IUPAC-NIST Solubility Data Series. 76. Solubility of Ethyne in Liquids

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Ethyne was probably first made in the laboratory by Edmund Davy in 1836. It was rediscovered nearly a quarter of a century later by Berthelot who gave it the name acetylene. Since that time ethyne has become a cheap raw material for the synthesis of organic materials and an important industrial fuel. A summary of the available solubility data for ethyne was published by Miller in 1965 [S. A Miller, *Acetylene—Its Properties, Manufacture, and Uses* (Academic, New York, 1965), Vol. I]. Many more data are now available in a wide range of research papers and patent applications. These data vary in their reliability. In the current work the data for systems included in Miller's book have been reassessed and complemented by data published more recently. Literature has been surveyed to 1999. Data for a system may be unreliable unless two or more groups of workers have published values in close agreement. Where possible values of the mole fraction solubility at a partial pressure of 101.3 kPa have been tabulated. Equations have been given for the variation of mole fraction with temperature in cases in which values over a temperature range are available. The greater the number of independent sources of the data the more the reliance which can be placed on the utility of the resulting equation. Extrapolation of such equations beyond the temperature range of experimental measure-

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ments can lead to errors. In many of the systems it may be assumed that approximate values of the mole fraction solubility, x_1, at a partial pressure of 101.3 kPa may be obtained by linear extrapolation of values for lower partial pressures, p_1, on the assumption that x_1/p_1 is approximately constant. However a similar linear extrapolation of solubilities at pressures appreciably higher that 101.3 kPa to give mole fraction solubilities at 101.3 kPa can lead to gross errors. For the purpose of evaluation of data use has been made of the Krichevsky–Il'inskaya equation to obtain approximate values of solubilities at 101.3 kPa from measurements at higher pressures. These values were then compared with measurements made at or near to 101.3 kPa. © *2001 American Institute of Physics.*

Key words: acetylene; ethyne; liquid–gas systems; solubility.

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1. Preface

Ethyne was probably first made in the laboratory by Edmund Davy in 1836. It was rediscovered nearly a quarter of a century later by Berthelot who gave it the name acetylene. Since that time ethyne has become a cheap raw material for the synthesis of organic materials and an important industrial fuel.

Due to the presence of a triple bond it undergoes addition reactions with halogens, halogen acids, hydrogen cyanide, aldehydes, ammonia, water, amines, and amides. The weakly acidic hydrogen atoms can be replaced by metals to form acetylides. It can readily form vinyl compounds which may be polymerised to give important polymers.

Ethyne burns with the evolution of much heat. The enthalpy of combustion is high ($-\Delta H°(298\,\mathrm{K}) = 1301\,\mathrm{kJ\,mol^{-1}}$). The flame from an oxyacetylene torch can reach about 3300 °C.

Ethyne has a low toxicity and only acts as a simple asphyxiant. It forms an explosive mixture with air over a range of 2.5%–12.5% by volume. The pure gas is liable to decompose explosively into its elements at total pressures above 206 kPa. However, it may be stored in solution at much greater pressures.

Much of the experimental work on solubility has been instigated to find suitable solvents for gas storage or removal of ethyne from mixed gas streams. There has also been the need to quantify the behavior of the gas when in contact with liquids during industrial syntheses. Acetone is the usual solvent for storage but there has been much interest in less volatile solvents.

A summary of the available solubility data for ethyne was published by Miller[1] in 1965. Many more data are now available in a wide range of research papers and patent applications. These data vary in their reliability. In the current work the data for systems included in Miller's book have been reassessed and complemented by data published more recently. Literature has been surveyed to 1999.

Data for a system may be unreliable unless two or more groups of workers have published values in close agreement. Where possible values of the mole fraction solubility at a partial pressure of 101.3 kPa have been tabulated. Equations have been given for the variation of mole fraction with temperature in cases in which values over a temperature range are available. The greater the number of independent sources of the data the more the reliance which can be placed on the utility of the resulting equation. Extrapolation of such equations beyond the temperature range of experimental measurements can lead to errors.

