90-5]

Mole fraction solubilities measured by Gibanel et al. (12) at a partial pressure of 101.3 kPa in 1,2-epoxyhexane fall in between solubilities in 2-methylcyclohexanone and 2,6-dimethylcyclohexanone. The data may be fitted to the equation

\[ \ln x_1 = -50.928 + 3025.0/(T/K) + 6.4117 \ln(T/K) \]

standard deviation in values of \( x_1 = 2.9 \times 10^{-5} \) temp. range 273-303 K

This equation may be accepted on a tentative basis.
COMPONENTS:
1. Ethene; \( \text{C}_2\text{H}_4; \) [74-85-1]
2. Solvents, other than Alcohols, containing Carbon, Oxygen and Hydrogen

CRITICAL EVALUATION:

1,4-Dioxane; \( \text{C}_4\text{H}_8\text{O}_2; \) [123-91-1]
Solubility in the cyclic diether, 1,4-dioxane is low compared with that in cyclic ketones. Solubilities at a partial pressure of ethene of 101.3 kPa reported by Gallardo et al. (13) for the temperature range 285.15 to 303.15 K fit the equation

\[
\ln x_1 = -1.2404 + 763.88/(T/K) - 1.0499 \ln(T/K)
\]

standard deviation in values of \( x_1 \) = 1.7 \times 10^{-5}
This equation fits the data better than the one given by the authors and may be accepted on a tentative basis.

1,1'-[Methylenebis(oxy)]-bisethane; \( \text{C}_5\text{H}_{12}\text{O}_2 \)
The mole fraction solubility reported by Lizano et al. (14) at a partial pressure of 101.3 kPa in the acetal, 1,1'-[methylenebis(oxy)]-bisethane, is higher than that in the cyclic ketones (see fig. 1). Values lie above the reference line based upon the Raoult's law equation. The data may be fitted to the equation

\[
\ln x_1 = -17.138 + 1927.7/(T/K) + 1.1882 \ln(T/K)
\]

standard deviation in values of \( x_1 \) = 2.6 \times 10^{-5}; temp. range 263-303 K
This equation may be accepted on a tentative basis

References
COMPONENTS:
1. Ethene; C₂H₄; [74-85-1]
2. Solvents, other than alcohols, containing carbon, oxygen and hydrogen

CRITICAL EVALUATION:

Figure 1 The solubility of ethene at a partial pressure of 101.3 kPa in compounds containing oxygen

- me 1,1'-[Methylenebis(oxy)]bisethane
- dm 2,6-Dimethylcyclohexanone
- hm 1,2-epoxyhexane (hexamethylene oxide)
- mc 2-Methylocyclohexanone
- c7 Cycloheptanone

- ac 2-Propanone (acetone)
- ma Methyl acetate
- c6 Cyclohexanone
- c5 Cyclopentanone
- 1,4 1,4-Dioxane

rl Reference line based upon the Raoult's law equation
COMPONENTS:
(1) Ethene or ethylene; C₂H₄; [74-85-1]
(2) 2-Propanone or acetone; C₃H₆O; [67-64-1]

VARIABLES:
T/K: 273.15 - 313.15
p₁/kPa: 101.325 (1 atm)

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

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>10²x₁</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>273.15</td>
<td>1.520</td>
<td>4.843</td>
<td>4.843</td>
</tr>
<tr>
<td>278.15</td>
<td>1.420</td>
<td>4.490</td>
<td>4.572</td>
</tr>
<tr>
<td>283.15</td>
<td>1.325</td>
<td>4.156</td>
<td>4.308</td>
</tr>
<tr>
<td>288.15</td>
<td>1.240</td>
<td>3.862</td>
<td>4.074</td>
</tr>
<tr>
<td>293.15</td>
<td>1.160</td>
<td>3.585</td>
<td>3.847</td>
</tr>
<tr>
<td>298.15</td>
<td>1.088</td>
<td>3.335</td>
<td>3.640</td>
</tr>
<tr>
<td>303.15</td>
<td>1.028</td>
<td>3.129</td>
<td>3.473</td>
</tr>
<tr>
<td>308.15</td>
<td>0.9641</td>
<td>2.912</td>
<td>3.285</td>
</tr>
<tr>
<td>313.15</td>
<td>0.9144</td>
<td>2.741</td>
<td>3.142</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.

Smoothed Data: For use between 273.15 and 313.15 K.

\[ \ln x₁ = -8.1906 + 10.9452/(T/100K) \]

The standard error about the regression line is 2.67 x 10⁻⁵.

AUXILIARY INFORMATION

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.

SOURCE AND PURITY OF MATERIALS:
(1) Ethene. Prepared by dropping ethanol into orthophosphoric acid. The gas was cooled, passed through several wash solutions, dried, and fractionated from liquid air several times.
(2) Acetone. Nippon Pure Chemical Co. or Merck. Extra pure grade. Recrystallized with sodium sulfite and stored over calcium chloride. Fractionated, boiling point (760 mmHg) 56.09°C.

REFERENCES:
COMPONENTS:
1. Ethene; \( \text{C}_2\text{H}_4; [74-85-1] \)
2. 2-Propanone, (acetone);
\( \text{C}_3\text{H}_6\text{O}; [67-64-1] \)

ORIGINAL MEASUREMENTS:
Hannaert, H.; Haccuria, M.; Mathieu, M.P.

VARIABLES:
\[
\frac{T}{K} = 243.15 - 293.15
\]
\( \rho_1 / \text{kPa} = 101.3 \)

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>( t/\text{C} )</th>
<th>( T/K )</th>
<th>( \text{Mole fraction Ethene, } x_1 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>-30</td>
<td>243.15</td>
<td>0.0264</td>
</tr>
<tr>
<td>-10</td>
<td>263.15</td>
<td>0.0196</td>
</tr>
<tr>
<td>10</td>
<td>283.15</td>
<td>0.0152</td>
</tr>
<tr>
<td>20</td>
<td>293.15</td>
<td>0.0135</td>
</tr>
</tbody>
</table>

Mole fraction solubility calculated by compilers for a gas partial pressure of 101.3 kPa using the equation developed by the authors with \( \nu = 1 \), for the applicable temperature range:

\[
\log (K\nu) = 3.28 - \left( \frac{\Delta H/\text{cal mol}^{-1}}{(2.3R(T/K))} \right)
\]

The authors' definitions are:

\( \Delta H = 1,890 \text{ cal mol}^{-1} \), Enthalpy of dissolution

\( K = \nu_i / x_i \) mole fraction gas in gas phase

\( x_i \) mole fraction gas in liquid phase

\( \pi/\text{atm} \) = total pressure

\( \nu \) = coefficient of fugacity

The function, \( K\nu/\text{atm} \), is equivalent to a Henry's constant in the form

\( H_1,2/\text{atm} = (\xi/\text{atm})/x_i \) where \( \xi \) is the fugacity.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
The authors describe several methods used; the one used in this case is the least accurate.

The apparatus is of glass and consists of a burette in which the gas is confined over mercury, two bulbs for the solvent, one above the other, a mercury manometer and a constant temperature bath. A measured volume of solvent is degassed in the top bulb at ambient temperature and charged to the absorption bulb in the bath. Gas is charged to the desired pressure. The quantity of gas added at constant pressure is measured. Agitation is manual.

SOURCE AND PURITY OF MATERIALS:
1. Ethene. Air Liquide. For narcosis, 99.9 per cent.
2. 2-Propanone. Merck and Co. Vapor pressure, \( p/\text{mm Hg} = 11 \) at \(-30^\circ\text{C}\) and 184 at \(20^\circ\text{C}\) as specified by authors.

ESTIMATED ERROR:

\( \delta x_i / x_i = \pm 10 \) to 15\% (authors)

REFERENCES:
COMPONENTS:
1. Ethene; C2H4; [74-85-1]
2. 2-Propanone (acetone);
   C3H6O; [67-64-1]

ORIGINAL MEASUREMENTS:
Leites, I.L.; Ivanovskii, F.P.

VARIABLES:
\[ T_K = 243.15, \]
\[ P_{\text{kPa}} = 101.325 \]

PREPARED BY:
W. Hayduk

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>t°C</th>
<th>T/K</th>
<th>( \log_{10}(H'/\text{mmHg}) )</th>
<th>( 2\text{Henry's Constant, ( H/atm \text{ (mole fraction)} )}^{-1} ) Ethene, ( x_1 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>-30</td>
<td>243.15</td>
<td>4.423</td>
<td>34.85</td>
</tr>
</tbody>
</table>

This result was part of a study for the behavior of solubilities in two-component solvent solutions.

1 Only graphical results were available in this paper; a value of log of Henry's constant (H') was read from an enlarged graph by the compiler.

2 Henry's constant (H) and mole fraction solubility (\( x_1 \)) were calculated by the compiler.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
A metal cryostat was cooled with dry-ice and acetone and controlled to a temperature to \( \pm 0.05 \text{ K} \). The equilibrium cell was mounted in the cryostat. The solvent was purified by fractional distillation and analyzed by chromatography. Details were not given.

SOURCE AND PURITY OF MATERIALS:
1. Ethene purity was stated to be 99.9%.
2. 2-Propanone was distilled and analyzed by chromatography. Actual purity not given.

ESTIMATED ERROR:
\[ \delta T_K = \pm 0.05 \]
\[ \delta x_1/x_1 = \pm 0.01 \text{ (Authors)} \]

REFERENCES:
COMPONENTS:
(1) Ethene or ethylene; C₂H₄; [74-85-1]
(2) 2-Propanone or acetone; C₃H₆O; [67-64-1]

VARIABLES:
\[
\begin{align*}
T/K &= 293.15 - 308.15 \\
p_1/kPa &= 101.3 \text{ (1 atm)}
\end{align*}
\]

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>Temperature (°C)</th>
<th>Mol Fraction (10^2 x_J)</th>
<th>Bunsen Coefficient (a)</th>
<th>Ostwald Coefficient (b)</th>
</tr>
</thead>
<tbody>
<tr>
<td>20.0</td>
<td>0.780</td>
<td>2.2900</td>
<td>2.5709</td>
</tr>
<tr>
<td>25.0</td>
<td>0.746</td>
<td>2.2752</td>
<td>2.4834c</td>
</tr>
<tr>
<td>35.0</td>
<td>0.681</td>
<td>2.0460</td>
<td>2.3084</td>
</tr>
</tbody>
</table>

\(a\) Bunsen coefficient, \(a/cm^3\text{(STP)}\ cm^-3\ atm^-1\).

\(b\) Listed as absorption coefficient in the original paper. Interpreted to be equivalent to Ostwald coefficient by compiler.

\(c\) Ostwald coefficient (absorption coefficient) estimated as 298.15 K value by author.

\(d\) Mole fraction values calculated by compiler assuming ideal gas behavior.

EVALUATOR'S COMMENT: McDaniel's data should be used with caution. His values are often 20 percent or more too small when compared with more reliable data.

The values of the Bunsen Coefficient and Ostwald Coefficient (Absorption Coefficient) given by the author for 293.15 K are incompatible. The mole fraction solubility given above has been calculated from the Ostwald Coefficient.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
The apparatus is all glass. It consists of a gas buret connected to a contacting vessel. The solvent is degassed by boiling under reduced pressure. Gas pressure or volume is adjusted using mercury displacement. Equilibration is achieved at atm pressure by hand shaking, and incrementally adding gas to the contacting chamber. Solubility measured by obtaining total uptake of gas by known volume of the solvent.

SOURCE AND PURITY OF MATERIALS:
(1) Ethene. Prepared by reaction of 1,2-dibromoethane with zinc-copper.
(2) 2-Propanone.

ESTIMATED ERROR:
\[\delta L/L \geq 0.20\]

REFERENCES:
COMPONENTS:
(1) Ethene or ethylene; C\textsubscript{2}H\textsubscript{4}; [74-85-1]
(2) Acetic acid, methyl ester or methyl acetate; C\textsubscript{3}H\textsubscript{6}O\textsubscript{2}; [79-20-9]

ORIGINAL MEASUREMENTS:
Horiuti, J.

VARIABLES:
\( T/K: \ 273.15 - 313.15 \)
\( P_j/kPa: \ 101.325 \text{ (1 atm)} \)

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 ( \alpha/\text{cm}^2\text{(STP)}\text{cm}^{-1} )</th>
<th>Ostwald Coefficient ( \text{L/cm}^3\text{cm}^{-1} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>273.15</td>
<td>1.567</td>
<td>4.618</td>
<td>4.618</td>
</tr>
<tr>
<td>278.15</td>
<td>1.470</td>
<td>4.300</td>
<td>4.379</td>
</tr>
<tr>
<td>283.15</td>
<td>1.381</td>
<td>4.009</td>
<td>4.156</td>
</tr>
<tr>
<td>288.15</td>
<td>1.287</td>
<td>3.710</td>
<td>3.914</td>
</tr>
<tr>
<td>293.15</td>
<td>1.208</td>
<td>3.456</td>
<td>3.709</td>
</tr>
<tr>
<td>298.15</td>
<td>1.136</td>
<td>3.226</td>
<td>3.521</td>
</tr>
<tr>
<td>303.15</td>
<td>1.071</td>
<td>3.017</td>
<td>3.348</td>
</tr>
<tr>
<td>308.15</td>
<td>1.009</td>
<td>2.823</td>
<td>3.185</td>
</tr>
<tr>
<td>313.15</td>
<td>0.958</td>
<td>2.660</td>
<td>3.049</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.

Smoothed Data: For use between 273.15 and 313.15 K.

\[
\ln x_j = -8.0481 + 10.6457/(T/100K)
\]

The standard error about the regression line is \( 4.61 \times 10^{-5} \).

<table>
<thead>
<tr>
<th>( T/K )</th>
<th>Mol Fraction ( 10^2x_j )</th>
</tr>
</thead>
<tbody>
<tr>
<td>273.15</td>
<td>1.575</td>
</tr>
<tr>
<td>283.15</td>
<td>1.373</td>
</tr>
<tr>
<td>288.15</td>
<td>1.286</td>
</tr>
<tr>
<td>293.15</td>
<td>1.208</td>
</tr>
<tr>
<td>298.15</td>
<td>1.136</td>
</tr>
<tr>
<td>303.15</td>
<td>1.071</td>
</tr>
<tr>
<td>313.15</td>
<td>0.958</td>
</tr>
</tbody>
</table>

AUXILIARY INFORMATION:

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) Ethene. Prepared by dropping ethanol into orthophosphoric acid. The gas was cooled, passed through several wash solutions, dried, and fractionated from liquid air several times.

(2) Methyl acetate. Merck. Extra pure grade. Dried with P\textsubscript{2}O\textsubscript{5}. Distilled several times. Boiling point (760 mmHg) 57.12°C.

ESTIMATED ERROR:
\( \delta T/K = 0.05 \)
\( \delta x_j/x_j = 0.01 \)

REFERENCES:
### COMPONENTS:
1. Ethene; $C_2H_4$; [74-85-1]
2. 1,3-Dioxolan-2-one, 4-methyl- (Propylene carbonate); $C_4H_8O_3$; [108-32-7]

### ORIGINAL MEASUREMENTS:
Brückl, N.; Kim, J. I.
*Z. Phys. Chem. (Wiesbaden)*

### VARIABLES:
- $T/K = 298.2$
- $P/kPa = 101.3$

### EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>$T/K$</th>
<th>$ln H$</th>
<th>$10^3 \times \text{Mole fraction of ethene in liquid}^+$, $10^3x_{C_2H_4}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>298.2</td>
<td>5.47</td>
<td>4.211</td>
</tr>
</tbody>
</table>

*at a partial pressure of 1 atmosphere, calculated by compiler, assuming $x_{C_2H_4} = 1/H$. 

### AUXILIARY INFORMATION

**METHOD/APPARATUS/PROCEDURE:**

Solubilities were determined by a volumetric method described as "the Ostwald method". No other details given.

**SOURCE AND PURITY OF MATERIALS:**

1. Linde Co. sample, purity 99.8 volume per cent.
2. Uvasol and analytical grade.

**ESTIMATED ERROR:**

$\delta T/K = \pm 0.1$; $\delta H = \pm 1.25\%$.

**REFERENCES:**
### COMPONENTS:

1. Ethene; \( \text{C}_2\text{H}_4 \); [74-85-1]
2. 1,3-Dioxolane-2-one, 4-methyl- (Propylene carbonate); \( \text{C}_4\text{H}_6\text{O}_3 \); [108-32-7]

### VARIABLES:

- \( T/\text{K} = 298.2 - 343.2 \)
- \( P/\text{kPa} < 101.3 \) (low pressures)

### ORIGINAL MEASUREMENTS:

Lenoir, J-Y.; Renault, P.; Renon, H.


### EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>( T/\text{K} )</th>
<th>Henry's constant ( H_{\text{C}_2\text{H}_4}/\text{atm} )</th>
<th>Mole fraction at 1 atm* ( x_{\text{C}_2\text{H}_4} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>298.2</td>
<td>192</td>
<td>0.00521</td>
</tr>
<tr>
<td>323.2</td>
<td>235</td>
<td>0.00426</td>
</tr>
<tr>
<td>343.2</td>
<td>271</td>
<td>0.00369</td>
</tr>
</tbody>
</table>

* Calculated by compiler assuming a linear function of \( H_{\text{C}_2\text{H}_4} \) vs \( x_{\text{C}_2\text{H}_4} \), i.e., \( x_{\text{C}_2\text{H}_4} (1 \text{ atm}) = 1/H_{\text{C}_2\text{H}_4} \).

### 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) Ethene, \( \text{C}_2\text{H}_4 \), [74-85-1]
(2) 1,4-Dioxane, \( \text{C}_4\text{H}_8\text{O}_2 \), [123-91-1]

ORIGINAL MEASUREMENTS:
Gallardo, M. A.; Urieta, J. S.; Gutierrez Losa, C.

VARIABLES:
\[
\begin{align*}
T/\text{K} & = 285.15 - 303.15 \\
P_1/\text{kPa} & = 101
\end{align*}
\]

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>( T/\text{K} )</th>
<th>( 10^4x_1 )</th>
<th>( \text{Bunsen Coefficient} )</th>
<th>( \text{Ostwald Coefficient} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>285.15</td>
<td>111.6</td>
<td>2.995</td>
<td>3.125</td>
</tr>
<tr>
<td>289.15</td>
<td>105.6</td>
<td>2.820</td>
<td>2.985</td>
</tr>
<tr>
<td>293.15</td>
<td>100.7</td>
<td>2.675</td>
<td>2.870</td>
</tr>
<tr>
<td>298.15</td>
<td>94.81</td>
<td>2.505</td>
<td>2.730</td>
</tr>
<tr>
<td>303.15</td>
<td>89.08</td>
<td>2.335</td>
<td>2.595</td>
</tr>
</tbody>
</table>

The compiler calculated the Bunsen and Ostwald coefficients from the author's mole fraction values assuming ideal gas behavior. The values are rounded to the nearest 0.005.

The authors fitted their data to the equation:

\[
\ln x_1 = 3.648 \ln (T/\text{K}) - 16.123
\]

from which they obtained

\[\Delta H^f_{\text{mol}} \text{kJ mol}^{-1} = -9.04, \text{ and } \Delta S^f_{\text{mol}} \text{JK}^{-1} \text{mol}^{-1} = -69\]

for the transfer of one mole of ethene 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

\[
\ln (p_2 /\text{kPa}) = -4591.3/(T/\text{K}) + 16.98.
\]

SOURCE AND PURITY OF MATERIALS:
(1) Ethene. Sociedad Espanola del Oxigeno. Stated to be 99.90 %.
(2) 1,4-Dioxane. Merck and Co. Purity checked by GLC to be \( \geq 99 \% \).

ESTIMATED ERROR:
\[\delta T/\text{K} = \pm 0.1\]
\[\delta P_1/\text{kPa} = \pm 1\]
\[\delta x_1/x_1 = \pm 0.01\]

REFERENCES:
COMPONENTS:

1. Ethene; C₂H₄; [74-85-1]
2. Cyclopentanone; C₅H₈O; [120-92-3]

VARIABLES:

\[ T/K = 273.15 - 303.15 \]
\[ P/kPa = 101.32 \]

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>(10^4 x_1)</th>
<th>(x_1)</th>
<th>(L/cm^3 cm^{-3})</th>
<th>(a/cm^3(STP) cm^{-3} atm^{-1})</th>
</tr>
</thead>
<tbody>
<tr>
<td>273.15</td>
<td>141.3</td>
<td>1.413</td>
<td>3.67</td>
<td>3.67</td>
</tr>
<tr>
<td>283.15</td>
<td>123.1</td>
<td>1.231</td>
<td>3.28</td>
<td>3.16</td>
</tr>
<tr>
<td>293.15</td>
<td>107.1</td>
<td>1.071</td>
<td>2.92</td>
<td>2.72</td>
</tr>
<tr>
<td>298.15</td>
<td>100.1</td>
<td>1.001</td>
<td>2.76</td>
<td>2.53</td>
</tr>
<tr>
<td>303.15</td>
<td>93.83</td>
<td>0.9383</td>
<td>2.62</td>
<td>2.36</td>
</tr>
</tbody>
</table>

1 For a gas partial pressure of 101.325 kPa.

2 The Bunsen and Ostwald coefficients were calculated by the compiler.

The authors fitted their data as a Henry's constant, \(H/\text{atm mole fraction}^{-1}\), to the following equation:

\[ \ln H = 8.4036 - 1132.98(T/K)^{-1} \]

They also obtained \(\Delta H/kJ\ mol^{-1} = -9.42\) and \(\Delta S/JK^{-1}mol^{-1} = -70\) for the transfer of one mole of ethene from the gas phase at 101.32 kPa to the hypothetical unit mole fraction solution.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The apparatus is described in ref. 1. It consists of a system of burettes for the gas, a mercury manometer and a solution vessel. The mole fraction of dissolved gas is estimated from the volume change at constant pressure of saturated gas in the burettes and the mass of solvent in the solution vessel determined by weighing.

The solvent vapor pressure was also measured and correlated as follows:

\[ \ln(P/kPa) = -5067.57(T/K)^{1/2} + 17.449 \]

SOURCE AND PURITY OF MATERIALS:

1. Ethene. Sociedad Espanol del Oxigeno. Specified purity 99.9%.
2. Cyclopentanone. Fluka. Specified purity 99.5%. Purity also checked with GLC and refractive index measurements.

ESTIMATED ERROR:

\[ T/K = \pm 0.2 \]
\[ \delta x_1/x_1 = \pm 0.7\% \] (authors)

REFERENCES:

1. Gallardo, M.A.; Urieta, J.S.; Gutierrez Losa, C.
Components:

1. Ethene; C₂H₄; [74-85-1]
2. Hexane, 1,2-epoxy-, (Hexamethylene oxide) C₆H₈O; [592-90-5]

Original Measurements:

Gibanel, F.; Lopez, M.C.; Gallardo, M.A.; Urieta, J.S.; Gutierrez Losa, C.


Variables:

\[ T/K = 273.15 - 303.15 \]
\[ P/kPa = 101.32 \]

Experimental Values:

<table>
<thead>
<tr>
<th>T/K</th>
<th>Mole Fraction</th>
<th>( 10^4 x_1 )</th>
<th>( ^1 \text{Ostwald Coefficient} )</th>
<th>( \text{Bunsen Coefficient} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>273.15</td>
<td>206</td>
<td>4.24</td>
<td>4.24</td>
<td></td>
</tr>
<tr>
<td>283.15</td>
<td>175</td>
<td>3.68</td>
<td>3.55</td>
<td></td>
</tr>
<tr>
<td>293.15</td>
<td>152</td>
<td>3.28</td>
<td>3.05</td>
<td></td>
</tr>
<tr>
<td>298.15</td>
<td>143</td>
<td>3.12</td>
<td>2.85</td>
<td></td>
</tr>
<tr>
<td>303.15</td>
<td>134</td>
<td>2.96</td>
<td>2.66</td>
<td></td>
</tr>
</tbody>
</table>

\(^1\)The Bunsen and Ostwald coefficients were calculated by the compiler using a solvent density at 293.15K of 0.890 g cm⁻³.

The authors fitted their data to the equation:

\[- \ln x_1 = 8.2306 - 1186.82 \ (T/K)^{-1}\]

They also obtained \( \Delta H/kJ \text{ mol}^{-1} = -9.87 \) and \( \Delta S/J \text{ K}^{-1} \text{ mol}^{-1} = -68 \) for the transfer of one mole of ethene from the gas phase at 101.32 kPa to the hypothetical unit mole fraction solution.

Auxiliary Information

Method/Apparatus/Procedure:

The solubility apparatus is described elsewhere (ref.1); it is based on that proposed by Ben Nairn and Baer (ref.2). The set-up consists of a burette system, a mercury manometer and a solution vessel. Mole fraction of the dissolved gas is estimated from the volume change at constant pressure of saturated gas in the burettes, and the mass of liquid in the solution vessel by weighing.

The solvent vapor pressure was determined and fitted to the following equation:

\[ \ln (P/kPa) = -4,891.6 \ (T/K)^{-1} \]
\[ + 17.3387 \]

Source and Purity of Materials:

1. Ethene. Sociedad Española del Oxigeno. Specified purity 99.9%.

Estimated Error:

\[ \delta x_1/x_1 = \pm 0.01 \] (authors)

References:

COMPONENTS:
1. Ethene; C₂H₄; [74-85-1]
2. Cyclohexanone; C₆H₁₀O; [108-94-1]

ORIGINAL MEASUREMENTS:
Gallardo, M.A.; Melendo, J.M.; Urieta, J.S.; Gutierrez Losa, C.

VARIABLES:

\[ T/K = 273.15 - 303.15 \]
\[ P/kPa = 101.32 \]

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>Mole Fraction</th>
<th>(10^4 x_1)</th>
<th>(\text{Ostwald Coefficient, } L/cm^3)</th>
<th>(\text{Bunsen Coefficient, } \alpha/cm (STP) cm^3) atm⁻¹</th>
</tr>
</thead>
<tbody>
<tr>
<td>273.15</td>
<td>150</td>
<td>3.33</td>
<td>3.33</td>
<td></td>
</tr>
<tr>
<td>283.15</td>
<td>131.5</td>
<td>2.99</td>
<td>2.88</td>
<td></td>
</tr>
<tr>
<td>293.15</td>
<td>114.5</td>
<td>2.67</td>
<td>2.49</td>
<td></td>
</tr>
<tr>
<td>298.15</td>
<td>106.9</td>
<td>2.52</td>
<td>2.31</td>
<td></td>
</tr>
<tr>
<td>303.15</td>
<td>100.5</td>
<td>2.40</td>
<td>2.16</td>
<td></td>
</tr>
</tbody>
</table>

The Bunsen and Ostwald coefficients were calculated by the compiler.

The authors fitted their data to the equation:

\[-\ln x_1 = 3.8489 \ln T - 17.393\]

They also obtained \(\Delta H/kJ\ mol⁻¹ = -9.54\) and \(\Delta S/J K⁻¹\) mol⁻¹ = -70 for the transfer of one mole of ethene from the gas phase at 101.32 kPa to the hypothetical unit mole fraction solution.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
The solubility apparatus is described in an earlier paper (ref. 1). It consists of a system of burettes, a mercury manometer and a solution vessel. The mole fraction of the dissolved gas is estimated from the volume change at constant pressure of saturated gas in the burettes, and the mass of solvent in the solution vessel determined by weighing.

SOURCE AND PURITY OF MATERIALS:
1. Ethene. Sociedad Espanol del Oxigeno, Specified purity 99.9%.
2. Cyclohexanone. Carlo Erba. Specified purity ≥ 99%.

ESTIMATED ERROR:

\[ \delta x_1 / x_1 = \pm 0.007 \]

(Authors)

REFERENCES:
1. Carnicer, J.; Gibanel, F.; Urieta, J.S.; Gutierrez Losa, C.
COMPONENTS:
1. Ethene; C₂H₄; [74-85-1]
2. 2-Methylcyclohexanone; C₇H₁₂O₆; [583-60-8]

ORIGINAL MEASUREMENTS:
Gallardo, M.A.; Carmen Lopez, M.; Urieta, J.S.; Gutierrez Losa, C.


VARIABLES:
\( T/K = 273.15 - 303.15 \)
\( P_i/kPa = 101.32 \)

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>( T/K )</th>
<th>( Mole ) Fraction ( 10^4 \ \varepsilon_i )</th>
<th>( 1 ) Ostwald Coefficient ( L/cm^3 \ cm^{-3} )</th>
<th>( 1 ) Bunsen Coefficient ( a/cm^3 \ (STP) \ cm^{-3} \ atm^{-1} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>273.15</td>
<td>188</td>
<td>3.580</td>
<td>3.580</td>
</tr>
<tr>
<td>283.15</td>
<td>164</td>
<td>3.205</td>
<td>3.090</td>
</tr>
<tr>
<td>293.15</td>
<td>140.7</td>
<td>2.815</td>
<td>2.620</td>
</tr>
<tr>
<td>298.15</td>
<td>131.5</td>
<td>2.660</td>
<td>2.435</td>
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<tr>
<td>303.15</td>
<td>122.8</td>
<td>2.515</td>
<td>2.265</td>
</tr>
</tbody>
</table>

1 The Bunsen and Ostwald coefficients were calculated by the compiler.

The authors fitted their data to the equation:
\[- \ln \varepsilon_i = 8.3232 - 1190.24 \ (T/K)^{-1}\]

They also obtained \( \Delta H/kJ \ mol^{-1} = -9.9 \) and \( \Delta S/J \ K^{-1} \ mol^{-1} = -69 \) for the transfer of one mole of ethene from the gas phase at 101.32 kPa to the hypothetical unit mole fraction solution.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
The experimental apparatus and method is described elsewhere (ref.1). It consists of a system of burettes, a mercury manometer and a solution vessel. The mole fraction of the dissolved gas is estimated from the volume change at constant pressure of saturated gas in the burettes, and the mass of solvent in the solution vessel determined by weighing.

The vapor pressure of the solvent was measured and fitted to the following equation:
\[ \ln (P_i/kPa) = -5552.37 \ (T/K)^{-1} + 18.046 \]

SOURCE AND PURITY OF MATERIALS:
1. Ethene. Sociedad Española del Oxigeno. Specified purity 99.9%.
2. 2-Methylcyclohexanone. Merck. Purity checked by GLC to be > 98.1%.

ESTIMATED ERROR:
\( \delta T/K = \pm 0.2 \)
\( \delta \varepsilon_i/\varepsilon_i = \pm 0.007 \) (authors)

REFERENCES:
1. Cornicer, J.; Gibanel, F.; Urieta, J.S.; Gutierrez Losa, C.
COMPONENTS:
(1) Ethene; C₂H₄; [74-85-1]
(2) 2,6-Dimethylcyclohexanone; C₁₄H₁₄O; [2816-57-1]

VARIABLES:
\[ T/K = 273.15 - 303.15 \]
\[ p_J/kPa = 101.32 \]

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>Mole Fraction (10^4 x_1)</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>273.15</td>
<td>220</td>
<td>3.72</td>
<td>3.72</td>
</tr>
<tr>
<td>283.15</td>
<td>186</td>
<td>3.10</td>
<td>3.22</td>
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<tr>
<td>293.15</td>
<td>159</td>
<td>2.62</td>
<td>2.81</td>
</tr>
<tr>
<td>298.15</td>
<td>148.4</td>
<td>2.43</td>
<td>2.66</td>
</tr>
<tr>
<td>303.15</td>
<td>137.3</td>
<td>2.24</td>
<td>2.48</td>
</tr>
</tbody>
</table>

The compiler calculated the Bunsen and Ostwald coefficients. Density data were calculated from the equation given in the source and ideal gas behavior was assumed.

The authors fitted the solubility data to the equation:
\[ -\ln x_1 = 8.5532 - 1293.69/(T/K) \]

The enthalpy and entropy of solution at 298.15 K and a partial pressure of 101.32 kPa were:
\[ \Delta H = -10.76 \text{ kJ mol}^{-1} \text{ and } \Delta S = -0.071 \text{ J K}^{-1} \text{ mol}^{-1} \]

METHOD/APPARATUS/PROCEDURE:

The solubility apparatus, based on the design of Ben-Nairn and Baer, was described earlier (ref 1). The essential parts were a gas buret, mercury manometer, and solution vessel. The solvent was degassed in the solution vessel. The saturation and volumetric measurements were carried out using solvent saturated gas. It appears that the mole fraction solubility at one atm was estimated from the raw data by assuming Henry's law is obeyed and that the partial pressure of the solvent is given by Raoult's law.

SOURCE AND PURITY OF MATERIALS:
(1) Sociedad Española del Oxígeno sample; purity 99.90 mole per cent.
(2) Fluka sample; purity 98.2 mole per cent. Major impurities had similar gas solubilities.

ESTIMATED ERROR:
\[ \delta T/K = \pm 0.05 \]
\[ \delta x/x = \pm 0.02 \]

REFERENCES:
1. Carnicer, J.; Gibanel, F.; Urieta, J. S.; Gutierrez-Losa, C.
COMPONENTS:
(1) Ethene; C₂H₄; [74-85-1]
(2) Cycloheptanone; C₇H₁₂O; [502-42-1]

VARIABLES:
T/K = 273.15 - 303.15
p/kPa = 101.32

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>Mole Fraction 10⁻⁶xᵢ</th>
<th>Bunsen Coefficient α/cm³(STP) cm⁻³ atm⁻¹</th>
<th>Ostwald Coefficient L/cm³ cm⁻³</th>
</tr>
</thead>
<tbody>
<tr>
<td>273.15</td>
<td>162.4</td>
<td>32.00</td>
<td>32.00</td>
</tr>
<tr>
<td>283.15</td>
<td>138.7</td>
<td>27.03</td>
<td>28.02</td>
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<tr>
<td>293.15</td>
<td>120.9</td>
<td>23.31</td>
<td>25.01</td>
</tr>
<tr>
<td>298.15</td>
<td>113.2</td>
<td>21.71</td>
<td>23.69</td>
</tr>
<tr>
<td>303.15</td>
<td>105.9</td>
<td>20.20</td>
<td>22.42</td>
</tr>
</tbody>
</table>

The compiler calculated the Bunsen and Ostwald coefficients. Density data were calculated from the equation given in the source and ideal gas behavior was assumed. The authors fitted the solubility data to the equation:

\[ \ln x_i = -8.4142 + 1172.26/(T/K) \]

The enthalpy and entropy of solution at 298.15 K and a partial pressure of 101.32 kPa were:

\[ \Delta H = -9.75 \text{ kJ mol}^{-1} \text{ and } \Delta S = -0.070 \text{ J K}^{-1} \text{ mol}^{-1} \]

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
The solubility apparatus, based on the design of Ben-Nairn and Baer, was described earlier (ref 1). The essential parts were a gas buret, mercury manometer, and solution vessel. The solvent was degassed in the solution vessel. The saturation and volumetric measurements were carried out using solvent saturated gas. It appears that the mole fraction solubility at one atm was estimated from the raw data by assuming Henry's law is obeyed and that the partial pressure of the solvent is given by Raoult's law.

SOURCE AND PURITY OF MATERIALS:
(1) Sociedad Española del Oxígeno sample; purity 99.90 mole per cent.
(2) Merck and Co. sample; purity 99.2 mole per cent.

ESTIMATED ERROR:
\[ \delta T/K = \pm 0.05; \]
\[ \delta x/x = \pm 0.007. \]

REFERENCES:
COMPONENTS:
(1) Ethene; C₂H₄; [74-85-1]
(2) 1,1'-[Methylenebis(oxy)]bis-ethane (formaldehyde diethyl acetal); C₅H₁₂O₂; [462-95-3]

ORIGINAL MEASUREMENTS:
Lizano, L. P.; Lopez, M. C.; Royo, F. M.; Urieta, J. S.
J. Soln. Chem.
1990, 19, 721-728.

VARIABLES:
T/K = 263.15 - 303.15
p/kPa = 101.32

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>Mole Fraction 10¹x₁</th>
<th>Bunsen Coefficient α/cm³(STP) cm⁻³atm⁻¹</th>
<th>Ostwald Coefficient L/cm³cm⁻³</th>
</tr>
</thead>
<tbody>
<tr>
<td>263.15</td>
<td>411</td>
<td>79.59</td>
<td>76.68</td>
</tr>
<tr>
<td>273.15</td>
<td>329</td>
<td>62.41</td>
<td>62.41</td>
</tr>
<tr>
<td>283.15</td>
<td>267</td>
<td>49.71</td>
<td>51.54</td>
</tr>
<tr>
<td>293.15</td>
<td>221</td>
<td>40.45</td>
<td>43.42</td>
</tr>
<tr>
<td>303.15</td>
<td>185</td>
<td>33.32</td>
<td>36.98</td>
</tr>
</tbody>
</table>

The compiler calculated the Bunsen and Ostwald coefficients. Density data were calculated from the equation given in the source and ideal gas behavior was assumed.

The authors fitted the solubility data to the equation:

\[
\ln x₁ = -9.2184 + 1585.23/(T/K).
\]

The enthalpy and entropy of solution at 298.15 K and a partial pressure of 101.32 kPa were:

\[
\Delta H = -13.18 \text{ kJ mol}^{-1} \quad \text{and} \quad \Delta S = -0.077 \text{ kJ K}^{-1} \text{ mol}^{-1}.
\]

AUXILIARY INFORMATION

SOURCE AND PURITY OF MATERIALS:
(1) Sociedad Española del Oxígeno sample; purity 99.90 mole per cent.
(2) Aldrich sample; purity better than 99 mole per cent.

ESTIMATED ERROR:

\[
\delta T/K = \pm 0.05; \quad \delta x/x = \pm 0.002.
\]

REFERENCES:
1. Carnicer, J.; Gibanel, F.; Urieta, J. S.; Gutierrez-Losa, C.
Critical Evaluation of Ethene Solubilities in Oxygen-Containing Solvents excluding Water and Alcohols for Pressures greater than 0.20 MPa

Ethene solubilities were reported for elevated pressures in five solvents containing oxygen which are generally described as ketones, an organic carbonate, ester, and an organic acid. When possible, the consistency of the data was tested by plotting log x (mole fraction solubility) versus log p (ethene partial pressure) expecting to observe a linear relation for relatively low concentrations of ethene and for relatively low gas partial pressures. The simplest equation describing the effects of both temperature and pressure has been observed to have the following form:

$$\log x_p = A + B(T/K)^{-1} + C \log (p/MPa)$$  \hspace{1cm} (1)

For a wider range in temperature, a more accurate description of the temperature effect involving two terms has been sometimes used. Furthermore, when there is a consistent curvature in the $\log x_p - \log p$ relation, a correction to equation (1) is introduced, thus describing the data over a larger range of pressure. With these modifications equation (1) becomes:

$$\log x_p = A + B \left(\frac{T}{K}\right)^{-1} + C \log (p/MPa) + D \log (T/K) + E(p/MPa)$$  \hspace{1cm} (2)

Equation (2) is warranted only when solubility data cover wide ranges of temperature and pressure.

The solubilities in the individual solvents will now be considered.

2-Propanone (acetone); C₃H₆O; [67-64-1]

Four research groups reported ethene solubilities in 2-propanone (1-4): Kiss et al. (1) and Shenderei et al. (2) for low temperatures, 228.15 K to 248.15 K and a range of pressures, and Voronkov et al. (3) and Hronec et al. (4) for a wide range of temperatures and pressures. Unfortunately, only the data of the former two groups are self-consistent and consistent with each other. On the other hand, the data of the latter two groups are entirely inconsistent and do not check one another even approximately for comparable temperatures and pressures. To be more specific, the data of Hronec et al. (4) do not even approximately approach Henry's law for low pressures, whereas the data for the other three groups of researchers do. The data of Voronkov et al. (3) cover a larger pressure range than the other data (to approximately 4 MPa). Unfortunately, the solubilities as recorded for Voronkov et al. for the temperatures of 323.15 K, 353.15 K and 373.15 K all are of the same order of magnitude, especially at higher pressures, a most unlikely possibility. Also the data for the lower temperature (263.15 K) does not even approach the higher values of Kiss et al. (1) and Shenderei et al. (2). It is considered that some serious errors were incorporated in the data of Voronkov et al. (3) and those of Hronec et al. (4) and, therefore, they are both rejected. Hence, there are no reliable solubility data at elevated pressures for 2-propanone at ambient and higher temperatures.