In many of the systems it may be assumed that approximate values of the mole fraction solubility x_1 at a partial pressure of 101.3 kPa may be obtained by linear extrapolation of values for lower partial pressures p_1 on the assumption that x_1/p_1 is approximately constant. However, a similar linear extrapolation of solubilities at pressures appreciably higher that 101.3 kPa to give mole fraction solubilities at 101.3 kPa can lead to gross errors. For the purpose of evaluation of data use has been made of the Krichevsky–Il'inskaya equation[2] to obtain approximate values of solubilities at 101.3 kPa from measurements at higher pressures. These values were then compared with measurements made at or near to 101.3 kPa. The equation may be written:

$$\ln\frac{f_1/\mathrm{kPA}}{x_1} = \ln(H^o/\mathrm{kPa}) - A(1+x_2^2) + p_1\frac{V^*}{RT},$$

where f_1 is the fugacity of ethyne; H^o the limiting value of the ratio p_1/x_1; and V^* the partial molar volume of the gas at infinite dilution. As an approximation the fugacity may be replaced by the partial pressure. The value of V^* may be estimated from changes in volume of solution caused by dissolution of gas if these data are available. However the term p_1V^*/RT is often small and may sometimes be neglected if it cannot be estimated.

As an approximation for a two component system the equation may be written:

$$\ln\left(\frac{p_1/\mathrm{kPa}}{x_1}\right) - \frac{p_1V^*}{RT} = \ln H^o/\mathrm{kPa} - A(1-x_2^2)$$
$$= \ln H^o/\mathrm{kPa} - Ax_1(2-x_1)$$

since $x_2 = (1-x_1)$ for a two component system.

A plot of the left hand side of the above equation against $x_1(2-x_1)$ should approximate to a straight line with slope $-A$ and intercept $\ln H^o/\mathrm{kPa}$. The value of x_1 at $p_1/\mathrm{kPa} = 101.3$ can then be calculated by a reiterative process.

The editor is grateful for help and encouragement given to him by other members of the IUPAC Commission on Solubility Data.

Peter G. T. Fogg
London
February 2001

1.1. References for the Preface

[1] S. A Miller, *Acetylene—Its Properties, Manufacture and Uses* (Academic, New York, 1965), Vol. I.
[2] I. R. Krichevsky and A. A. Il'inskaya, Acta Physicochim. URSS **20**, 327 (1945).

2. Introduction to the Solubility Data Series Solubility of Gases in Liquids

2.1. The 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.

2.2. Compilations and Evaluations

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

2.2.1. 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) nonsaturating 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 Data

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 percent for weight percent; mol dm^{-3} for molar; etc. Usually, only one type of value (e.g., mass percent) 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, conversion 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 numerous sources.[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.

2.2.2. 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 estimated 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.

2.3. Quantities and Units Used in Compilation and Evaluation of Solubility Data

2.3.1. 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 properties 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 equilibrium.

2.3.2. 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, IUPAC Green Book.[3] A few quantities follow the ISO standards[14] or the German standard;[15] see a review by Cvitaš[16] for details.

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 $x(1)$ (condensed phases) or y_1 (gases):

$$x_1 = n_1 \Big/ \sum_{s=1}^{c} n_s \tag{1}$$

when 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 percent* 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_{s+} cations and v_{s-} anions, with $v_s = v_{s+} + v_{s-}$ and a mixture of p nonelectrolytes j, of which some may be solvent components, a generalization of the definition in Ref. 17 gives:

$$x_{+i} = \frac{v_{+i} x_{+i}}{1 + \sum_{j=1}^{s} (v_j - 1) x_j}, \quad x_{-i} = \frac{v_{-i} x_{+i}}{v_{+i}} \quad i = 1 \ldots s \tag{2}$$

$$x'_j = \frac{x_j}{1 + \sum_{i=1}^{s} (v_i - 1) x_i}, \quad j = (s+1) \ldots p. \tag{3}$$

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

$$\sum_{i=1}^{s} (x_{+i} + x_{-i}) + \sum_{i=s+1}^{c} x'_i = 1. \tag{4}$$

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

$$x_1 = \frac{v_{2+} x'_1}{v_{2+} - (v_2 - 1) x_{2+}} \quad x_2 = \frac{x_{2+}}{v_{2+} - (v_2 - 1) x_{2+}}. \tag{5}$$