For low temperatures the data of Kiss et al. (1) and Shenderei et al. (2) are consistent and have been used to develop an equation to represent the data. It should be mentioned that the data of Kiss et al. as obtained for method B gave solubilities somewhat lower than those for method A, and hence were considered less accurate and were not used in the development of equation (3):

$$\log x_p = 716.29 \left(\frac{T}{K}\right)^{-1} + 1.0053 \log (p/MPa) + 0.050 p - 3.502$$  \hspace{1cm} (3)
COMPONENTS:
1. Ethene; C₂H₄; [74-85-1]
2. Solvents containing oxygen excluding water and alcohols; pressures greater than 0.20 MPa (2 atm)

EVALUATOR:
Walter Hayduk
Department of Chemical Engineering
University of Ottawa
Ottawa, ON
Canada K1N 6N5
February, 1994

CRITICAL EVALUATION:

In this case the combined data of both research groups were reasonably well represented for pressures from 0.1 MPa to 1.0 MPa with an average, and a maximum difference of 2.8%, and 7.0%, respectively. It is noted that a factor for the slight curvature in the log \( x_p - \log p \) lines is included in equation (3).

These data for solubilities in 2-propanone at 228.15 K, 238.15 K, and 248.15 K are classified as tentative.

Propanoic acid (propionic acid); C₃H₆O₃; [79-09-4]

Ethene solubilities in propionic acid were reported only as Henry's constant by Efremova and Sokolova (5) for the temperatures of 323.15 K, 373.15 K and 423.15 K, although the pressure range for the measurements was reported to be from 2.53 MPa to 12.41 MPa. It is noted that one of the values on the data sheet (for ethene solubility at 423.15 K) is for a temperature above the normal boiling point of the solvent, or above 414 K.

These solubility results are classified as tentative.

Acetic acid, ethenyl ester (vinyl acetate); C₄H₆O₂; [108-5-4]

Only the data of Zernov et al. (6) are available for ethene solubilities in the ethenyl ester of acetic acid (vinyl acetate). When the consistency of these data is tested using the relation between log \( x \) and \( \log p \), three inconsistencies appear. First, at low pressures and for temperatures from 293.1 K to 353.1 K, the solubilities are all of the same order of magnitude, which appears to be a most unlikely behavior. Next, at pressures greater than 1 MPa for some of the data the solubilities form large irregular inflections in the solubility-pressure relation; again this appears most unlikely. Finally, the composition of the gas phase at equilibrium indicates a relatively constant vapor content of the gas phase with changing pressures over large pressure ranges. This also, appears unlikely.

Only because no other solubility results are available in this solvent for comparison, these solubility data are classified as tentative.

1,3-Dioxolan-2-one, 4-methyl-(propylene carbonate); C₄H₆O₃; [108-32-7]

Ethene solubilities in 1,3-dioxolan-2-one, 4-methyl (propylene carbonate) as reported by Shakhova et al. (7) are entirely consistent. An equation based on all the data for the complete pressure range was developed as follows:

\[
\log x_p = 442.90 \ (T/K)^{-1} + 0.9260 \log (p/MPa) - 2.8703 \tag{4}
\]

Vapor pressures for this solvent are not readily available but believed to be low. In the development of equation (4) it was assumed that the solvent vapor pressure was negligible. The average, and maximum, deviations for the data from the equation are 2.3%, and 6.4%, respectively. When extrapolated to 0.1013 MPa for a temperature of 298.15 K, a value of the ethene solubility of 0.00495 mole fraction ethene, is obtained.

Figure 1 shows these data for propylene carbonate solvent and the lines representing equation (4). These data are classified as tentative.

2-Butanone (methyl ethyl ketone); C₄H₈O; [74-93-3]

Ethene solubilities in 2-butanone for varying pressures at 223.15 K 238.15 K and 248.15 K as reported by Shenderel et al. (2) are entirely

...
Fig. 1 Ethene Solubility in Propylene carbonate as a Function of Temperature and Pressure

consistent when plotted as log \( x_p \) versus log \( p \). An equation based on the data for mole fraction solubilities (\( x_p \)) of less than 0.60 is as follows:

\[
\log x_p = 553.24 \left( \frac{T}{K} \right)^{-1} - 2.6964 + 1.074 \log \left( \frac{p}{\text{MPa}} \right) \tag{5}
\]

The vapor pressure for 2-butanone at these low temperatures was considered to be negligibly low. The average, and maximum deviations of the data from equation (5) are 2.8%, and 8.8%, respectively. There are no low pressure solubility data for this solvent for comparison.

These data are classified as tentative.

References
COMPONENTS:
1. Ethene; C₂H₄; [74-85-1]
2. Solvents containing oxygen excluding water and alcohols; pressures greater than 0.20 MPa (2 atm)

CRITICAL EVALUATION:

COMPONENTS:
1. Ethene; C₂H₄; [74-85-1]
2. 2-Propanone (acetone);
   C₃H₆O; [67-64-1]

ORIGINAL MEASUREMENTS:
Kiss, G.; Vanko, M.; Hagara, A.;
Vanko, A.
Petrochemia (Ceskoslovenska), 1980, 20,
132-137.

VARIABLES:  
T/K = 238.15, 248.15  
P/MPa = 0.101-1.013

PREPARED BY:  
W. Hayduk

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>t/C</th>
<th>Partial Pressure p'/MPa</th>
<th>Solubility s/cm³ gas at NTP(g solvent)¹</th>
<th>Mole Fraction Ethene, x₁</th>
<th>Henry's Constant H/atm(mole fraction)¹</th>
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</thead>
<tbody>
<tr>
<td>-35.0</td>
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<td></td>
<td></td>
</tr>
<tr>
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<td></td>
<td></td>
<td></td>
<td></td>
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<td>0.152</td>
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<td>30.36</td>
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</tr>
<tr>
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</tr>
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<td>28.97</td>
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</tr>
<tr>
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</tr>
<tr>
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<td>166.87</td>
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</tr>
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<td>0.912</td>
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<td>26.55</td>
<td></td>
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<tr>
<td>1.013</td>
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<td>25.89</td>
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</tbody>
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<pre><code>|
</code></pre>
<p>| By method B: | | | | |
| 0.101 | 11.8 | 0.0297 | 33.70 |
| 0.203 | 24.6 | 0.0604 | 33.12 |
| 0.405 | 58.3 | 0.1313 | 30.48 |</p>

¹Calculated by compiler.
Mole fraction ethylene at a gas partial pressure of 1 atm and 238.15 K is x₁ = 0.0333 as estimated by compiler assuming Henry's law.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
Method A: The solubility cell is placed in a metal block surrounded by a cooling coil supplied by liquid nitrogen. Septum stoppers at the top and bottom permit sampling of the solution by means of a pressure microsyringe. The cell is initially charged with 2.5 cm³ of solvent which is then saturated with gas by bubbling through a distribution ring containing 0.1 mm holes. The gas is continuously released through a pressure controlling manometer. The temperature is measured by miniature thermocouple. Analysis is by gas chromatography.

Method B: Apart from the explanation that a static method was used, no further description is provided.

SOURCE AND PURITY OF MATERIALS:
No information about the source and purity of gas or solvent is provided.

ESTIMATED ERROR:
δ T/K = ± 0.1  
δ p/MPa = ± 0.001  
δ s/s = ± 0.02(Compiler)

REFERENCES:
COMPONENTS:

1. Ethene; C₂H₄; [74-85-1]
2. 2-Propanone (acetone); C₄H₈O; [67-64-1]

ORIGINAL MEASUREMENTS:
Kiss, G.; Vanko, M.; Hagara, A.; Vanko, A.
Petrochemia (Czechoslovakia), 1980, 20, 132-137.

VARIABLES:

\[ T/K = 238.15, 248.15 \]
\[ P/MPa = 0.101-1.013 \]

PREPARED BY:
W. Hayduk

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>( t/C )</th>
<th>( T/K )</th>
<th>Partial Pressure p/MPa</th>
<th>Solubility ( s/\text{cm}^3 ) gas at NTP (g solvent)⁻¹</th>
<th>( \text{Mole Fraction} ) Ethene, ( x_1 )</th>
<th>( ¹\text{Henry's Constant} ) H/atm (mole fraction)⁻¹</th>
</tr>
</thead>
<tbody>
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<td>15.40</td>
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<td></td>
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<td>21.80</td>
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<td>32.20</td>
<td>0.0770</td>
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By method A:

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<th>( t/C )</th>
<th>( T/K )</th>
<th>Partial Pressure p/MPa</th>
<th>Solubility ( s/\text{cm}^3 ) gas at NTP (g solvent)⁻¹</th>
<th>( \text{Mole Fraction} ) Ethene, ( x_1 )</th>
<th>( ¹\text{Henry's Constant} ) H/atm (mole fraction)⁻¹</th>
</tr>
</thead>
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<td>0.0243</td>
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<tr>
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<tr>
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<td>39.57</td>
<td></td>
</tr>
</tbody>
</table>

By method B:

By method B: Apart from the explanation that a static method was used, no further description is provided.

¹Calculated by compiler.

Mole fraction ethylene at a gas partial pressure of 1 atm and 248.15 K is 0.0256 as estimated by compiler assuming Henry's law.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Method A: The solubility cell is placed in a metal block surrounded by a cooling coil supplied by liquid nitrogen. Septum stoppers at the top and bottom permit sampling of the solution by means of a pressure microsyringe. The cell is initially charged with 2.5 cm³ of solvent which is then saturated with gas by bubbling through a distribution ring containing 0.1 mm holes. The gas is continuously released through a pressure controlling manometer. The temperature is measured by miniature thermocouple. Analysis is by gas chromatography.

Method B: Apart from the explanation that a static method was used, no further description is provided.

SOURCE AND PURITY OF MATERIALS:

No information about the source and purity of gas or solvent is provided.

ESTIMATED ERROR:

\[ \delta T/K = \pm 0.1 \]
\[ \delta p/MPa = \pm 0.001 \]
\[ \delta s/s = \pm 0.02 \] (Compiler)

REFERENCES:
**COMPONENTS:**

1. Ethene; \( \text{C}_2\text{H}_4; [74-85-1] \)
2. 2-Propanone (acetone); \( \text{C}_3\text{H}_6\text{O}; [67-64-1] \)

**ORIGINAL MEASUREMENTS:**


**VARIABLES:**

\( T/K = 238.15, 308.15 \)
\( P/kPa = 150-504 \)

**EXPERIMENTAL VALUES:**

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<tr>
<th>( v/C )</th>
<th>( T/K )</th>
<th>( P/kPa )</th>
<th>( p/kPa )</th>
<th>( \text{s/cm}^3 ) gas at NTP ( g \text{ solvent} )</th>
<th>( x_i )</th>
<th>( \text{Henry's Constant H/} \text{atm} )</th>
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</tbody>
</table>

\(^1\text{Calculated by compiler.}\

It is noted by the compiler that the results tabulated here appear to be inconsistent and in serious disagreement with results published earlier from the same laboratory: Kiss, Vanko, Hagara and Vanko, Petroohemia, 1980, 20, 132-137.

**AUXILIARY INFORMATION**

**METHOD/APPARATUS/PROCEDURE:**

The apparatus consisted of an absorber, 10-cm\(^3\) in volume, and a complex system using electrical contacts in a tube for maintaining a constant gas supply pressure in the absorber. The contacts were used to start and stop a gear pump which pumped silicone oil as an "inert" medium to displace gas from a gas storage vessel. The change in volume of silicone oil utilized was read on a burette and was considered to represent the volume of gas used. The absorber initially contained 3-5 cm\(^3\) of solvent confined in a thin-walled glass ampoule. The chamber was pressurized with gas and to initiate the experiment the ampoule was broken using a stainless steel ball.

**SOURCE AND PURITY OF MATERIALS:**

1. Ethene purity was 99.8%.
2. Acetone was reagent grade with water content < 0.5%.

**ESTIMATED ERROR:**

\[ \delta P/kPa = \pm 5 \]
\[ \delta s/s = \pm 10\% \text{ (Authors)} \]

**REFERENCES:**
COMPONENTS:
1. Ethene; C₂H₄; [74-85-1]
2. 2-Propanone (acetone); C₃H₆O; [67-64-1]

ORIGINAL MEASUREMENTS:
Voronkov, A.P.; Mislavskaya, V.S.; Mushii, R. Ya.; Drygina, V.V.
Zh. Prikl. Khim. 1979, 52, 2642;
VINITI No. 458-79.

VARIABLES:
\[ T/K = 263.15 - 373.15 \]
\[ P/MPa = 0.101 - 7.60 \]

PREPARED BY:
W. Hayduk

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>Temperatures</th>
<th>Acetone in Liquid</th>
<th>Ethene in Liquid</th>
<th>Acetone in Gas</th>
<th>Ethene in Gas</th>
<th>Partial Pressure Ethene, ( p_1/\text{atm} )</th>
<th>Total Pressure, ( P/\text{atm} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>-10 263.15</td>
<td>0.990</td>
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<td>0.878</td>
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<td>0.973</td>
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<td>0.0385</td>
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<td>9.84</td>
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<td>0.0102</td>
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<td>0.0037</td>
<td>0.9963</td>
<td>34.87</td>
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</tr>
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</table>

1 Calculated by Compiler.
Henry's law is obeyed up to about 25 atm (2.53 MPa).
The data were from the paper deposited in VINITI, Moscow.
continued...

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
The equipment essentially consisted of an autoclave immersed in a constant temperature bath and connected to a membrane pressure gauge.

Henry's constants for the lower pressure region and the solubilities for a pressure of 1 atm as estimated by the compiler are:

<table>
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<tr>
<th>( T/K )</th>
<th>( H, \text{ atm/mole fraction} )</th>
<th>( x, \text{ mole fraction} )</th>
</tr>
</thead>
<tbody>
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<td>353.15</td>
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<tr>
<td>373.15</td>
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<td>0.00319</td>
</tr>
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</table>

SOURCE AND PURITY OF MATERIALS:
The sources and purities of gas and solvent were not specified.

ESTIMATED ERROR:
\( \delta T/K = \pm 0.2 \)
\( \delta p/\text{atm} = \pm 0.05 \)
\( \delta x/\text{mole fraction} = \pm 0.002 \) (Authors)

REFERENCES:
COMPONENTS:
1. Ethene; C₂H₄; [74-85-1]
2. 2-Propanone (acetone); C₃H₆O; [67-64-1]

VARIABLES:
\[ T/K = 263.15 - 373.15 \]
\[ P/MPa = 0.101 - 7.60 \]

EXPERIMENTAL VALUES: ...continued

<table>
<thead>
<tr>
<th>Temperature (°C)</th>
<th>T/K</th>
<th>Acetone in Liquid ( x_1 )</th>
<th>Ethene in Liquid ( 1 - x_1 )</th>
<th>Acetone in Gas ( y_1 )</th>
<th>Ethene in Gas ( 1 - y_1 )</th>
<th>Partial Pressure Ethene, ( P_1 ) atm</th>
<th>Total Pressure, P/atm</th>
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<td>0.9831</td>
<td>24.58</td>
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</tbody>
</table>

\(^1\text{Calculated by Compiler.}\)

Henry's law is obeyed up to about 25 atm (2.53 MPa).
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<table>
<thead>
<tr>
<th>T/K</th>
<th>( H ), atm/mole fraction</th>
<th>( x ), mole fraction</th>
</tr>
</thead>
<tbody>
<tr>
<td>263.15</td>
<td>125</td>
<td>0.00800</td>
</tr>
<tr>
<td>283.15</td>
<td>225</td>
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<td>303.15</td>
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<td>323.15</td>
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</tr>
<tr>
<td>373.15</td>
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<td>0.00319</td>
</tr>
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</table>

SOURCE AND PURITY OF MATERIALS:
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ESTIMATED ERROR:
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REFERENCES:
COMPONENTS: ORIGINAL MEASUREMENTS:

1. Ethene; C₂H₄; [74-85-1]
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VARIABLES:

\[ T/K = 263.15 - 373.15 \]
\[ P/MPa = 0.101 - 7.60 \]

EXPERIMENTAL VALUES: continued

<table>
<thead>
<tr>
<th>Temperatures</th>
<th>Acetone in Liquid (1-x₁)</th>
<th>Ethene in Liquid (x₁)</th>
<th>Acetone in Gas (1-y₁)</th>
<th>Ethene in Gas (y₁)</th>
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<th>Total Pressure</th>
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</table>

*Mole Fractions*

<table>
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<tr>
<th>Temperatures</th>
<th>Acetone in Liquid (1-x₁)</th>
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<tbody>
<tr>
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<td></td>
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<td></td>
</tr>
<tr>
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<td>0.0140</td>
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<td>29.58</td>
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<td>0.2971</td>
<td>0.7029</td>
<td>3.51</td>
<td>5</td>
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</table>

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<td>0.00333</td>
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<tr>
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</table>

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REFERENCES:


PREPARED BY:

W. Hayduk
COMPONENTS:
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VARIABLES:
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EXPERIMENTAL VALUES: ...continued

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<th>( T/\text{K} )</th>
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<td>( y_1 )</td>
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<td>0.776</td>
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<td>0.0366</td>
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</tbody>
</table>

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<th>( x, \text{mole fraction} )</th>
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2. 2-Propanone, (Acetone); C₆H₆O; [67-64-1]

**ORIGINAL MEASUREMENTS:**

**VARIABLES:**
\[
\begin{align*}
T/K &= 228.05 - 248.15 \\
P/\text{MPa} &= 0.101 - 1.82 \\
\end{align*}
\]

**PREPARED BY:**
C.L. Young.

**EXPERIMENTAL VALUES:**
<table>
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<tr>
<th>T/K</th>
<th>p/atm</th>
<th>p/bar</th>
<th>( x_{C_2H_4} )</th>
<th>Solubility, ( \text{cm}^3\text{g}^{-1} ) at P = 101.325 kPa</th>
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<td></td>
</tr>
<tr>
<td>3</td>
<td>0.1000</td>
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<td>5</td>
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<td>75.51</td>
<td></td>
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<td>10</td>
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<td>236.88</td>
<td></td>
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<tr>
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<td>0.5125</td>
<td>402.11</td>
<td></td>
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<tr>
<td>228.05</td>
<td>1.0</td>
<td>0.0410</td>
<td>16.35</td>
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<tr>
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<td>55.87</td>
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<td>10</td>
<td>0.6050</td>
<td>515.50</td>
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<td></td>
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</table>

**AUXILIARY INFORMATION**

**METHOD/APPARATUS/PROCEDURE:**
Glass equilibrium cell fitted with magnetic stirrer. Pressure measured with Bourdon gauge. Samples of liquid analysed by stripping out ethene. Details in ref. (1).

**SOURCE AND PURITY OF MATERIALS:**
1. Prepared from ethanol by dehydration and purified by absorption in cuprous chloride under pressure.
2. Distilled.

**ESTIMATED ERROR:**
\[
\begin{align*}
\delta T/K &= \pm 0.1; \delta p/\text{bar} = \pm 0.3; \\
\delta x_{C_2H_4} &= \pm 2\% .
\end{align*}
\]

(estimated by compiler.)

**REFERENCES:**
COMPONENTS:
1. Ethene; C₂H₄; [74-85-1]
2. Propanoic acid (propionic acid); C₃H₆O₂; [79-09-4]

ORIGINAL MEASUREMENTS:
Efremova, G.D.; Sokolova, E.S.
VINITI No. 6067-73.

VARIABLES:
\[ T/K = 323.15 - 423.15 \]
\[ P/MPa = 2.53 - 12.41 \]

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>( t / \degree C )</th>
<th>( T/K )</th>
<th>( H/\text{atm (mole fraction)}^{-1} )</th>
<th>( x_1 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>50</td>
<td>323.15</td>
<td>133</td>
<td>0.00752</td>
</tr>
<tr>
<td>100</td>
<td>373.15</td>
<td>178</td>
<td>0.00562</td>
</tr>
<tr>
<td>150</td>
<td>423.15</td>
<td>257</td>
<td>0.00389</td>
</tr>
</tbody>
</table>

*Calculated by compiler for a gas partial pressure of 101.3 kPa; it is stated that the Krichevskii-Kazarnovskii equation applies at high pressures but the parameters are not given here.

The data were obtained from the portion of the paper deposited in VINITI, Moscow.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
A titanium autoclave whose volume was calibrated, was used. The autoclave was equipped with a membrane pressure gauge along with a thermocouple placed near the bottom of the autoclave.

SOURCE AND PURITY OF MATERIALS:
1. Ethene critical temperature was measured as 9.30°C (reported value 9.60°C).
2. Solvent purified by fractional crystallization; resulting melting point was -21.0°C compared with reported value of -20.8°C.

ESTIMATED ERROR:
\[ \delta T/K = \pm 0.2 \]
\[ \delta x_1/x_1 = \pm 2\% \text{ (Compiler)} \]

REFERENCES:
COMPONENTS:
1. Ethene; C₂H₄; [74-85-1]
2. Acetic acid, ethenyl ester
   (vinyl acetate); C₄H₆O₂; [108-5-4]

ORIGINAL MEASUREMENTS:
Zernov, V.S.; Kogan, V.B.;
Lyubetskii, S.G.
J. Appl. Chem. (USSR) 1971, 44,
1837-40.
OR Zhur. Prikl. Khim. 1971, 44,
1819-23.

VARIABLES:
T/K = 293.1 - 423.1
P/MPa = 0.20 - 7.09

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>P/MPa</th>
<th>Solvent, x₂</th>
<th>Solute, x₁</th>
<th>Solvent vapor, y₂</th>
<th>Solute, y₁</th>
</tr>
</thead>
<tbody>
<tr>
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<td>0.20</td>
<td>0.989</td>
<td>0.011</td>
<td>0.063</td>
<td>0.937</td>
</tr>
<tr>
<td></td>
<td>0.41</td>
<td>0.975</td>
<td>0.025</td>
<td>0.036</td>
<td>0.964</td>
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<tr>
<td></td>
<td>0.71</td>
<td>0.953</td>
<td>0.047</td>
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<td>0.966</td>
</tr>
<tr>
<td></td>
<td>1.01</td>
<td>0.940</td>
<td>0.060</td>
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<td>0.966</td>
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<tr>
<td></td>
<td>2.02</td>
<td>0.760</td>
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<td>0.966</td>
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<tr>
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<td>4.05</td>
<td>0.530</td>
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<td>0.036</td>
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</tr>
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<td>5.06</td>
<td>0.487</td>
<td>0.513</td>
<td>0.034</td>
<td>0.966</td>
</tr>
</tbody>
</table>

313.1 | 0.21  | 0.989       | 0.011       | 0.150             | 0.850      |
|       | 0.44  | 0.975       | 0.025       | 0.075             | 0.925      |
|       | 0.67  | 0.960       | 0.040       | 0.060             | 0.940      |
|       | 1.01  | 0.951       | 0.049       | 0.047             | 0.953      |
|       | 2.02  | 0.839       | 0.161       | 0.047             | 0.953      |
|       | 3.04  | 0.657       | 0.343       | 0.047             | 0.953      |
|       | 4.05  | 0.562       | 0.418       | 0.047             | 0.953      |
|       | 5.06  | 0.541       | 0.459       | 0.046             | 0.954      |

¹Calculated by compiler.
Liquid and gas molar volumes as well as partial molal volumes of dissolved ethene also given in this paper.
Normal Henry's law not even approximately obeyed above 1 MPa pressure.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
A description of the apparatus is found in ref. 1. It consists of two graduated thick-walled glass tubes, 5 mm in diameter and 60 cm in length sealed in a temperature-controlled jacket. Mercury can be independently charged to the bottom of each tube. The saturation tube is equipped with an electromagnetic vibrator immersed in the mercury to aid in equilibration of the phases. A separate mercury reservoir is pressurized with nitrogen whose pressure can be regulated. Ethylene is stored in one tube, while the solvent is condensed in the equilibration tube. The ethene is transferred to the solvent tube as required. The solubility method is thus a volumetric one.

SOURCE AND PURITY OF MATERIALS:
1. Purity 99.3%.
2. Twice distilled. Normal boiling point = 345.4 K and refractive index nD = 1.3953.
Note: At high temperatures and pressures 0.0001 mole % hydroquinone inhibitor was added.

ESTIMATED ERROR:
δT/K = ± 0.05
δP/MPa = ± 0.25%
δx₁/x₂ = ± 0.04 (compiler)

REFERENCES:
1. Zernov, V.S.; Kogan, V.B.;
Lyubetskii, S.G.; Duntov, F.I.
COMPONENTS:

1. Ethene; \( \text{C}_2\text{H}_4 \); [74-85-1]
2. Acetic acid, ethenyl ester (vinyl acetate); \( \text{C}_4\text{H}_6\text{O}_2 \); [108-5-4]

ORIGIINAL MEASUREMENTS:

Zernov, V.S.; Kogan, V.B.; Lyubetskii, S.G.

VARIABLES:

\[ \frac{T}{K} = 293.1 - 423.1 \]
\[ P/\text{MPa} = 0.20 - 7.09 \]

PREPARED BY:

W. Hayduk

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>( T/K )</th>
<th>( P/\text{MPa} )</th>
<th>Solvent, ( x_2 )</th>
<th>Solute, ( x_1 )</th>
<th>Solvent vapor, ( y_2 )</th>
<th>Solute, ( y_1 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>333.1</td>
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<td>0.011</td>
<td>0.165</td>
<td>0.835</td>
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<td>0.49</td>
<td>0.975</td>
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<td>0.170</td>
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<td>0.79</td>
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</tr>
<tr>
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<tr>
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<td>0.484</td>
<td>0.069</td>
<td>0.931</td>
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<td>0.427</td>
<td>0.093</td>
<td>0.907</td>
</tr>
</tbody>
</table>

1Calculated by compiler.
Liquid and gas molar volumes as well as partial molal volumes of dissolved ethene also given in this paper.
Normal Henry's law not even approximately obeyed above 1 MPa pressure.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

A description of the apparatus is found in ref. 1. It consists of two graduated thick-walled glass tubes, 5 mm in diameter and 60 cm in length sealed in a temperature-controlled jacket. Mercury can be independently charged to the bottom of each tube. The saturation tube is equipped with an electromagnetic vibrator immersed in the mercury to aid in equilibration of the phases. A separate mercury reservoir is pressurized with nitrogen whose pressure can be regulated. Ethylene is stored in one tube, while the solvent is condensed in the equilibration tube. The ethene is transferred to the solvent tube as required. The solubility method is thus a volumetric one.

SOURCE AND PURITY OF MATERIALS:

1. Purity 99.3%.
2. Twice distilled. Normal boiling point = 345.4 K and refractive index \( n_0^\text{D} = 1.3953 \).
   Note: At high temperatures and pressures 0.0001 mole % hydroquinone inhibitor was added.

ESTIMATED ERROR:

\( \delta T/K = \pm 0.05 \)
\( \delta P/\text{MPa} = \pm 0.25\% \)
\( \delta x_1/x_1 = \pm 0.04 \) (compiler)

REFERENCES:

1. Zernov, V.S.; Kogan, V.B.; Lyubetskii, S.G.; Duntov, F.I.
### COMPONENTS:
1. Ethene; $C_2H_4$; [74-85-1]
2. Acetic acid, ethenyl ester (vinyl acetate); $C_4H_6O_2$; [108-5-4]

### ORIGINAL MEASUREMENTS:
Zernov, V.S.; Kogan, V.B.; Lyubetskii, S.G.;

### VARIABLES:
\[ T/K = 293.1 - 423.1 \]
\[ P/\text{MPa} = 0.20 - 7.09 \]

### EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>P/MPa</th>
<th>Solvent, $x_2$</th>
<th>Solute, $x_1$</th>
<th>Solvent vapor, $y_2$</th>
<th>Solute, $y_1$</th>
</tr>
</thead>
<tbody>
<tr>
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<tr>
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<tr>
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<td>0.862</td>
</tr>
<tr>
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<td>5.06</td>
<td>0.639</td>
<td>0.361</td>
<td>0.138</td>
<td>0.862</td>
</tr>
<tr>
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<td>6.08</td>
<td>0.600</td>
<td>0.400</td>
<td>0.138</td>
<td>0.862</td>
</tr>
<tr>
<td></td>
<td>7.09</td>
<td>0.563</td>
<td>0.457</td>
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<td>0.861</td>
</tr>
<tr>
<td>398.1</td>
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</tr>
<tr>
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<td>0.225</td>
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<td>0.589</td>
<td>0.411</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

'Calculated by compiler.
Liquid and gas molar volumes as well as partial molal volumes of dissolved ethene also given in this paper.
Normal Henry's law not even approximately obeyed above 1 MPa pressure.

### AUXILIARY INFORMATION

#### METHOD/APPARATUS/PROCEDURE:
A description of the apparatus is found in ref. 1. It consists of two graduated thick-walled glass tubes, 5 cm in diameter and 60 cm in length sealed in a temperature-controlled jacket. Mercury can be independently charged to the bottom of each tube. The saturation tube is equipped with an electromagnetic vibrator immersed in the mercury to aid in equilibration of the phases. A separate mercury reservoir is pressurized with nitrogen whose pressure can be regulated. Ethylene is stored in one tube, while the solvent is condensed in the equilibration tube. The ethene is transferred to the solvent tube as required. The solubility method is thus a volumetric one.

#### SOURCE AND PURITY OF MATERIALS:
1. Purity 99.3%.
2. Twice distilled. Normal boiling point = 345.4 K and refractive index $n_2^5 = 1.3953$.
Note: At high temperatures and pressures 0.0001 mole % hydroquinone inhibitor was added.

#### ESTIMATED ERROR:
\[ \Delta T/K = \pm 0.05 \]
\[ \Delta P = \pm 0.25\% \]
\[ \Delta x_1/x_1 = \pm 0.04 \] (compiler)

#### REFERENCES:
1. Zernov, V.S.; Kogan, V.B.; Lyubetskii, S.G.; Duntov, F.I.
COMPONENTS:
1. Ethene; C₂H₄; [74-85-1]
2. Acetic acid, ethenyl ester (vinyl acetate); C₄H₆O₂; [108-5-4]

ORIGINAL MEASUREMENTS:
Zernov, V.S.; Kogan, V.B.;
Lyubetskii, S.G.

VARIABLES:
T/K = 293.1 - 423.1
P/MPa = 0.20 - 7.09

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>P/MPa</th>
<th>Solvent, $x_2$</th>
<th>Solvent vapor, $y_2$</th>
<th>1Solute, $x_1$</th>
<th>1Solute, $y_1$</th>
</tr>
</thead>
<tbody>
<tr>
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<td>0.989</td>
<td>0.011</td>
<td>0.410</td>
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<td>1.24</td>
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<td>0.605</td>
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<td>0.960</td>
<td>0.040</td>
<td>0.383</td>
<td>0.617</td>
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</tr>
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</tr>
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<td>0.344</td>
<td>0.656</td>
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</tr>
<tr>
<td>5.05</td>
<td>0.730</td>
<td>0.270</td>
<td>0.344</td>
<td>0.656</td>
<td></td>
</tr>
<tr>
<td>6.08</td>
<td>0.680</td>
<td>0.320</td>
<td>0.344</td>
<td>0.656</td>
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</tr>
<tr>
<td>7.09</td>
<td>0.641</td>
<td>0.359</td>
<td>0.345</td>
<td>0.655</td>
<td></td>
</tr>
</tbody>
</table>

1 Calculated by compiler.

Liquid and gas molar volumes as well as partial molal volumes of dissolved ethene also given in this paper.

Normal Henry's law not even approximately obeyed above 1 MPa pressure.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
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SOURCE AND PURITY OF MATERIALS:
1. Purity 99.3%.
2. Twice distilled. Normal boiling point = 345.4 K and refractive index $n_\alpha = 1.3953$.
Note: At high temperatures and pressures 0.0001 mole % hydroquinone inhibitor was added.

ESTIMATED ERROR:
$\delta T/K = \pm 0.05$
$\delta P/P = \pm 0.25\%$
$\delta x_1/x_1 = \pm 0.04$ (compiler)

REFERENCES:
1. Zernov, V.S.; Kogan, V.B.;
Lyubetskii, S.G.; Duntov, F.I.
COMPONENTS:
1. Ethene; C₂H₄; [74-85-1]
2. 1,3-Dioxolan-2-one,4-methyl- (Propylene carbonate); C₆H₆O₃; [108-32-7]

ORIGINAL MEASUREMENTS:
Shakhova, S.F.; Zubchenko, Yu P.;
Rezina, O.A.

VARIABLES:
T/K = 298.15 - 343.15
P/MPa = 0.52 - 4.22

PREPARED BY:
C.L. Young.

EXPERIMENTAL VALUES:
\[
\begin{array}{cccc}
T/K & P/MPa & \text{Mole fraction of ethene} \times C₂H₄ & \text{vol}/\text{vol} \\
298.15 & 0.517 & 0.0216 & 5.8 \\
 & 0.719 & 0.0310 & 8.4 \\
 & 0.861 & 0.0356 & 9.7 \\
 & 0.983 & 0.0409 & 11.2 \\
 & 2.077 & 0.0843 & 24.2 \\
 & 2.695 & 0.1034 & 30.3 \\
 & 3.830 & 0.1423 & 43.6 \\
323.15 & 0.557 & 0.0196 & 5.25 \\
 & 0.811 & 0.0250 & 6.75 \\
 & 1.246 & 0.0384 & 10.5 \\
 & 1.600 & 0.0492 & 13.6 \\
 & 2.209 & 0.0667 & 18.8 \\
 & 3.040 & 0.0900 & 26.0 \\
 & 4.021 & 0.1124 & 33.3 \\
 & 4.361 & 0.1246 & 37.4 \\
343.15 & 0.661 & 0.0175 & 4.68 \\
 & 1.021 & 0.0258 & 6.97 \\
 & 1.031 & 0.0270 & 7.30 \\
 & 1.401 & 0.0345 & 9.40 \\
 & 2.471 & 0.0641 & 18.0 \\
 & 3.441 & 0.0843 & 24.2 \\
 & 4.171 & 0.1031 & 30.2 \\
 & 4.221 & 0.1034 & 30.3 \\
\end{array}
\]

+ quoted in original paper, appears to be volume of gas at
T/K = 273.15 and P = 1 atmosphere adsorbed by unit volume
of liquid at room temperature.

METHOD/APPARATUS/PROCEDURE:
Mixture stirred by ball in rocking autoclave. Samples of liquid
analysed by volumetric method.
Details in ref. (1).

Henry's constants were listed as
follows:
\[
\begin{array}{ccc}
T/C & H/\text{atm mole fraction}^{-1} \\
25 & 235 \\
50 & 298 \\
70 & 333 \\
\end{array}
\]

SOURCE AND PURITY OF MATERIALS:
1. Purity 99.97 mole per cent.
2. Distilled, no other details
given.

ESTIMATED ERROR:
\[
\begin{align*}
\delta T/K &= \pm 0.1; \delta P/\text{MPa} = \pm 0.01; \\
\delta x_{C₂H₄} &= \pm 5\% \\
\end{align*}
\]

(estimated by compiler)

REFERENCES:
Kaplan, L.K.;
### COMPONENTS:

1. Ethene; \( \text{C}_2\text{H}_4; \ [74-85-1] \)

2. 2-Butanone, (methyl ethylketone); \( \text{C}_4\text{H}_8\text{O}; \ [74-93-3] \)

### ORIGINAL MEASUREMENTS:


### VARIABLES:

\[
\begin{align*}
T/K & = 223.05 - 248.15 \\
p/\text{MPa} & = 0.30 - 1.82
\end{align*}
\]

### PREPARED BY:

C.L. Young.

### EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>( p/\text{atm} )</th>
<th>( p/\text{bar} )</th>
<th>( x_{\text{C}_2\text{H}_4} )</th>
<th>Solubility+</th>
<th>( + ) cm³g⁻¹ at ( P = 101.325 ) kPa</th>
</tr>
</thead>
<tbody>
<tr>
<td>248.15</td>
<td>3</td>
<td>3.0</td>
<td>0.0950</td>
<td>32.32</td>
<td>0.0950</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>5.1</td>
<td>0.1622</td>
<td>59.52</td>
<td>0.1622</td>
</tr>
<tr>
<td></td>
<td>10</td>
<td>10.1</td>
<td>0.3349</td>
<td>155.11</td>
<td>0.3349</td>
</tr>
<tr>
<td></td>
<td>12</td>
<td>12.2</td>
<td>0.4169</td>
<td>220.24</td>
<td>0.4169</td>
</tr>
<tr>
<td></td>
<td>15</td>
<td>15.2</td>
<td>0.5381</td>
<td>352.56</td>
<td>0.5381</td>
</tr>
<tr>
<td></td>
<td>18</td>
<td>18.2</td>
<td>0.6070</td>
<td>708.29</td>
<td>0.6070</td>
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<tr>
<td>238.15</td>
<td>3</td>
<td>3.0</td>
<td>0.1180</td>
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<td></td>
<td>5</td>
<td>5.1</td>
<td>0.2000</td>
<td>76.08</td>
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<tr>
<td></td>
<td>10</td>
<td>10.1</td>
<td>0.4477</td>
<td>249.62</td>
<td>0.4477</td>
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<tr>
<td></td>
<td>12</td>
<td>12.2</td>
<td>0.5685</td>
<td>404.49</td>
<td>0.5685</td>
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<tr>
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<td>15</td>
<td>15.2</td>
<td>0.8300</td>
<td>1503.32</td>
<td>0.8300</td>
</tr>
<tr>
<td>223.05</td>
<td>3</td>
<td>3.0</td>
<td>0.1620</td>
<td>59.52</td>
<td>0.1620</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>5.1</td>
<td>0.2787</td>
<td>118.56</td>
<td>0.2787</td>
</tr>
<tr>
<td></td>
<td>10</td>
<td>10.1</td>
<td>0.6830</td>
<td>663.42</td>
<td>0.6830</td>
</tr>
</tbody>
</table>

### AUXILIARY INFORMATION

**METHOD/APPARATUS/PROCEDURE:**
Glass equilibrium cell fitted with magnetic stirrer. Pressure measured with Bourdon gauge. Samples of liquid analysed by stripping out ethene. Details in ref. (1).

**SOURCE AND PURITY OF MATERIALS:**

1. Prepared from ethanol by dehydration and purified by absorption in cuprous chloride under pressure.

2. Distilled.

**ESTIMATED ERROR:**

\[
\begin{align*}
\delta T/K & = \pm 0.1; \quad \delta p/\text{bar} = \pm 0.3; \\
\delta x_{\text{C}_2\text{H}_4} & = \pm 2%. \\
\text{(estimated by compiler).}
\end{align*}
\]

**REFERENCES:**


Critical evaluation of the solubility of ethene at a partial pressure not greater than 101.3 kPa in solvents containing nitrogen.

In general solubility in compounds containing nitrogen which have been studied is lower than solubility in halogen or oxygen compounds measured under the same conditions. It is considerably lower than solubility in hydrocarbons.

1-Methyl-2-pyrrolidinone; C_{9}H_{9}NO; [872-50-4]

Solubility in 1-methyl-2-pyrrolidinone at, or below 101.3 kPa was measured by Wu et al. (1), Shenderei and Ivanovskii (2) and by Lenoir et al. (3). Measurements by Shenderei from 273.15 to 288.15 K and pressures from about 13 kPa to 101.3 kPa indicate that mole fraction solubility is, within the limits of the experimental accuracy, proportional to pressure to at least 101.3 kPa. Lenoir et al. measured Henry's constant at 298.15 K and low pressure by gas chromatography. The corresponding mole fraction solubility at a partial pressure of 101.3 kPa, calculated on the basis of a linear variation with change in pressure, is within about 5% of the value corrected to 101.3 kPa from direct measurements by Wu at 100 kPa. The six data points for a partial pressure of 101.3 kPa from the three sources fit the equation

\[ \ln x = -503.92 + 22206/(T/K) + 74.519 \ln(T/K) \]

This can be accepted on a tentative basis for the temperature range 273-298 K.

Nitrobenzene; C_{6}H_{5}NO; [98-95-3]

The solubility in nitrobenzene was measured by Choudhari and Doraiswami (4) at a total pressure of 94.23 kPa in the temperature range 286-333 K. Lenoir et al. (3) measured Henry's constant at low pressure by gas chromatography. The corresponding mole fraction solubility at 101.3 kPa, calculated on the assumption of a linear variation of mole fraction solubility with variation of pressure, is 0.00794. The corrected and interpolated value from Choudhari's measurements is 0.00543. Measurements of gas solubility by gas chromatography are subject to some uncertainty because of effects due to surface adsorption. Some of the values of solubilities of other gases reported in Lenoir's paper are appreciably higher than values reported by other workers. The evaluator considers that Choudhari's measurements are likely to be the more reliable although further work on the system is required. The five mole fraction solubilities from Choudhari, corrected to a partial pressure of gas of 101.3 kPa, fit the equation

\[ \ln x = -233.51 + 12038/(T/K) + 32.982 \ln(T/K) \]

Temperature range 386-333 K.