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 $w(1)$:

TABLE 1. Interconversions between quantities used as measures of solubilities c-component systems containing c-1 solutes i and single solvent c (ρ—density of solution; M_i—molar masses of i. For relations for two-component systems, set summations to 0.)

	x_i	w_i	m_i	c_i
$x_i=$	x_i	$\dfrac{1}{1+\dfrac{M_i}{M_c}\left\{\dfrac{1}{w_i}-1+\sum_{j\neq 1}^{c-1}\left(\dfrac{M_c}{M_j}-1\right)\dfrac{w_j}{w_i}\right\}}$	$\dfrac{1}{1+\dfrac{1}{m_iM_c}+\sum_{j\neq i}^{c-1}\dfrac{m_j}{m_i}}$	$\dfrac{1}{1+\dfrac{1}{M_c}\left(\dfrac{\rho}{c_i}-M_i\right)+\sum_{j\neq i}^{c-1}\dfrac{c_j}{c_i}\left(1-\dfrac{M_j}{M_c}\right)}$
$w_i=$	$\dfrac{1}{1+\dfrac{M_c}{M_i}\left\{\dfrac{1}{x_i}-1+\sum_{j\neq i}^{c-1}\left(\dfrac{M_j}{M_c}-1\right)\dfrac{x_j}{x_i}\right\}}$	w_i	$\dfrac{1}{1+\dfrac{1}{m_iM_i}\left(1+\sum_{j\neq i}^{c-1}m_jM_j\right)}$	$\dfrac{c_iM_i}{\rho}$
$m_i=$	$\dfrac{1}{M_c\left(\dfrac{1}{x_i}-1-\sum_{j\neq i}^{c-1}\dfrac{x_j}{x_i}\right)}$	$\dfrac{1}{M_i\left(\dfrac{1}{w_i}-1-\sum_{j\neq i}^{c-1}\dfrac{w_j}{w_i}\right)}$	m_i	$\dfrac{1}{\dfrac{1}{c_i}\left(\rho-\sum_{j\neq i}^{c-1}c_jM_j\right)-M_i}$
$c_i=$	$\dfrac{\rho}{M_i+M_c\left\{\dfrac{1}{x_i}-1+\sum_{j\neq i}^{c-1}\left(\dfrac{M_j}{M_c}-1\right)\dfrac{x_j}{x_i}\right\}}$	$\dfrac{\rho w_i}{M_i}$	$\dfrac{\rho}{\dfrac{1}{m_i}\left(1+\sum_{j\neq i}^{c-1}m_jM_j\right)+M_j}$	c_i

$$w_1=g_1\Big/\sum_{s=1}^{c}g_s \tag{6}$$

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

4. *Molality* of solute 1 in a solvent 2, m_1:

$$m_1=n_1/n_2M_2 \tag{7}$$

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:

$$c_1=[\text{formula of solute}]=n_1/V \tag{8}$$

SI base units: mol m^{-3}. The symbol c_1 is preferred to [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, ρ_1 or γ_1:

$$\rho_1=g_1/V \tag{9}$$

SI base units: kg m^{-3}.

7. *Mole ratio*, $r_{\mathrm{A,B}}$ (dimensionless)[15]

$$r_{\mathrm{A,B}}=n_1/n_2. \tag{10}$$

Mass ratio, symbol $\zeta_{\mathrm{A,B}}$, may be defined analogously[15]

8. *Ionic strength*, I_{m} (molality basis), or I_c (concentration basis):

$$I_m=\frac{1}{2}\sum_i m_iz_i^2,\quad I_c=\frac{1}{2}\sum_i c_iz_i^2 \tag{11}$$

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 nonsaturating components. For a single salt i with ions of charges z_+, z_-,

$$I_m=|z_+z_-|\upsilon m_i,\quad I_c=|z_+z_-|\upsilon c_i. \tag{12}$$

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,[4,5,7,18] 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 nonideality 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 =0.101 325 MPa rather than 1 bar=0.1 MPa.