Ammonia; NH_{3}; [7664-41-7]

Hannaert et al. (5) reported the solubility of ethene in liquid ammonia in a paper in which the solubilities of various hydrocarbons in liquid ammonia and other solvents were reported. In each case solubilities are reported as coefficients of a two constant equation giving the variation of Henry's constant with temperature. The equation can be written in the form

\[ \log H = A - B/(2.3 \, R \, T) \]

The authors identify the constant B with a heat of solution of the gas in the solvent. Mole fraction solubilities can be calculated from values of H.
COMPONENTS:
1. Ethene; C2H4; [74-85-1]
2. Solvents containing nitrogen

CRITICAL EVALUATION:

if it is assumed that solubilities vary linearly with partial pressure of gas. The equation for solubility of ethene in ammonia is reported to be valid for the temperature range of 208-318 K. What is unusual about the equation for ethene in ammonia is the very low value of $B$ or heat of solution compared with values for other systems which were studied by the authors. The value is 0.23 kcal mol$^{-1}$ compared with 2.72 kcal mol$^{-1}$ for ethyne in ammonia and 1.215 kcal mol$^{-1}$ for propene in ammonia. The low value for ethene corresponds to a very small variation of solubility with change in temperature and contrasts markedly with the behaviour of ethene in nitrobenzene and in 1-methyl-2-pyrrolidinone. The evaluator is of the opinion that the solubility equation for ethene in ammonia should be treated with caution until it is confirmed by other measurements.

UN-N-Dimethylacetamide; C4H9NO; [127-19-5]
N,N-Dimethylformamide; C3H7NO; [68-12-2]
N-Methylformamide; C2H5NO; [123-39-7]
Acetonitrile; C2H3N; [75-05-8]

Brückl and Kim (6) measured the solubility in the above solvents at 298.2 K. There is no reason to doubt the reliability of the measurements but they have not been confirmed by other workers. In the case of the amides the mole fraction solubility at a partial pressure of 101.3 kPa increases with increase in the number of methyl groups present. Solubility in N-methylformamide is low compared with the solubility in nitrobenzene and in 1-methyl-2-pyrrolidinone and is close to the solubility in ammonia as reported by Hannaert (5).

Benzenamine; C6H7N; [62-53-3]

Lenoir et al. (3) measured Henry's constant for dissolution in benzenamine by a chromatographic method. The mole fraction solubility at a partial pressure of 101.3 kPa calculated on the assumption of a linear variation of mole fraction solubility with change in pressure, is close to the value for dissolution in nitrobenzene. However the value needs confirmation by further measurements because of unreliability of the chromatographic method.

Cyclohexylamine; C6H13N; [108-91-8]

Keevil et al. (7) reported a value of the solubility in cyclohexylamine at 298.1 K and 101.3 kPa. The value is higher than that in other nitrogen compounds for which data is available. This can be explained by the presence of the alicyclic ring. There is no reason to doubt the reliability of the measurement but confirmation is needed.

N,N-Dimethylformamide; C3H7NO; [68-12-2] + Ethyne; C2H2; [74-86-2]

Shenderei (8) measured the solubility of ethene in N,N-dimethylformamide, containing various proportions of ethyne, at 218.15 K over the pressure range 13.3 - 101.3 kPa. The measurements indicate that the mole fraction solubility (moles C2H4/total moles of C2H4, C2H2, & DMF) does not change when the proportion of ethyne is increased from 33.8 to 249 cm$^3$(STP)/g DMF. This is in contrast to the solubility of carbon dioxide in N,N-dimethylformamide containing various concentrations of ethyne. In this case the mole fraction solubility decreases with increase of ethyne concentration. The evaluator considers that the data for ethene needs to be confirmed before it can be accepted as reliable.
<table>
<thead>
<tr>
<th>COMPONENTS:</th>
<th>EVALUATOR:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Ethene; ( \text{C}_2\text{H}_4 ); [74-85-1]</td>
<td>Peter G.T. Fogg</td>
</tr>
<tr>
<td>2. Solvents containing nitrogen</td>
<td>School of Applied Chemistry</td>
</tr>
<tr>
<td></td>
<td>University of North London</td>
</tr>
<tr>
<td></td>
<td>Holloway Road, London, N7 8DB, U.K.</td>
</tr>
<tr>
<td></td>
<td>November, 1993</td>
</tr>
</tbody>
</table>

CRITICAL EVALUATION:

References

COMPONENTS:
(1) Ethene or ethylene; C₂H₄; [74-85-1]
(2) Ammonia; NH₃; [7664-41-7]

ORIGINAL MEASUREMENTS:
Hannaert, H.; Haccuria, M.;
Mathieu, M. P.
Ind. Chim. Belge 1967, 32,
156-164.

VARIABLES:
T/K = 208.15 - 318.15

PREPARED BY:
H.L. Clever

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>Temperature Interval of Measurements</th>
<th>Ethene Mol % Range</th>
<th>KπY/atm¹</th>
<th>Enthalpy of Dissolution at 293.15 K</th>
<th>Constant A</th>
</tr>
</thead>
<tbody>
<tr>
<td>208.15-318.15</td>
<td>0 - 2</td>
<td>275</td>
<td>0.23</td>
<td>2.61</td>
</tr>
</tbody>
</table>

1 \[ \text{log} \left( \frac{K\pi Y}{atm} \right) = A - \frac{(\Delta H/\text{cal mol}^{-1})}{(2.3R(T/K))} \]

The author's definitions are:

\[ K = \frac{y_1}{x_1} = \text{mole fraction gas in gas phase} \]
\[ \pi/\text{atm} = \text{total pressure}, \]
\[ \nu = \text{coefficient of fugacity}. \]

The function, \( K\pi Y/\text{atm} \), is equivalent to a Henry's constant in the form

\[ H_1,2/\text{atm} = \left( f_2/\text{atm} \right)/x_1 \text{ where } f_2 \text{ is the fugacity}. \]

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
The authors describe three methods:
1.A. [Saturat. n°1]. A measure of the static pressure of saturation in an apparatus which gave a precision of 10 - 15 %.
1.B. [Saturat. n°2]. A measure of the static pressure of saturation in an apparatus which gave a precision of 2 - 5 %.
2. [Chromato]. A gas liquid chromatographic method estimated to have a precision of 2 - 5 %.
3. [Anal. directe]. Direct analysis of the gaseous and liquid phases.

Method 1.B. was used in this system plus Mes. dir. Teneurs?

SOURCE AND PURITY OF MATERIALS:
(1) Ethene. Air Liquide. For narcosis, 99.9 per cent.
(2) Ammonia. Source not given. Industrial product. Contained 0.1 per cent water. Density, \( \rho/\text{g cm}^{-3} = 0.717 \) at \(-65^\circ\text{C}\) and \( 0.705 \) at \(-50^\circ\text{C}\).
COMPONENTS:
1. Ethene; C₂H₄; [74-85-1]
2. Miscellaneous compounds

ORIGINAL MEASUREMENTS:
Brückl, N.; Kim, J. I.
Z. Phys. Chem. (Wiesbaden)
1981, 126, 133-150.

VARIABLES:
\[ T/K = 298.2 \]
\[ P/kPa = 101.3 \]

PREPARED BY:
C. L. Young

EXPERIMENTAL VALUES:
\[ T/K = 298.2 \]

\[ \ln(H/\text{atm}) = 10^3 \times \text{Mole fraction of ethene in liquid, } \times_\text{C₂H₄} \]

<table>
<thead>
<tr>
<th>Compound</th>
<th>( x_{\text{C₂H₄}} )</th>
<th>( \times_\text{C₂H₄} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>( N,N)-Dimethylacetamide; ( \text{C₄H₉NO} ); [127-19-5]</td>
<td>8.148</td>
<td>4.81</td>
</tr>
<tr>
<td>( N,N)-Dimethylformamide; ( \text{C₅H₇NO} ); [68-12-2]</td>
<td>6.738</td>
<td>5.00</td>
</tr>
<tr>
<td>( N)-Methylformamide; ( \text{C₅H₇NO} ); [123-39-7]</td>
<td>3.380</td>
<td>5.69</td>
</tr>
<tr>
<td>Acetonitrile; ( \text{C₃H₃N} ); [75-05-8]</td>
<td>6.097</td>
<td>5.10</td>
</tr>
</tbody>
</table>

\(^{±}\) at a partial pressure of 1 atmosphere, calculated by compiler, assuming \( x_{\text{C₂H₄}} = 1/H \).

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
Solubilities were determined by a volumetric method described as "the Ostwald method". No other details given.

SOURCE AND PURITY OF MATERIALS:
1. Linde Co. sample, purity 99.8 volume per cent.
2. Uvasol and analytical grade.

ESTIMATED ERROR:
\[ \delta T/K = \pm 0.1; \; \delta H = \pm 1.25\% \]

REFERENCES:
COMPONENTS:
1. Ethene; \( \text{C}_2\text{H}_4; \) [74-85-1]
2. 2-Pyrrolidinone, 1-methyl-,
(N-methylpyrrolidinone); \( \text{C}_5\text{H}_9\text{NO}; \) [872-50-4]

ORIGINAL MEASUREMENTS:
Wu, Z.; Zeck, S.; Langhorst, R.;
Knapp, H.
Proc. Int. Conf. Coal Gas and Air,
Beijing, China, 1985, 1, 209-229.

VARIABLES:
\( T/K = 298.15 \)
\( P/kPa = 100 \) (1 bar)

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>( T/K )</th>
<th>Henry's Constants</th>
<th>Ostwald Coefficient</th>
<th>Mole Fraction ( x_l )</th>
</tr>
</thead>
<tbody>
<tr>
<td>298.15</td>
<td>135.6</td>
<td>132.7</td>
<td>1.885</td>
</tr>
</tbody>
</table>

\(^1\)Calculated by compiler.
\(^2\)Calculated by compiler for a gas partial pressure of 101.325 kPa.

Values personally received from the first author for the gas and liquid phase compositions corresponding to a pressure of 1 bar were respectively: \( y_l = 0.999 \), and \( x_l = 0.0074274 \) mole fraction.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
Ethylene gas was stored in a glass burette equipped with an accurate manometer for measuring pressure and situated in a constant temperature air bath. A known quantity of completely degassed solvent was charged into an equilibrium cell immersed in a liquid bath. The volume of gas absorbed was measured after the gas was admitted into the cell. The solubility was determined from the quantities of gas and solvent used. The apparatus and procedure are described in detail in reference 1.

SOURCE AND PURITY OF MATERIALS:
1. Ethene purity was 99.9 vol. percent.
2. Solvent was provided by Merck with a minimum purity of 99.0\% (GC). After treatment with molecular sieve 4X, the water content was reduced to less than 0.01\%. The purity was then analyzed to be 99.9\%.
Measured values: \( d^{25}_l = 1.02812 \)
\( n^{25}_l = 1.4686 \)

ESTIMATED ERROR:
\( \delta P/kPa = \pm 0.05 \)
\( \delta T/K = \pm 0.01 \)
\( \delta L/L = \pm 0.01 \)

REFERENCES:
1. Zeck, S.

COMPONENTS:
1. Ethene; \( \text{C}_2\text{H}_4 \); [74-85-1]
2. 2-Pyrrolidinone, 1-methyl-, (N-methylpyrrolidinone); \( \text{C}_5\text{H}_9\text{NO} \); [872-50-4]

ORIGINAL MEASUREMENTS:
Shenderei, E.R.; Ivanovskii, F.P.
Gaz. Prom. 1962, 7, 11-17.
Same paper also in:

VARIABLES:
\( T/\text{K} = 273-288 \)
\( P/\text{kPa} = 101.3 \text{ (1 atm)} \)

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>( t/\text{C} )</th>
<th>( T/\text{K} )</th>
<th>( K \text{ mm Hg (mole fraction)}^{-1} \text{ atm (mole fraction)}^{-1} )</th>
<th>( 1^1 y \text{Mole Fraction Ethene, } x_1 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>273.15</td>
<td>74200</td>
<td>0.01024</td>
</tr>
<tr>
<td>5</td>
<td>278.15</td>
<td>81500</td>
<td>0.00933</td>
</tr>
<tr>
<td>10</td>
<td>283.15</td>
<td>88000</td>
<td>0.00864</td>
</tr>
<tr>
<td>15</td>
<td>288.15</td>
<td>96250</td>
<td>0.00790</td>
</tr>
</tbody>
</table>

\( ^1 \text{Calculated by compiler}; x_1 \) is for a partial pressure of 101.325 kPa.
Experiments were performed at several pressures between 100 and 760 mm mercury and Henry's law was found to be obeyed.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
Glass equilibrium cell fitted with a magnetic stirrer. Pressure measured with a Bourdon gauge. Samples of liquid analyzed by stripping out ethene. The solubilities were measured at several pressures below atmospheric and Henry's constant was determined. Details in ref. (1).

SOURCE AND PURITY OF MATERIALS:
Sources and purities of materials not given.

2. Properties of solvent as used by authors:
Normal boiling point = 479.15 K
Density at 20°C = 1.0220 g/cm³
Refractive index, \( n_D^2 = 1.4700 \)

ESTIMATED ERROR:
\( \delta x_1/x_1 = \pm 2\% \)
(Estimated by compiler)

REFERENCES:
Gaz. Prom. 1958, 12, 36.
COMPONENTS:
1. Ethene; C₂H₄; [74-85-1]
2. Nitrobenzene; C₆H₅NO₂; [98-95-3]

ORIGINAL MEASUREMENTS:
Choudhari, R.V.; Doraiswami, L.K.

VARIABLES:
T/K = 286.0-333.0
P/kPa = 94.23

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>Solubility at P = 94.23 (0.93 atm) s/g(l)⁻¹</th>
<th>¹Solubility at P = 101.325 kPa Mole Fraction, x₁</th>
<th>¹Henry's Constant H/atm(mole fraction)⁻¹</th>
</tr>
</thead>
<tbody>
<tr>
<td>286</td>
<td>1.97</td>
<td>0.00763</td>
<td>131.1</td>
</tr>
<tr>
<td>303</td>
<td>1.26</td>
<td>0.00496</td>
<td>201.6</td>
</tr>
<tr>
<td>313</td>
<td>0.99</td>
<td>0.00394</td>
<td>254.1</td>
</tr>
<tr>
<td>323</td>
<td>0.84</td>
<td>0.00337</td>
<td>296.7</td>
</tr>
<tr>
<td>333</td>
<td>0.76</td>
<td>0.00308</td>
<td>324.5</td>
</tr>
</tbody>
</table>

¹Calculated by compiler; x₁ is for a gas partial pressure of 101.325 kPa.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
The glass absorption vessel was equipped with a stainless steel stirrer and a jacket through which constant temperature water was circulated. A volume of 400-500 cm³ of solvent was charged into the vessel, thermal equilibrium was established and then gas was bubbled through the solvent. Samples were withdrawn at 10-15 min. intervals for analysis using a chemical analysis for the olefin content. When the concentrations remained constant, equilibrium was considered established. Precautions were taken to exclude water vapor from the air from entering the vessel. Experiments were performed at atmospheric pressure, 0.93 atm (at Poona, India). Reference 1 refers to the method of olefin analysis.

SOURCE AND PURITY OF MATERIALS:
1. Ethene purity 99.0%.
2. Nitrobenzene purity 99.0%.
The purities were tested by chromatography.

ESTIMATED ERROR:
T/K = ± 0.05
δs/s = ± 2%

REFERENCES:
1. Thomas, C.L.; Block, H.S.; Hockstra, J.
   1938, 10, 153.
<table>
<thead>
<tr>
<th>COMPONENTS:</th>
<th>ORIGINAL MEASUREMENTS:</th>
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</thead>
<tbody>
<tr>
<td>1. Ethene, C$_2$H$_4$; [74-85-1]</td>
<td>Keevil, T.A.; Taylor, D.R.</td>
</tr>
<tr>
<td>2. Cyclohexylamine, C$<em>6$H$</em>{11}$N; [108-91-8]</td>
<td>Streitwieser, A.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>VARIABLES:</th>
<th>PREPARED BY:</th>
</tr>
</thead>
<tbody>
<tr>
<td>$T/K = 298.1$</td>
<td>C.L. Young</td>
</tr>
<tr>
<td>$P_1/kPa = 101.3$</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>EXPERIMENTAL VALUES:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Partial pressure of ethene = 1 atm = 101.3 kPa.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>T/K</th>
<th>Mole fraction of ethane.</th>
</tr>
</thead>
<tbody>
<tr>
<td>298.1</td>
<td>0.0105</td>
</tr>
</tbody>
</table>

**AUXILIARY INFORMATION**

**METHOD/APPARATUS/PROCEDURE:**

Volumetric apparatus of moderate accuracy. Solvent confined to glass bulb and known amount of gas added. Pressure measured using a mercury manometer together with a null point manometer in which the gas pressure was balanced by dry air. Details in source.

**SOURCE AND PURITY OF MATERIALS:**

1. No details given.
2. Degassed and dried over lithium cyclohexylamide.

**ESTIMATED ERROR:**

$\delta T/K = \pm 0.1; \delta x_{C_2H_4} = \pm 1\%$

**REFERENCES:**
COMPONENTS:
1. Ethene; C₂H₄; [74-85-1]
2. 1-Methyl-2-pyrrolidinone, Nitrobenzene, Benzenamine (Aniline), Dimethylsulfoxide, or Hexamethylphosphoric triamide

ORIGINAL MEASUREMENTS:
Lenoir, J-Y.; Renault, P.; Renon, H.
J. Chem. Eng. Data

VARIABLES:
\[ T/K = 298.15 \]
\[ P/kPa = 101.32 \]

PREPARED BY:
C. L. Young

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>Component</th>
<th>Henry's constant, ( H/\text{atm} )</th>
<th>Mole fraction ethene, ( x_1 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-Methyl-2-pyrrolidinone; C₆H₅NO; [872-50-4]</td>
<td>126</td>
<td>0.00794</td>
</tr>
<tr>
<td>Nitrobenzene; C₆H₅NO₂; [98-95-3]</td>
<td>126</td>
<td>0.007947</td>
</tr>
<tr>
<td>Benzenamine (Aniline); C₆H₅N; [62-53-3]</td>
<td>208</td>
<td>0.00481</td>
</tr>
<tr>
<td>Sulfinylbismethane (Dimethylsulfoxide); C₆H₆SO; [67-68-5]</td>
<td>312</td>
<td>0.00321</td>
</tr>
<tr>
<td>Hexamethylphosphoric triamide; C₆H₁₅NO₃P; [680-31-9]</td>
<td>52.9</td>
<td>0.0189</td>
</tr>
</tbody>
</table>

'Calculated by compiler for a partial pressure of 101.3 kPa assuming that the mole fraction ethene is equal to 1/H.

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:
\[ \delta T/K = \pm 0.1; \quad \delta H/\text{atm} = \pm 6\% \]
(estimated by compiler)

REFERENCES:
### COMPONENTS:

1. Ethene; C₂H₄; [74-85-1]

2. Benzonitrile, 1,4-Dioxane, Nitrobenzene, Dimethylsulfoxide, or Hexamethylphosphoric triamide

### ORIGINAL MEASUREMENTS:

Brückl, N.; Kim, J. I.

*Z. Phys. Chem. (Wiesbaden)*

1981, 126, 133-150.

### VARIABLES:

- T/K = 298.2
- P/kPa = 101.3

### PREPARED BY:

C. L. Young

### EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>COMPONENT</th>
<th>lnH</th>
<th>10^3 X₁</th>
</tr>
</thead>
<tbody>
<tr>
<td>Benzonitrile; C₇H₈N; [100-47-0]</td>
<td>4.71</td>
<td>9.00</td>
</tr>
<tr>
<td>1,4-Dioxane; C₄H₈O₂; [123-91-1]</td>
<td>4.70</td>
<td>9.10</td>
</tr>
<tr>
<td>Nitrobenzene; C₆H₅NO₂; [98-95-3]</td>
<td>4.96</td>
<td>7.01</td>
</tr>
<tr>
<td>Sulfinylbismethane (Dimethylsulfoxide); C₅H₄OS; [67-68-5]</td>
<td>5.75</td>
<td>3.182</td>
</tr>
<tr>
<td>Hexamethylphosphoric triamide; C₆H₁₁NO₃P; [680-31-9]</td>
<td>4.14</td>
<td>15.92</td>
</tr>
</tbody>
</table>

\(^1\text{Calculated by compiler for a partial pressure of 101.3 kPa assuming that the mole fraction ethene is equal to } 1/H.\)

### AUXILIARY INFORMATION

**METHOD/APPARATUS/PROCEDURE:**

Solubilities were determined by a volumetric method described as "the Ostwald method". No other details given.

**SOURCE AND PURITY OF MATERIALS:**

1. Linde Co. sample, purity 99.8 volume per cent.

2. Uvasol or analytical grade. Serlabo sample, purity 99 mole per cent.

**ESTIMATED ERROR:**

\(\delta T/K = \pm 0.1; \quad \delta H/\text{atm} = \pm 1.25\%\)

(estimated by compiler)
COMPONENTS: ORIGINAL MEASUREMENTS:

1. Ethene; C₂H₄; [74-85-1]
2. Ethyne (Acetylene); C₂H₂; [74-86-2]
3. N,N-Dimethylformamide (DMF) C₃H₇NO; [68-12-2]

Shenderei, E.R.

VARIABLES:

\[ T/K = 218.15 (-55^\circ C) \]

\[ P_i/kPa = 13.3 - 101.33 \]

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>Concentration Ethyne, cm³ (STP) (g DMF)⁻¹</th>
<th>Partial Pressure, mm Hg</th>
<th>kPa</th>
<th>Solubility, S, cm³ (STP) (g DMF)⁻¹</th>
<th>Solubility Coefficient Ethene, ( x₁ )</th>
<th>( \beta = 760 S/P_i )</th>
</tr>
</thead>
<tbody>
<tr>
<td>33.8</td>
<td>100</td>
<td>13.33</td>
<td>1.33</td>
<td>10.10</td>
<td>0.003937</td>
</tr>
<tr>
<td></td>
<td>300</td>
<td>40.00</td>
<td>4.02</td>
<td>10.18</td>
<td>0.01181</td>
</tr>
<tr>
<td></td>
<td>500</td>
<td>66.66</td>
<td>6.76</td>
<td>10.27</td>
<td>0.01968</td>
</tr>
<tr>
<td></td>
<td>760</td>
<td>101.325</td>
<td>10.38</td>
<td>10.38</td>
<td>0.02992</td>
</tr>
<tr>
<td>101</td>
<td>100</td>
<td>13.33</td>
<td>1.60</td>
<td>12.16</td>
<td>0.003937</td>
</tr>
<tr>
<td></td>
<td>300</td>
<td>40.00</td>
<td>4.85</td>
<td>12.29</td>
<td>0.01181</td>
</tr>
<tr>
<td></td>
<td>500</td>
<td>66.66</td>
<td>8.15</td>
<td>12.39</td>
<td>0.01968</td>
</tr>
<tr>
<td></td>
<td>760</td>
<td>101.325</td>
<td>12.51</td>
<td>12.51</td>
<td>0.02992</td>
</tr>
<tr>
<td>164</td>
<td>100</td>
<td>13.33</td>
<td>1.85</td>
<td>14.06</td>
<td>0.003937</td>
</tr>
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<td></td>
<td>300</td>
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<td>5.60</td>
<td>14.19</td>
<td>0.01181</td>
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<td>500</td>
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<td>760</td>
<td>101.325</td>
<td>14.45</td>
<td>14.45</td>
<td>0.02992</td>
</tr>
<tr>
<td>249</td>
<td>100</td>
<td>13.33</td>
<td>2.17</td>
<td>16.49</td>
<td>0.003937</td>
</tr>
<tr>
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<td>300</td>
<td>40.00</td>
<td>6.57</td>
<td>16.64</td>
<td>0.01181</td>
</tr>
<tr>
<td></td>
<td>500</td>
<td>66.6</td>
<td>11.05</td>
<td>16.80</td>
<td>0.01968</td>
</tr>
<tr>
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<td>760</td>
<td>101.325</td>
<td>16.99</td>
<td>16.99</td>
<td>0.02992</td>
</tr>
</tbody>
</table>

1 Calculated by compiler.

2 Volumetric solubility calculated on basis of cm³ (STP) of ethene and ethyne/g DMF.

3 Mole fraction calculated on basis of three components in solution. Henry's law is obeyed for ethene in ethyne-DMF solutions.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The method was described in reference 1 and 2. The apparatus consisted of a thick-walled glass absorption tube containing a magnet stirring bar for vertical motion, a pressure gauge, and a steel bulb for condensing the gas, connected by high pressure tubing. The gas handling system consisted of glass bulbs, a mercury manometer and a vacuum system. The volume of solvent was measured using a cathetometer and the quantity of gas by pressure differences. The low temperature was obtained using methanol in a temperature-controlled bath cooled with dry ice.

SOURCE AND PURITY OF MATERIALS:

Sources and purities not specified.

ESTIMATED ERROR:

\[ \delta x_1/x_1 = \pm 2\% \]

(compiler)

REFERENCES:

   *Gas. Prom.* 1958, 12, 36.
Critical Evaluation of Ethene Solubilities in Organic Compounds

Controlling Nitrogen for Pressures greater than 0.20 MPa

Solubilities of ethene are available for only two organic solvents containing nitrogen at pressures above 0.20 MPa. These two solvents are N,N-dimethylformamide and 1-methyl-2-pyrrolidinone.

N,N-Dimethylformamide; C₃H₇NO; [68-12-2]

Ethene solubilities in N,N-dimethylformamide were reported for the temperatures 298.15 K, 323.15 K and 343.15 K and for pressures in the range of 0.79 MPa to 4.22 MPa by Shakhova et al. (1). The vapor pressure for this solvent is very low so that the total pressure was considered to be the gas partial pressure. The data which were found to be essentially consistent were used to develop an equation relating the mole fraction solubility to the gas partial pressure in MPa. It is noted that the pressure in bar + 10 is equivalent to MPa.

\[
\log x_p = 457.46 \left( \frac{T}{K} \right)^{-1} + 0.9862 \log \left( \frac{p}{\text{MPa}} \right) - 2.7274
\]  

(1)

Only the last data point for a temperature of 343.15 K was omitted because it was obviously inconsistent. Otherwise, the data are well described by equation (1); the average, and maximum deviations from the equation are 1.4%, and 4.7%, respectively. It is further noted that extrapolation of equation (1) for a temperature of 298.15 K to a pressure of 0.1013 MPa yielded a solubility of 0.0067 mole fraction in good agreement with reliable solubilities measured at that pressure and also the value obtained using the Henry's law constant reported on the data sheet. These data are classified as tentative.

1-Methyl-2-pyrrolidinone; C₅H₇NO; [872-50-4]

Ethene solubilities in 1-methyl-2-pyrrolidinone were also reported by Shakhova et al. (1) for the temperatures 298.15 K, 323.15 K and 343.15 K, and for a large range of pressures, from 0.375 MPa to 9.46 MPa. These data were found to be consistent; however, a curvature of the line representing the relation between \( \log (x_p/\text{mole fraction}) \) and \( \log (p/\text{MPa}) \) was observed. The following equation which contains a correction factor for the curvature was developed for all the data for this solvent:

\[
\log (x_p) = 486.13 \left( \frac{T}{K} \right)^{-1} + 0.9930 \log \left( \frac{p}{\text{MPa}} \right) - 0.012 p - 2.755
\]  

(2)

The average, and maximum deviations of the values calculated using equation (2) from the data are 1.9%, and 6.5%, respectively. It is noted that equation (2) was extrapolated to a pressure of 0.1013 MPa for a temperature of 298.15 K to obtain a mole fraction solubility of 0.0077 which can be compared with the value based on the Henry's law constant recorded on the data sheet, of 0.0074 mole fraction ethene. Similarly, this extrapolated value compares very favourably with the actual experimental value as discussed in the preceding chapter of this volume. It is further noted that the vapor pressure of this solvent is also low, so that the total pressures on the data sheet were considered to be gas partial pressures in the development of equation (2).

These data are classified as tentative.

Reference

### COMPONENTS:
1. Ethene; \( \text{C}_2\text{H}_4 \); [74-85-1]
2. N,N-Dimethylformamide; \( \text{C}_6\text{H}_7\text{NO} \); [68-12-2]

### ORIGINAL MEASUREMENTS:
Shakhova, S. P.; Zubchenko, Yu. P.; Rezina, O. A.

### VARIABLES:
\[
\frac{T}{K} = 298.15 - 343.15 \\
\frac{P}{\text{MPa}} = 0.79 - 4.21
\]

### EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>( T/K )</th>
<th>( P/\text{bar} )</th>
<th>Mole fraction of ethene ( \omega_{\text{C}_2\text{H}_4} ) vol/vol</th>
<th>Mole fraction of ethene ( \omega_{\text{C}_2\text{H}_4} ) vol/vol</th>
</tr>
</thead>
<tbody>
<tr>
<td>298.15</td>
<td>7.90</td>
<td>0.0512</td>
<td>15.7</td>
</tr>
<tr>
<td></td>
<td>10.23</td>
<td>0.0680</td>
<td>21.2</td>
</tr>
<tr>
<td></td>
<td>12.26</td>
<td>0.0792</td>
<td>25.0</td>
</tr>
<tr>
<td></td>
<td>16.11</td>
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<td>33.4</td>
</tr>
<tr>
<td></td>
<td>18.64</td>
<td>0.1220</td>
<td>40.4</td>
</tr>
<tr>
<td></td>
<td>19.76</td>
<td>0.1275</td>
<td>42.5</td>
</tr>
<tr>
<td>323.15</td>
<td>8.00</td>
<td>0.0390</td>
<td>11.8</td>
</tr>
<tr>
<td></td>
<td>14.08</td>
<td>0.0674</td>
<td>21.0</td>
</tr>
<tr>
<td></td>
<td>15.50</td>
<td>0.0754</td>
<td>23.7</td>
</tr>
<tr>
<td></td>
<td>21.28</td>
<td>0.1030</td>
<td>33.4</td>
</tr>
<tr>
<td>323.5</td>
<td>27.16</td>
<td>0.1309</td>
<td>43.8</td>
</tr>
<tr>
<td></td>
<td>33.84</td>
<td>0.1608</td>
<td>55.7</td>
</tr>
<tr>
<td></td>
<td>12.63</td>
<td>0.0706</td>
<td>22.1</td>
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<tr>
<td></td>
<td>22.90</td>
<td>0.0910</td>
<td>29.1</td>
</tr>
<tr>
<td></td>
<td>28.98</td>
<td>0.1207</td>
<td>39.9</td>
</tr>
<tr>
<td>343.15</td>
<td>31.51</td>
<td>0.1239</td>
<td>41.1</td>
</tr>
<tr>
<td></td>
<td>36.17</td>
<td>0.1407</td>
<td>47.6</td>
</tr>
<tr>
<td></td>
<td>41.85</td>
<td>0.1610</td>
<td>55.8</td>
</tr>
<tr>
<td></td>
<td>42.15</td>
<td>0.1804</td>
<td>64.0</td>
</tr>
</tbody>
</table>

\( ^\dagger \) quoted in original paper, appears to be volume of gas at \( T/K = 273.15 \) and \( P = 1 \) atmosphere adsorbed by unit volume of liquid at room temperature.

### AUXILIARY INFORMATION

#### METHOD/APPARATUS/PROCEDURE:
Mixture stirred by ball in rocking autoclave. Samples of liquid analysed by a volumetric method. Details in ref. (1).

Henry's constants were listed as follows:

<table>
<thead>
<tr>
<th>( t/\text{C} )</th>
<th>( H/\text{atm mole fraction}^{-1} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>25</td>
<td>150</td>
</tr>
<tr>
<td>50</td>
<td>183</td>
</tr>
<tr>
<td>70</td>
<td>221</td>
</tr>
</tbody>
</table>

#### SOURCE AND PURITY OF MATERIALS:
1. Purity 99.97 mole per cent.
2. Distilled, no other details given.

#### ESTIMATED ERROR:
\( \delta \frac{T}{K} = \pm 0.1; \delta \frac{P}{\text{bar}} = \pm 0.1; \delta \omega_{\text{C}_2\text{H}_4} = \pm 5\% . \)

#### REFERENCES:
COMPONENTS:
1. Ethene; C₂H₄; [74-85-1]
2. 1-Methyl-2-pyrrolidinone, (N-methylpyrrolidinone); C₅H₇NO; [872-50-4]

ORIGINAL MEASUREMENTS:
Shakhova, S. F.; Zubchenko, Yu. P.;
Rezina, O. A.

VARIABLES:
T/K = 298.15 - 343.15
P/MPa = 0.37 - 9.46

PREPARED BY:
C. L. Young

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>P/bar</th>
<th>Mole fraction</th>
<th>a⁺</th>
<th>T/K</th>
<th>P/bar</th>
<th>Mole fraction</th>
<th>a⁺</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>of ethene in liquid,</td>
<td></td>
<td></td>
<td></td>
<td>of ethene in liquid,</td>
<td></td>
</tr>
<tr>
<td>298.15</td>
<td>0.0274</td>
<td>6.52</td>
<td></td>
<td>323.15</td>
<td>0.0214</td>
<td>18.14</td>
<td>0.0970</td>
</tr>
<tr>
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<td>9.83</td>
<td></td>
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<td>0.0473</td>
<td>11.5</td>
<td></td>
</tr>
<tr>
<td>6.38</td>
<td>0.0473</td>
<td>11.5</td>
<td></td>
<td>8.00</td>
<td>0.0596</td>
<td>14.7</td>
<td></td>
</tr>
<tr>
<td>10.54</td>
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<td>19.2</td>
<td></td>
<td>14.89</td>
<td>0.1074</td>
<td>27.9</td>
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</tr>
<tr>
<td>18.64</td>
<td>0.1363</td>
<td>37.2</td>
<td></td>
<td>25.53</td>
<td>0.1748</td>
<td>49.1</td>
<td></td>
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<tr>
<td>47.32</td>
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<td>96.2</td>
<td></td>
<td>56.44</td>
<td>0.3546</td>
<td>127.4</td>
<td></td>
</tr>
<tr>
<td>63.94</td>
<td>0.3919</td>
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<td></td>
<td>64.75</td>
<td>0.4115</td>
<td>162.1</td>
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<tr>
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<td>5.08</td>
<td></td>
<td>3.85</td>
<td>0.0214</td>
<td>5.08</td>
<td></td>
</tr>
<tr>
<td>6.09</td>
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<td>8.21</td>
<td></td>
<td>6.79</td>
<td>0.0381</td>
<td>9.18</td>
<td></td>
</tr>
<tr>
<td>10.94</td>
<td>0.0596</td>
<td>14.7</td>
<td></td>
<td>86.84</td>
<td>0.0319</td>
<td>147</td>
<td></td>
</tr>
</tbody>
</table>

† quoted in original paper, appears to be volume of gas at T/K = 273.15 and P = 1 atmosphere adsorbed by unit volume of liquid at room temperature.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
Mixture stirred by ball in rocking autoclave. Samples of liquid analysed by a volumetric method. Details in ref. (1).

Henry's constants were listed as follows:

<table>
<thead>
<tr>
<th>t/C</th>
<th>H/atm mole fraction⁻¹</th>
</tr>
</thead>
<tbody>
<tr>
<td>25</td>
<td>135</td>
</tr>
<tr>
<td>50</td>
<td>174</td>
</tr>
<tr>
<td>70</td>
<td>208</td>
</tr>
</tbody>
</table>

SOURCE AND PURITY OF MATERIALS:

1. Purity 99.97 mole per cent.
2. Distilled, no other details given.

ESTIMATED ERROR:

δT/K = ±0.1; δP/bar = ±0.1;
δαC₂H₄ = ±5% (estimated by compiler)

REFERENCES:
Critical Evaluation of Ethene Solubilities in Organic Solvents for Pressures less than 0.20 MPa

Seven research groups reported solubilities of ethene in organic sulfur or organic phosphorus compounds usually expressed as the Henry's constants. Particularly the data of Lenoir et al. (1) were obtained using a chromatographic method at low gas partial pressures, leading to possible errors when the results were extrapolated to 0.1013 MPa pressure. For only four of the eleven solvents were the results reported for three or more temperatures. Thus, for most of the solvents the effect of temperature on the solubility could not be determined from the results available. The sulfur and phosphorus-containing solvents were mainly the organic esters of either sulfuric or phosphoric acids. The ethene solubilities in the high boiling phosphoric acid esters were of particular interest because five of these solvents belonged to a homologous series. Thus the effect of solvent molecular weight could be qualitatively observed.

There is a data sheet describing the solubility of ethene in triphenylphosphine at pressures up to 0.595 MPa which, strictly speaking, should have appeared in a chapter all of its own.

The solubilities in individual solvents will now be considered.

**Carbon disulfide; CS₂; [75-15-0]**

The solubility of ethene in carbon disulfide was reported by Sahgal et al. (2) for 298.15 K and a partial pressure of 0.1013 MPa. No comparable data are available in the literature.

This result is classified as tentative.

**Sulfinylbismethane (dimethyl sulfoxide); C₂H₆SO; [67-68-5]**

The solubility of ethene in sulfinylbismethane at 298.15 K and for a gas partial pressure of 101.3 kPa was reported by Brückl and Kim (3) and also by Lenoir et al. (1). The two solubilities differ by less than 1%.

These values are classified as tentative.

**Sulfuric acid, diethyl ester (diethyl sulfate); C₄H₁₀O₄S; [64-67-5]**

Ethene solubilities in sulfuric acid, diethyl ester were reported for temperatures ranging from 273.15 K to 353.15 K and for a gas partial pressure of 101.3 kPa by Truchard et al. (4). These data are entirely consistent and are well represented by the following equation:

$$\log x = 4.79.73 \left(\frac{T}{K}\right)^{-1} - 3.5998$$  \hspace{1cm} (1)

Equation (1) is simpler than that of the authors, and it represents the data with an average deviation of 0.7% and a maximum deviation of 1.5% for the whole temperature range.

The results of Truchard et al. (4) are classified as tentative.

**Amidosulfurous acid, diethylmethyl ester (N,N-dimethylsulfonamide, methyl ester); C₆H₁₃NOS₂; [21954-69-8]**

Ethene solubilities of Makitra et al. (5) in the sulfonamide solvent for pressures below atmospheric are available for temperatures ranging from 253.15 K to 333.15 K. Unfortunately these data appear to be quite inconsistent. Henry's law is not even approximately obeyed; for each
**COMPONENTS:**

1. Ethene; C₂H₄; [74-85-1]

2. Organic solvents containing sulfur or phosphorus for pressures less than 0.2 MPa

**EVALUATOR:**

Walter Hayduk  
Department of Chemical Engineering  
University of Ottawa  
Ottawa, ON  
Canada K1N 6N5  
March, 1994

**CRITICAL EVALUATION:**

At temperatures below atmospheric it would be expected that Henry's law would be obeyed. Furthermore, there is a large degree of scattering of the data. Also, the solubilities at any one pressure (at 725 mm of mercury pressure for example) do not follow a regular function of temperature.

**Solubilities of ethene in five esters of phosphoric acid** were reported by Lenoir et al. (1) for a temperature of 325.2 K (and for three temperatures for the tripropyl ester) as Henry's law constants. There is some doubt that these Henry's constants, by a chromatographic technique at low partial pressures of gas, are representative of the true value at 0.1013 MPa pressure. However, a check on the value obtained by Lenoir et al. for the tributyl ester is available from the results of Kosyakov et al. (6) for that solvent. The latter researchers reported results for temperatures ranging from 223.15 K to 313.15 K from which they determined Henry's constants. The results of both research groups appear consistent with one another, and were used to develop an equation for the temperature effect of solubility at a pressure of 0.1013 MPa for phosphoric acid, tributyl ester as follows:

$$\log z = 568.32 \left(\frac{T}{K}\right) - 3.4716$$  \hspace{1cm} (2)

The average, and maximum deviation of the data from equation (2) for this solvent is 0.5%, and 1.2%, respectively. Equation (2) was developed for a temperature range from 223.15 K to 325.15 K and extrapolation beyond this temperature range is not recommended.

As part of the consistency check, Figure 1 was constructed to indicate the effect on the solubilities of ethene of the solvent molecular weight for the phosphoric acid esters for the constant temperature of 325.2 K. Figure 1 indicates that there is a consistent increase in ethene solubility at a temperature of 325.2 K as the molecular weight of the phosphoric acid ester is increased. Thus, Figure 1 may have some value in extending solubility data to the many different esters of phosphoric acid.