9. *Bunsen coefficient* α (dimensionless): The volume of saturating gas, V_1, reduced to $T°=273.15$ K, $p°=1$ bar, which is absorbed by unit volume V_2^* of pure solvent at the temperature of measurement and partial pressure $p°=1$ bar. If the gas is ideal, Henry's law (see below) holds, and the liquid is incompressible, then

$$\alpha=\frac{V_1^\circ}{V_2^*}=\left(\frac{V_1}{V_2^*}\right)\left(\frac{T^\circ}{T}\right). \tag{13}$$

10. *Kuenen coefficient*, S:

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

$$S = \frac{V_1 T^\circ}{g_2 T} = \frac{\alpha V_{m,2}}{M_2} \tag{14}$$

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):[18] 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,

$$L = \frac{V_1}{V_2^*} = \left(\frac{\alpha T}{T^\circ}\right)\left(\frac{p^\circ}{p}\right). \tag{15}$$

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

12. *Absorption coefficient*, β (dimensionless): The most common of several definitions of absorption coefficient is the volume of gas, reduced to $T^\circ = 273.15$ K, $p^\circ = 1$ 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

$$\beta = \alpha(1 - p_2/p^\circ) \tag{16}$$

where p_2 is the partial pressure of the vapor of the solvent.

13. *Henry's Law constant*, k_H:

$$K_H = \lim_{x_1 \to 0} (p_1/x_1) \tag{17}$$

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:

$$K_2 = p_1/c_1$$

and

$$K_c = c_1^g/c_1 \tag{18}$$

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 constant. 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.

$$x_1 = \frac{1}{1 + \dfrac{RT^\circ}{p_1^\circ V_{m,2}^* \alpha}} = \frac{1}{1 + \dfrac{RT^\circ}{p_1^\circ M_2 S}} = \frac{1}{1 + \dfrac{RT^\circ}{p_1^\circ V_{m,2}^* L}}$$

$$= \frac{1}{1 + \dfrac{RT^\circ}{p^\circ V_{m,2}^* \beta}}. \tag{19}$$

14. *Salt Effects on the Solubility of Gases*:[19] These are often reported as Sechenov (Setchenow, Setschenow) salt effect parameters k_{syz}, which are defined in various ways. The general semi-empirical Sechenov equation is

$$\log(z_1^\circ/z_1) = k_{syz} y \tag{20}$$

where solubility is expressed in quantities z, with superscript o designating pure solvent, and salt composition is expressed in quantities y. The quantities c_2, m_2, x_2', I_m and I_c are used for y, and the quantities c_1, m_1, x_{1+}, a, S and L for z, giving 30 definitions of k_{syz}. Here, components 1 and 2 are the gaseous solute and electrolyte, respectively. The ratios of z values are the same for $z = c_1$, α and L and for m_1 and S, respectively, leaving 15 distinct definitions. If z is the same, the definitions of k_{syz} are related simply through ten equations between pairs of c_1, m_2, x_2^*, I_m and I_c. Some relations among the definitions, in terms of k_{scc}, k_{smm} and k_{sxx}, are:

$$k_{scc} = k_{sc\alpha} = k_{scL} = \frac{m_2}{c_2} k_{smc} = \frac{x_{2'}}{c_2} k_{sxc} = \frac{I_c}{c_2} k_{sI_c c}$$

$$k_{smm} = \frac{x_{2'}}{m_2} k_{sxm} = k_{smS} = \frac{c_2}{m_2} k_{scm} = \frac{I_m}{m_2} k_{sI_m m} \tag{21}$$

$$k_{sxx} = \frac{c_2}{x_{2'}} k_{scx} = \frac{m_2}{x_{2'}} k_{smx} = \frac{I_m}{x_{2'}} k_{sI_m x} = \frac{I_c}{x_{2'}} k_{sI_c x}.$$