The data of Lenoir et al. (1) and of Kosyakov et al. (6) are classified as tentative.

**Hexamethyolphosphoric triamide; C₆H₁₄N₃OP; [680-31-9]**

Two sources for the ethene solubility in hexamethyolphosphoric acid triamide for a temperature of 298.2 K are available: Brückl and Kim (3), and Lenoir et al. (1), with values of 0.0159 mole fraction ethene, and 0.0189 mole fraction, respectively. The difference between these two comparable results of 19% is clearly beyond any normal experimental error. Given the low pressure chromatographic method used by Lenoir et al. (1), their value is rejected, and the value of Brückl and Kim (3) is classified as tentative.
**COMPONENTS:**
1. Ethene; C₂H₄; [74-85-1]
2. Organic solvents containing sulfur or phosphorus for pressures less than 0.2 MPa

**EVALUATOR:**
Walter Hayduk
Department of Chemical Engineering
University of Ottawa
Ottawa, ON
Canada K1N 6N5
March, 1994

**CRITICAL EVALUATION:**

Triphenylphosphine; C₁₅H₁₅P; [603-35-0]

Ethene solubilities at the three temperatures, 363.2 K, 378.2 K, and 393.2 K, for the three pressures, 0.491 MPa, 0.546 MPa and 0.595 MPa, respectively, were reported by Herman et al. (7). There are insufficient data to check for consistency. A linear extrapolation to a pressure of 0.1013 MPa results in mole fraction solubilities of 0.0060 at 363.2 K, 0.0054 at 378.2 K and 0.0049 at 393.2 K. The extrapolated results must be considered approximate only.

The original data are classified as tentative.

**Figure 1** Solubility of ethene at 325.2 K and 0.1013 MPa in esters of phosphoric acid as a function of solvent molecular weight

---

**References**

### COMPONENTS:

1. Ethene; C₂H₄; [74-85-1]
2. Organic solvents containing sulfur or phosphorus for pressures less than 0.2 MPa

### CRITICAL EVALUATION:


COMPONENTS:
1. Ethene; C₂H₄; [74-85-1]
2. Carbon disulfide; CS₂; [75-15-0]

ORIGINAL MEASUREMENTS:
Sahgal, A.; La, H.M.; Hayduk, W.

VARIABLES:
T/K = 298.15
P/kPa = 101.325

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>t/C</th>
<th>T/K</th>
<th>Mole Fraction Ethene, x₁</th>
<th>Ostwald Coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>25.2</td>
<td>298.15</td>
<td>0.00646</td>
<td>2.61</td>
</tr>
</tbody>
</table>

Mole fraction ethene, x₁, is for a gas partial pressure of 101.325 kPa.

SOURCE AND PURITY OF MATERIALS:
1. Ethene was CP grade from Matheson, 99.5 mole % minimum purity.
2. Carbon disulfide was of the chromatography grade from Matheson Coleman and Bell, minimum purity 99.0 mole %.

ESTIMATED ERROR:
δ x₁/x₁ = ± 2%
δ T/K = ± 0.05

REFERENCES:

METHOD/APPARATUS/PROCEDURE:
A glass apparatus equipped with a gas storage burette, a spiral tube for gas absorption, a miniature internal manometer and a solution storage burette was used. Degassed solvent was injected at a constant rate into the absorption spiral by means of a syringe-pump while the gas was displaced by mercury using a mechanical elevating device for a mercury bottle, at a rate required to keep the gas pressure constant. Readings of the volume of vapor-free gas consumed and volume of solvent required to achieve saturation were obtained from which the solubility was calculated. Constant temperature fluid was circulated through a jacket enclosing the burettes and absorption spiral.

PREPARED BY:
W. Hayduk

AUXILIARY INFORMATION
COMPONENTS:
1. Ethene; C₂H₄; [74-85-1]
2. Sulfuric acid, diethyl ester (diethyl sulfate); C₄H₁₀O₄S; [64-67-5]

ORIGINAL MEASUREMENTS:
Truchard, A.M.; Harris, H.G.;
Himmelblau, D.M.

VARIABLES:
T/K = 273-353
P/kPa = 101.325

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>t/C</th>
<th>T/K</th>
<th>H/ atm (mole fraction)⁻¹</th>
<th>Ethene, x₁</th>
<th>²Partial Molal Heat of Solution -ΔH/ cal (mole)²</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>273.15</td>
<td>68.71</td>
<td>0.01455</td>
<td>2430</td>
</tr>
<tr>
<td>20</td>
<td>293.15</td>
<td>92.24</td>
<td>0.01084</td>
<td>2300</td>
</tr>
<tr>
<td>25</td>
<td>298.15</td>
<td>98.73</td>
<td>0.01013</td>
<td>2270</td>
</tr>
<tr>
<td>30</td>
<td>303.15</td>
<td>105.1</td>
<td>0.00951</td>
<td>2240</td>
</tr>
<tr>
<td>40</td>
<td>313.15</td>
<td>117.3</td>
<td>0.00853</td>
<td>2180</td>
</tr>
<tr>
<td>60</td>
<td>333.15</td>
<td>144.2</td>
<td>0.00693</td>
<td>2080</td>
</tr>
<tr>
<td>80</td>
<td>353.15</td>
<td>172.8</td>
<td>0.00579</td>
<td>1995</td>
</tr>
</tbody>
</table>

Calculated by compiler; mole fraction ethene, x₁, is for a partial pressure of 101.325 kPa.

Partial molal heat of solution tabulated by authors and based on equation:

\[ \Delta H = 2.303 \left( \frac{\partial \log H}{\partial (1/T)} \right) \]

Temperature coefficient of H expressed by:

\[ \log H = 3.04666 - 0.132845 \left( \frac{1}{T} \right) - 5.39706 \left( \frac{1}{T} \right)^2 \]

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
Two calibrated glass spheres, one larger than the other, immersed in a bath connected to a mercury manometer were used. Approximately 200 cm³ of solvent was placed in the larger sphere and both were thoroughly evacuated. A supply of ethene was charged to the smaller flask to 2 atm pressure. Ethene was admitted to the flask containing the solvent and allowed to reach equilibrium by stirring. The pressures were read and material balances made to determine the solubility. Solubilities were measured for equilibrium pressures between 50 and 1300 mm of mercury pressure and Henry's law was found to apply in all cases.

SOURCE AND PURITY OF MATERIALS:
1. Ethene source and purity not given.
2. Diethyl sulfate was Eastman practical grade purified by washing with Na₂CO₃ solution and drying with CaCl₂.

ESTIMATED ERROR:

\[ \delta H/H = \pm 0.02 \]
\[ \delta T/K = \pm 0.05 \]

REFERENCES:
**COMPONENTS:**

1. Ethene; C\textsubscript{2}H\textsubscript{4}; [74-85-1]
2. Amidosulfurous acid, diethyl-, methyl ester, (N-N diethyl sulfonamide, methylester); C\textsubscript{8}H\textsubscript{13}N\textsubscript{0}2S; [21954-69-8]

**ORIGINAL MEASUREMENTS:**


**VARIABLES:**

<table>
<thead>
<tr>
<th>T/K</th>
<th>253.15 - 338.15</th>
</tr>
</thead>
<tbody>
<tr>
<td>P\textsubscript{i}/kPa</td>
<td>13.3 - 96.7</td>
</tr>
</tbody>
</table>

**PREPARED BY:**

W. Hayduk

**EXPERIMENTAL VALUES:**

<table>
<thead>
<tr>
<th>Temperature (°C)</th>
<th>20</th>
<th>35</th>
<th>50</th>
<th>65</th>
</tr>
</thead>
<tbody>
<tr>
<td>T/K</td>
<td>253.15</td>
<td>273.15</td>
<td>308.15</td>
<td>338.15</td>
</tr>
<tr>
<td>Partial Pressure, P mm Hg, kPa</td>
<td>100</td>
<td>200</td>
<td>300</td>
<td>400</td>
</tr>
<tr>
<td>13.3</td>
<td>26.7</td>
<td>40.4</td>
<td>53.3</td>
<td>66.7</td>
</tr>
<tr>
<td>5</td>
<td>7</td>
<td>10</td>
<td>12</td>
<td>15</td>
</tr>
<tr>
<td>4</td>
<td>6</td>
<td>8</td>
<td>11</td>
<td>13</td>
</tr>
<tr>
<td>2</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>8</td>
</tr>
<tr>
<td>2</td>
<td>4</td>
<td>6</td>
<td>7</td>
<td>8</td>
</tr>
<tr>
<td>1</td>
<td>3</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

The solubility is expressed as 10\textsuperscript{-4} x\textsubscript{i}, where x\textsubscript{i} is the mole fraction.

1 The solubility at 101.3 kPa was calculated by the compiler from Henry's constants given in the paper.
2 Solubility at 101.3 kPa as calculated by the compiler from H values listed below.
The data were obtained from the paper deposited in VINITI, Moscow.

**AUXILIARY INFORMATION**

**METHOD/APPARATUS/PROCEDURE:**

The method of measurement was not specified. It is stated in the paper that Henry's law is obeyed. A check of the data shows that Henry's law is only very approximately obeyed.

Henry's constants, H in mm Hg/mole fraction, as determined by the authors and as calculated by the compiler are as follows:

<table>
<thead>
<tr>
<th>t/°C</th>
<th>(authors)</th>
<th>(compiler)</th>
</tr>
</thead>
<tbody>
<tr>
<td>-20</td>
<td>3920</td>
<td>2927</td>
</tr>
<tr>
<td>0</td>
<td>4025</td>
<td>3714</td>
</tr>
<tr>
<td>20</td>
<td>5830</td>
<td>6000</td>
</tr>
<tr>
<td>35</td>
<td>6380</td>
<td>6222</td>
</tr>
<tr>
<td>50</td>
<td>7090</td>
<td>7407</td>
</tr>
<tr>
<td>65</td>
<td>9350</td>
<td>13,333</td>
</tr>
</tbody>
</table>

**SOURCE AND PURITY OF MATERIALS:**

1. Ethene purity by gas chromatography was 99.5%.
2. The solvent was washed and boiling temperature was measured at 4 mm mercury pressure as 115°C. Actual purity not determined.

**ESTIMATED ERROR:**

\[ \delta x_1/x_1 = 0.1 \text{ or } 10\% \text{ (Compiler)} \]

**REFERENCES:**
COMPONENTS: ORIGINAL MEASUREMENTS:

1. Ethene; \( \text{C}_2\text{H}_4; \ [74-85-1] \)
2. Esters of phosphoric acid

Lenoir, J-Y.; Renault, P.; Renon, H.


VARIABLES:

\[ T/\text{K} = 298.2 \ - \ 343.2 \]

\[ P/\text{kPa} = 101.3 \]

PREPARED BY:

C. I. Young

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>( T/\text{K} )</th>
<th>Henry's constant ( H_{\text{C}_2\text{H}_4}/\text{atm} )</th>
<th>Mole fraction at 1 atm* ( x_{\text{C}_2\text{H}_4} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phosphoric acid, trimethyl ester; ( \text{C}_3\text{H}_9\text{O}_3\text{P} ; [512-56-1] )</td>
<td>325.2</td>
<td>199</td>
</tr>
<tr>
<td>Phosphoric acid, triethyl ester; ( \text{C}<em>6\text{H}</em>{18}\text{O}_3\text{P} ; [78-40-0] )</td>
<td>325.2</td>
<td>87.0</td>
</tr>
<tr>
<td>Phosphoric acid, tripropyl ester; ( \text{C}<em>9\text{H}</em>{21}\text{O}_3\text{P} ; [513-08-6] )</td>
<td>298.2</td>
<td>41.1</td>
</tr>
<tr>
<td></td>
<td>323.2</td>
<td>57.3</td>
</tr>
<tr>
<td></td>
<td>343.2</td>
<td>71.1</td>
</tr>
<tr>
<td>Phosphoric acid, tributyl ester; ( \text{C}<em>{12}\text{H}</em>{27}\text{O}_3\text{P} ; [126-73-8] )</td>
<td>325.2</td>
<td>52.5</td>
</tr>
<tr>
<td>Phosphoric acid, tri(2-methylpropyl) ester; ( \text{C}<em>{12}\text{H}</em>{27}\text{O}_3\text{P} ; [126-71-6] )</td>
<td>325.2</td>
<td>48.7</td>
</tr>
</tbody>
</table>

* Calculated by compiler assuming a linear function of \( H_{\text{C}_2\text{H}_4} \) vs \( x_{\text{C}_2\text{H}_4} \)

i.e., \( x_{\text{C}_2\text{H}_4} (1 \text{ atm}) = 1/H_{\text{C}_2\text{H}_4} \)

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. Ethene; C\(_2\)H\(_4\); [74-85-1]
2. Phosphoric acid, tributyl ester (tributyl phosphate); C\(_{12}\)H\(_{27}\)O\(_4\)P; [126-73-8]

### ORIGINAL MEASUREMENTS:

Kosyakov, N.E.; Yushko, V.I.;
Sergienko, I.D.; Khokhlov, C.F.;
Taraba, P.F.


### VARIABLES:

\( T/K = 223-313 \)
\( P/kPa = 101.3 \) (1 atm)

### EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>( t/C )</th>
<th>( ^1T/K )</th>
<th>(^2) Henry's Constant ( H/\text{atm (mole fraction)} )</th>
<th>(^2) Mole Fraction Ethene, ( x_1 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>40</td>
<td>313.15</td>
<td>45.2</td>
<td>0.0221</td>
</tr>
<tr>
<td>20</td>
<td>293.15</td>
<td>34.1</td>
<td>0.0293</td>
</tr>
<tr>
<td>0</td>
<td>273.15</td>
<td>24.9</td>
<td>0.0401</td>
</tr>
<tr>
<td>-20</td>
<td>253.15</td>
<td>16.9</td>
<td>0.0593</td>
</tr>
<tr>
<td>-40</td>
<td>233.15</td>
<td>10.9</td>
<td>0.0921</td>
</tr>
<tr>
<td>-50</td>
<td>223.15</td>
<td>8.33</td>
<td>0.120</td>
</tr>
</tbody>
</table>

\(^1\)Calculated by compiler.

\(^2\)Only graphical data given in paper; mole fraction solubility, \( x_1 \), read from enlarged graph corresponding to a gas partial pressure of 101.325 kPa.

Data measured at several pressures between 100 and 760 mm mercury pressure shows that Henry's law is obeyed.

### AUXILIARY INFORMATION

**METHOD/Apparatus/PROCEDURE:**
A static method was used. Details are given in reference 1.

**SOURCE AND PURITY OF MATERIALS:**
1. Ethene minimum purity 99.0 mole %.
2. Purity and source unspecified.

**ESTIMATED ERROR:**
\( \delta x_1/x_1 = \pm 2\% \) (Original data)
\( \delta x_1/x_1 = \pm 4\% \) (As read from graph by compiler)

**REFERENCES:**
1. Braude, G.E.; Shakhova, C.F.
COMPONENTS:
1. Ethene; C\(_{2}\)H\(_{4}\); [74-85-1]
2. Triphenylphosphine; C\(_{15}\)H\(_{18}\)P; [603-35-0]

VARIABLES:

\[ T/K = 363.2 - 393.2 \]
\[ P/MPa = 0.491 - 0.595 \]

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>T/K</th>
<th>P/MPa</th>
<th>( x_{C_{2}H_{4}} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>363.2</td>
<td>0.491</td>
<td>0.029</td>
</tr>
<tr>
<td>378.2</td>
<td>0.546</td>
<td>0.029</td>
</tr>
<tr>
<td>393.2</td>
<td>0.595</td>
<td>0.029</td>
</tr>
</tbody>
</table>

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
Cailletet tube with sample of known composition confined over mercury. Pressure on the sample was increased by small increments until bubble point reached. Equilibrium established at each step. Sample stirred with magnetically operated device. Pressure measured using Bourdon gauge.

SOURCE AND PURITY OF MATERIALS:
1. Phillips sample, purity 99.98 mole per cent.
2. Fluka sample, purity 99.5 wt per cent.

ESTIMATED ERROR:
\[ \delta T/K = \pm 0.1; \delta P/MPa = \pm 0.001 \]
\[ \delta x_{C_{2}H_{4}} = \pm 5\% \]

REFERENCES:
Critical Evaluation of Ethene Solubilities in Biological Fluids, Olive Oil and Petroleum for Pressures less than 0.1013 MPa

The solubility for a temperature of 298.15 K of ethene for a range of pressures below atmospheric was reported for components of dog blood including water, hemoglobin solution, blood plasma as well as in whole blood by Grollman (1). The solubilities were reported as the Bunsen and Ostwald coefficients. It can be concluded that Henry's law is obeyed for water and approximately obeyed for the other three solvents. It is also apparent that the ethene solubility is lowest in the hemoglobin solution and increases in water, in blood plasma and finally reaches the highest value in whole blood for constant gas pressures. Further, the solubilities in whole blood of three different species were compared at 310.65 K; lowest values were obtained for human blood, higher values in rabbit blood and highest values in dog blood. These results may be of qualitative value only because the results for water are too low when compared with modern values. Please see the chapter for solubilities in water in this volume.

Orcutt and Waters (2) reported ethene solubilities at 298.15 K in human blood and in aqueous solutions containing increasing quantities of chemical reagents. These reagents were acid ferricyanide, caustic and alkaline hydrosulfite reagent added sequentially, with the ethene solubility determined after each addition. The solubility decreased with each addition of the chemical solutions. It is of interest that the extrapolated value for the ethene solubility in human blood at 298.15 K expressed as the Ostwald coefficient is 0.143 cm$^3$ ethene/cm$^3$ of blood and is nearly identical to the value obtained by the previous researcher of 0.142 cm$^3$ ethene/cm$^3$ blood except in the latter case it is for dog blood. This contradicts the findings of Grollman at 310.65 K.

The solubilities of Orcutt and Waters are classified as tentative.

The single value for the solubility of ethene in olive oil at 310.2 K of Saidman et al. (3) is classified as tentative.

The solubilities of ethene in a petroleum fraction at two temperatures were reported both as the Bunsen and Ostwald coefficients by Gniewosz and Walfisz (4). Without further specifications as to properties and analysis of the petroleum fraction, this data is of little use.

References
COMPONENTS:
1. Ethene; \( \text{C}_2\text{H}_4 \); [74-85-1]
2. Water; \( \text{H}_2\text{O} \); [7732-18-5]
   Dog blood, dog plasma, and dog hemoglobin.

ORIGINAL MEASUREMENTS:
Grollman, A.

VARIABLES:
\( T/K = 298.15 \) (25.0°C)
\( P_1/\text{kPa} = 73.3-133.3 \)

PREPARED BY:
W. Hayduk

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>Ethene Partial Pressure ( P_1/\text{mm mercury} )</th>
<th>Ethene Partial Pressure ( P_1/\text{kPa} )</th>
<th>Ostwald Coefficient, ( L/\text{cm}^3) (gas)</th>
<th>Ostwald Coefficient, ( L/\text{cm}^3) (solvent)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water</td>
<td>Plasma</td>
<td>Hemoglobin</td>
<td>Whole Blood</td>
</tr>
<tr>
<td>550 73.33</td>
<td>0.112</td>
<td>0.114</td>
<td>0.104</td>
</tr>
<tr>
<td>600 79.99</td>
<td>0.113</td>
<td>0.114</td>
<td>0.104</td>
</tr>
<tr>
<td>650 86.66</td>
<td>0.113</td>
<td>0.114</td>
<td>0.105</td>
</tr>
<tr>
<td>700 93.33</td>
<td>0.112</td>
<td>0.115</td>
<td>0.106</td>
</tr>
<tr>
<td>750 99.99</td>
<td>0.113</td>
<td>0.115</td>
<td>0.105</td>
</tr>
<tr>
<td>800 106.7</td>
<td>0.113</td>
<td>0.115</td>
<td>0.106</td>
</tr>
<tr>
<td>850 113.3</td>
<td>0.113</td>
<td>0.116</td>
<td>0.106</td>
</tr>
<tr>
<td>900 112.0</td>
<td>0.116</td>
<td>0.115</td>
<td>0.106</td>
</tr>
<tr>
<td>950 126.7</td>
<td>0.113</td>
<td>0.117</td>
<td>0.107</td>
</tr>
<tr>
<td>1000 133.3</td>
<td>0.113</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Average \( L \) -- 0.1129 0.1151 0.1056 0.1420

1. Calculated by compiler.
2. Plasma was obtained by centrifugation of the dog blood.
3. The hemoglobin solution contained 8.5 g purified hemoglobin in 100 cm³ of solution.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
A glass bubbling-type of saturator immersed in a constant temperature bath was used. A known volume of saturated solution was transferred over mercury into a Van Slyke desorption apparatus. Gas removed in three evacuations was transferred to a sample tube where the volume was determined and a sample of the gas was analyzed. Solubilities were determined at several pressures below atmospheric and above atmospheric and expressed as Ostwald coefficients.

SOURCE AND PURITY OF MATERIALS:
1. Ethene source and purity was not given.
2. Heparin was used as a blood anticoagulant.

ESTIMATED ERROR:
\( \delta T/K = \pm 0.05 \)
\( \delta L/L = \pm 4\% \)
(compiler)

REFERENCES:
COMPONENTS:
1. Ethene; \( \text{C}_2\text{H}_4 \); [74-85-1]
2. Water; \( \text{H}_2\text{O} \); [77-32-18-5]
   Human blood, dog blood, rabbit blood, and aqueous lipoidal suspensions of dog blood.

ORIGINAL MEASUREMENTS:
Grollman, A.
J. Biol. Chem. 1929, 82, 317-325.

VARIABLES:
\[ T/K = 310.65 \quad (37.5^\circ \text{C}) \]
\[ p/k\text{Pa} = 101.325 \]

PREPARED BY:
W. Hayduk

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>Solvent</th>
<th>Bunsen Coefficient ( \beta/\text{cm}^3(\text{gas}) )</th>
<th>( \text{Ostwald coefficient} ) L/\text{cm}^3(\text{gas})cm^-3(\text{solvent})</th>
<th>Solubility, e/\text{cm}^3 gas (g water)^-1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water, distilled</td>
<td>0.078</td>
<td>0.089</td>
<td>0.0785</td>
</tr>
<tr>
<td>Lipoidal suspension of dog blood</td>
<td>0.120</td>
<td>0.136</td>
<td>--</td>
</tr>
<tr>
<td>Human blood</td>
<td>0.123</td>
<td>0.140</td>
<td>0.156</td>
</tr>
<tr>
<td>Dog blood</td>
<td>0.141</td>
<td>0.160</td>
<td>0.167</td>
</tr>
<tr>
<td>Rabbit blood</td>
<td>0.128</td>
<td>0.146</td>
<td>0.148</td>
</tr>
</tbody>
</table>

1 Calculated by compiler.
2 Water content of blood samples was determined by drying overnight at 110°C and determining loss in weight.
3 Blood lipoids were extracted from blood corpuscles with ethyl ether and petroleum ether.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
A glass bubbling-type of saturator immersed in a constant temperature bath was used. The gas was presaturated with water vapor. A known volume of saturated solution was transferred over mercury into a Van Slyke desorption apparatus. Gas removed in three evacuations was transferred to a sample tube where the volume was determined and a sample of the gas was analyzed. The solubilities were expressed as the Bunsen coefficients.

SOURCE AND PURITY OF MATERIALS:
1. Ethene source and purity not given.
2. Heparin was used as a blood anticoagulant in all cases.

ESTIMATED ERROR:
\[ \delta \beta/\beta = \pm 0.04 \] (compiler)
\[ \delta T/K = \pm 0.05 \]

REFERENCES:
COMPONENTS:
1. Ethene; C₂H₄; [74-85-1]
2. Human blood.
3. Various aqueous solutions.

ORIGINAL MEASUREMENTS:
Orcutt, F.S.; Waters, R.M.


VARIABLES: 
T/K = 298.15
P/kPa = 101.325

PREPARED BY:
W. Hayduk

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>Solution, defined below</th>
<th>Ostwald coefficient L/cm³(gas) cm⁻³(solvent solution)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>0.118</td>
</tr>
<tr>
<td>II</td>
<td>0.110</td>
</tr>
<tr>
<td>III</td>
<td>0.093</td>
</tr>
</tbody>
</table>

I: Solution I contains 1 cm³ blood added to 2.5 cm³ aqueous acid ferricyanide reagent, total 3.5 cm³.

II: Solution II contains Solution I to which is added 1 cm³ 1N caustic, total 4.5 cm³.

III: Solution III contains Solution II to which is added 1 cm³ alkaline hydrosulfite reagent, total 5.5 cm³.

The value of the Ostwald coefficient in dilute aqueous salt solutions containing blood exceeds that in water suggesting that the Ostwald coefficient in blood is greater than that in water, L = 0.108 cm³ gas/cm³ water. The Ostwald coefficient was estimated by the compiler for "pure" blood using reference 1 and was found to be L = 0.143 cm³ ethene/cm³ blood.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
The Van Slyke-Neill manometric method which is based on the desorption of gases from blood in a partial vacuum was used. A small volume of solvent is saturated with gas by alternately bubbling the gas through the solvent and shaking the saturator at constant temperature and atmospheric pressure. A small, carefully measured volume of saturated solution is drawn into a 50 cm³ burette by lowering the mercury level in it. A partial vacuum is produced releasing most of the gas. The pressure, volume and temperature are measured. Corrections are made for the solvent vapor pressure (assumed to be as for water) and for the residual gas solubility in the solvent at the low pressure. Details in reference 1.

SOURCE AND PURITY OF MATERIALS:
1. Ethene source and purity not specified.
2. Human, blood, not otherwise specified.
3. Aqueous solutions as given above, not otherwise specified.

ESTIMATED ERROR:

δL/ L = ±0.10
(compiler)

REFERENCES:
1. Orcutt, F.S.; Seevers, M.H.

COMPONENTS:
1. Ethene, (Ethylene); C₂H₄; [74-85-1]
2. Olive oil.

ORIGINAL MEASUREMENTS:
Saidman, L.J.; Eger, E.I.; Munson, E.S.; Severinghaus, J.W.
*Anesthesiology, 1966, 27, 180-184.*

VARIABLES:
\[ T/K = 310.2 \]

PREPARED BY:
C.L. Young.

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>( t/°C )</th>
<th>( T/K )</th>
<th>No of Samples</th>
<th>Ostwald coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>37</td>
<td>310.2</td>
<td>6</td>
<td>1.260</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>0.028</td>
</tr>
</tbody>
</table>

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
Modified Scholander apparatus used. Known amount of water equilibrated with a known volume of gas and change in volume used to estimated Ostwald coefficient. Details of apparatus in source and ref. (1).

SOURCE AND PURITY OF MATERIALS:
1. No details given.
2. Degassed.

ESTIMATED ERROR:
\[ \delta T/K = \pm 0.1. \] (estimated by compiler)

REFERENCES:
COMPONENTS:

(1) Ethene or ethylene; C₂H₄; [74-85-1]

(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 a/cm³(STP)cm⁻³atm⁻¹</th>
<th>Ostwald Coefficient L/cm³ cm⁻³</th>
</tr>
</thead>
<tbody>
<tr>
<td>T/K</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10 283.15</td>
<td>0.165</td>
<td>0.164 Av.</td>
</tr>
<tr>
<td></td>
<td>0.162</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.166</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>0.164 Av.</strong></td>
<td>0.170</td>
</tr>
<tr>
<td>20 293.15</td>
<td>0.144</td>
<td>0.142 Av.</td>
</tr>
<tr>
<td></td>
<td>0.141</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.142</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>0.142 Av.</strong></td>
<td>0.152</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) Ethene. No information.

(2) Petroleum. Russian petroleum. Cleaned by boiling in a large copper flask.

ESTIMATED ERROR:

$$\delta a/a = \pm 0.05 \text{ (compiler)}$$

REFERENCES:
Critical Evaluation for Ethene Solubilities in Hydrocarbon Fuels, Russian

Solubilities of ethene in gasoline and kerosenes were reported by Hannaert et al. (1) for temperatures ranging from 233.15 K to 293.15 K expressed as an exponential function of the equilibrium ratio \( K = \frac{y_1}{x_1} \) in which \( y_1 \) and \( x_1 \) are mole fractions in the gas, and liquid phase, respectively. It was possible to calculate mole fractions because the boiling fractions and densities of these hydrocarbons were measured and were associated with certain average molecular weights. In consequence, the results must be of lower accuracy because the true composition was actually unknown. The authors claimed accuracies ranging from 2% to 15%.

Hannaert et al. (1) also reported solubilities of ethene in two types of Carbowax for a range of temperatures from 273.15 K to 353.15 K. As for gasoline and kerosenes, a similar exponential function was used to express the solubility results. Here also, the molecular weights of the Carbowax had been previously determined so that mole fraction solubilities could be determined.

Both results of Hannaert et al. (1) are classified as tentative.

Chou and Chao (2) reported solubilities of ethene in Fischer-Tropsch SASOL wax for pressures ranging from 1.016 MPa to 5.163 MPa and for temperatures 473.2 K and 533.1 K. The results are consistent and obey Henry's law.

These data are classified as tentative.

Safronova and Zhuze (3,4) reported ethene solubilities in three Russian crude oils for three temperatures, 293 K, 323 K and 373 K for pressures to 20 MPa, in the form of modified Bunsen coefficients. In the first paper, published in 1958, some numerical results were reported and in the second paper, published in 1962, only graphical results were reported, for the same crude oils. Densities, viscosities and some analyses of the oils were also given. Even for identical conditions deviations between results were up to 9% from the two sources. Thus, the accuracy is probably of this order.

These data are classified as tentative.

References
COMPONENTS:
(1) Ethene or ethylene; C₂H₄; [74-85-1]
(2) Kerosenes; Gasoline.

VARIABLES:
T/K = 233.15 - 293.15

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>Temperature Interval of Measurements</th>
<th>Ethene Mol % Range</th>
<th>Enthalpy of Dissolution A</th>
<th>Constant A</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>10²x₂/mol %</td>
<td>293.15 K</td>
<td></td>
</tr>
<tr>
<td>Kerosene A-1</td>
<td>1 - 2</td>
<td>44</td>
<td>2.65</td>
</tr>
<tr>
<td>Kerosene A-2</td>
<td>1 - 2</td>
<td>44</td>
<td>2.41</td>
</tr>
<tr>
<td>Kerosene A-3</td>
<td>2 - 5</td>
<td>48</td>
<td>2.74</td>
</tr>
<tr>
<td>Gasoline</td>
<td>1 - 3</td>
<td>43</td>
<td>2.42</td>
</tr>
</tbody>
</table>

1 log (Kπv/atm) = A - (ΔH/cal mol⁻¹)/(2.3R(T/K))

The author's definitions are:

\[ K = y_1/x_1 = \text{mole fraction gas in gas phase} \]
\[ \pi/\text{atm} = \text{total pressure}, \]
\[ \nu = \text{coefficient of fugacity}. \]

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
The authors describe three methods:

1.A. [Saturat. n°1]. A measure of the static pressure of saturation in an apparatus which gave a precision of 10 - 15 %.

1.B. [Saturat. n°2]. A measure of the static pressure of saturation in an apparatus which gave a precision of 2 - 5 %.

2. [Chromato]. A Gas liquid chromatographic method estimated to have a precision of 2 - 5 %.

3. [Anal. directe]. Direct analysis of the gaseous and liquid phases.

Method 1.B. was used for all of the kerosene systems except kerosene A-6/A-5 between 243 and 293 K for which method 1.A. was used.

SOURCE AND PURITY OF MATERIALS:

(1) Ethene. Air Liquide. For narcosis, 99.9 per cent.
(2) Kerosenes and gasoline.

<table>
<thead>
<tr>
<th>Distillation Range, t°C</th>
<th>Density p²/cm³</th>
<th>mol wt</th>
</tr>
</thead>
<tbody>
<tr>
<td>A-1 150-280</td>
<td>0.7805</td>
<td>170</td>
</tr>
<tr>
<td>A-2 150-185</td>
<td>0.7700</td>
<td>145</td>
</tr>
<tr>
<td>A-3 207-255</td>
<td>0.784</td>
<td>192</td>
</tr>
<tr>
<td>Gasoline 94-168</td>
<td>0.7521</td>
<td>122</td>
</tr>
</tbody>
</table>

ESTIMATED ERROR:

The function, Kπv/atm, is equivalent to a Henry's constant in the form

\[ H_{1,2}/\text{atm} = (f_2/\text{atm})/x_1 \]

where \( f_2 \) is the fugacity.
COMPONENTS:
(1) Ethene or ethylene; C₂H₄;
[74-85-1]
(2) Carbowaxes;
Carbowax 400,
Carbowax 350.

ORIGINAL MEASUREMENTS:
Hannaert, H.; Haccuria, M.;
Mathieu, M. P.
Ind. Chim. Belge 1967, 32,
156-164.

VARIABLES:
T/K = 273.15 - 353.15

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>Temperature Interval of Measurements</th>
<th>Ethene % Range at 293.15 K</th>
<th>Enthalpy of Dissolution</th>
<th>Constant A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbowax 400 273.15-353.15</td>
<td>---</td>
<td>83</td>
<td>1.69</td>
</tr>
<tr>
<td>Carbowax 350 293.15-313.15</td>
<td>---</td>
<td>81.5</td>
<td>2.66</td>
</tr>
</tbody>
</table>

1 \log (Kπν/\text{atm}) = A - (\Delta H/\text{cal mol}^{-1})/2.3R(T/K)

The author's definitions are:

\( K = y_1/x_1 \) = mole fraction gas in gas phase
mole fraction gas in liquid phase,

\( \pi/\text{atm} = \) total pressure,

\( ν = \) coefficient of fugacity.

The function, \( K\pi\nu/\text{atm} \), is equivalent to a Henry's constant in the form

\( H_{1,2}/\text{atm} = (f_1/\text{atm})/x_1 \) where \( f_1 \) is the fugacity.

AUXILIARY INFORMATION

METHOD/APPAUSRATUS/PROCEDURE:
The authors describe three methods:

1.A. [Saturat. n°1]. A measure of the static pressure of saturation in an apparatus which gave a precision of 10 - 15 %.

1.B. [Saturat. n°2]. A measure of the static pressure of saturation in an apparatus which gave a precision of 2 - 5 %.

2. [Chromato]. A Gas liquid chromatographic method estimated to have a precision of 2 - 5 %.

3. [Anal. directe]. Direct analysis of the gaseous and liquid phases.

Method 2 was used for these systems.

SOURCE AND PURITY OF MATERIALS:
(1) Ethene. Air Liquide. For narcosis, 99.9 per cent.

ESTIMATED ERROR:

REFERENCES:
COMPONENTS:
1. Ethene; C₂H₄; [74-85-1]
2. Fischer-Tropsch SASOL wax

ORIGINAL MEASUREMENTS:
Chou, J.S.; Chao, K-C.

VARIABLES:
T/K = 473-533; p/MPa = 1-5;

PREPARED BY:
C.L. Young

EXPERIMENTAL VALUES:
<table>
<thead>
<tr>
<th>T/K (t/°C)</th>
<th>p/atm</th>
<th>p/MPa</th>
<th>Solubility/mol kg⁻¹</th>
</tr>
</thead>
<tbody>
<tr>
<td>473.2 (200.0)</td>
<td>10.06</td>
<td>1.016</td>
<td>0.234</td>
</tr>
<tr>
<td>20.12</td>
<td>2.039</td>
<td>0.491</td>
<td></td>
</tr>
<tr>
<td>29.99</td>
<td>3.039</td>
<td>0.746</td>
<td></td>
</tr>
<tr>
<td>39.97</td>
<td>4.050</td>
<td>1.01</td>
<td></td>
</tr>
<tr>
<td>49.90</td>
<td>5.056</td>
<td>1.26</td>
<td></td>
</tr>
<tr>
<td>533.1 (259.9)</td>
<td>10.04</td>
<td>1.017</td>
<td>0.200</td>
</tr>
<tr>
<td>20.12</td>
<td>2.039</td>
<td>0.416</td>
<td></td>
</tr>
<tr>
<td>30.90</td>
<td>3.131</td>
<td>0.633</td>
<td></td>
</tr>
<tr>
<td>40.04</td>
<td>4.057</td>
<td>0.851</td>
<td></td>
</tr>
<tr>
<td>50.95</td>
<td>5.163</td>
<td>1.07</td>
<td></td>
</tr>
</tbody>
</table>

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
Single pass flow method. Gas passed through presaturator then equilibrium cell. At equilibrium liquid samples withdrawn, pressure released, solidified hydrocarbon collected in glass trap and weighed. Gas estimated volumetrically. Temperature measured with chromel-alumel thermocouple and pressure with Bourdon gauge.

SOURCE AND PURITY OF MATERIALS:
1. Matheson sample, purity at least 99.5 mole %.
2. SASOL wax, av carbon no. 43, av. mol wt 605, 74% paraffins, 14% monoolefins, 12% oxygenates, % branching 0.05, carbon no range 20-250.

ESTIMATED ERROR:
δT/K = ± 0.1; δp/MPa = ±0.05
δSolubility = ±1.5%

REFERENCES:
COMPONENTS:
1. Ethene; C₂H₄; [74-85-1]
2. Three crude oil solvents;
some properties given below:

ORIGINAL MEASUREMENTS:
Safronova, T.P.; Zhuze, T.P.


VARIABLES:
$T/K = 293.15 - 373.15$
$P/MPa = 5.07 (50 atm)$

PREPARED BY:
W. Hayduk

EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>t/C</th>
<th>$T/K$</th>
<th>Solvent I</th>
<th>Solvent II</th>
<th>Solvent III</th>
<th>$P/\text{atm} (\text{MPa})$</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>293.15</td>
<td>3.22</td>
<td>2.11</td>
<td>1.67</td>
<td>25 (2.53)</td>
</tr>
<tr>
<td>50</td>
<td>323.15</td>
<td>1.15</td>
<td>1.15</td>
<td>1.15</td>
<td>50 (5.07)</td>
</tr>
<tr>
<td>100</td>
<td>373.15</td>
<td>1.00</td>
<td>0.73</td>
<td>0.73</td>
<td>50 (5.07)</td>
</tr>
</tbody>
</table>

1Data for the solubilities were shown only graphically as a function of pressure. Values for the lower pressure region for which the relation was linear, were read from enlarged graphs by the compiler. Additional data were shown to at least 10.1 MPa.

Some properties of the solvents are shown below:

<table>
<thead>
<tr>
<th>Solvent Density, $\rho$, g cm⁻³</th>
<th>Fraction Solvent Vaporized, %</th>
<th>Average Composition of Vapor, %</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>To 473K From 473 to 573K</td>
<td>To 473K From 473 to 573</td>
</tr>
<tr>
<td>I 0.8530</td>
<td>25</td>
<td>19.5</td>
</tr>
<tr>
<td>II 0.8494</td>
<td>18</td>
<td>23.5</td>
</tr>
<tr>
<td>III 0.8713</td>
<td>20</td>
<td>20</td>
</tr>
</tbody>
</table>

Solvents: I = Romashkinskaya; II = Surakhanskaya; III = Nebitdagskaya
Fractions: A = Paraffin; B = Naphthenic; C = Aromatic
please see next page for (apparently) same data published in a different form.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
The apparatus and procedure are described in reference 1.

SOURCE AND PURITY OF MATERIALS:
1. Ethene purity and source not specified.
2. Solvents. The names of the oils must designate their source.

ESTIMATED ERROR:
$\delta K_B = \pm 6\%$ (compiler)

REFERENCES:
1. Safronova, T.P.; Zhuze, T.P.
## EXPERIMENTAL VALUES:

<table>
<thead>
<tr>
<th>Temperature (°C)</th>
<th>Pressure (p/MPa)</th>
<th>Solubility Coefficient (/cm³ cm⁻³ atm⁻¹)</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>25</td>
<td>0.616</td>
</tr>
<tr>
<td></td>
<td>50</td>
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### SOURCE AND PURITY OF MATERIALS:

1) Ethene.

2) Petroleum crude oils. Three crude oils. Descriptions given above. Additional information on composition in the paper.

### ESTIMATED ERROR:

The compiler estimates the data have an uncertainty of 3 to 5 percent.

### REFERENCES:

Safronova, T. P.; Zhuze, T. P.

Khim. i Tekhnol. Topliva i Nasyel 1958, 3 (2), 41-46.

Chem. Abstr. 1958, 52, 8518d.
# 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-). The word "aqueous" or "ternary" in brackets after the solvent name designates that the solvent is in solution with water, or is one component of a multicomponent non-aqueous solvent solution, respectively.

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