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_{scc}, k_{smm} and k_{sxx} are more complicated and can be found using Eq. (5) and Table 1 at the end of this Introduction. For example,

$$k_{sxx} = f(m)\left(\frac{k_{smm}}{v_{2+}} + \frac{1}{m_2}\log\frac{f(m)}{f(m^\circ)}\right) \tag{22}$$

where

$$f(m) = 1 + (m_1 + v_2 m_2) M_3, \quad f(m^\circ) = 1 + m_1^\circ M_3. \tag{23}$$

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_{scc} is

$$\frac{s(k_{scc})}{k_{scc}} = \frac{\sqrt{2}}{c_2 k_{scc} \ln 10} \frac{s(c_1)}{c_1}. \tag{24}$$

For example, for $k_{scc} = 0.1$ and $c_2 = 0.01$ mol dm^{-3}, $s(k_{scc})/k_{scc}$ is 30% when $s(c_1)/c_1 = 0.05\%$ and 1200% when $s(c_1)/c_1 = 2\%$. At $c_2 = 1$ 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 nonideality of the gas. See Ref. 18 for details.

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

15. *Density*, ρ or γ:

$$\rho = g/V \tag{25}$$

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

16. *Relative density*, $d=\rho/\rho^\circ$: 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* in no longer used.

Thermodynamics of Solubility (Ref. 20)

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

$$\ln x_1 = A + B(\mathrm{K}/T) + C\ \ln(T/\mathrm{K}) + D(T/\mathrm{K}) \tag{26}$$

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:

$$\Delta G^\circ_{m,1} M_3/R = -A(T/\mathrm{K}) - B - C(T/\mathrm{K})\ln(T/\mathrm{K}) - D(T/\mathrm{K})^2 \tag{27}$$

$$\Delta S^\circ_{m,1}/R = A + C\ \ln(T/\mathrm{K}) + C + 2D(T/\mathrm{K}) \tag{28}$$

$$\Delta H^\circ_{m,1} M_3/R = -B + C(T/\mathrm{K}) + D(T/\mathrm{K})^2 \tag{29}$$

$$\Delta C^\circ_{m,p} M_3/R = C + 2D(T/\mathrm{K}). \tag{30}$$

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

2.4. References for the Introduction

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December, 1995

3. Critical Evaluations and Compilations of Solubility Data

3.1. Water

Components:
(1) Ethyne; C_2H_2; [74-86-2]
(2) Water, H_2O; [7732-18-5]

Evaluator:
Peter G. T. Fogg, Univeristy of North London, London, United Kingdom.

Critical Evaluation

The solubility in water has been measured by various workers.[2–13] A fitting equation based upon eight data points in the range 274–343 from the available data was published by Wilhelm *et al.*[1] This equation may be written in the form

$$\ln x_1 = -156.603 + 8165.06/(T/\mathrm{K}) + 21.4152 \ln(T/\mathrm{K}).$$

The present evaluator has found that values of the mole fraction solubility at a partial pressure of 101.3 kPa based on all the data from Refs. 2–5, 7–9, and 11–13 fit the equation

$$\ln x_1 = -282.531 + 13\,707.8/(T/\mathrm{K}) + 40.255 \ln(T/\mathrm{K})$$

standard deviation in values of $x = 3.59 \times 10^{-5}$.

This equation is valid for 273–343 K.

In the range 280–310 K values from this equation lie within about 2.5% of those from Wilhelm's equation. At 273.15 K the above equation indicates a mole fraction solubility of 1.480×10^{-3} compared with 1.400×10^{-3} from Wilhelm's equation. The difference at 343.15 K is much greater. The above equation gives a value of 5.160×10^{-4}, whereas Wilhelm's equation gives 4.17×10^{-4}. The difference at higher temperatures is probably due to the weight given to the data published by Flid and Golynets. The present evaluator has used solubilities at four temperatures from this paper. Wilhelm *et al.* used the value at one temperature only.

References:

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Components:
(1) Ethyne; C_2H_2; [74-86-2]
(2) Water, H_2O; [7732-18-5]
(3) Electrolytes

Original Measurements:
J. Billitzer, Z. Phys. Chem. **40**, 535–544 (1902)

Variables:
T/K = 288.15;
p_1 /kPa = 101.3

Prepared By:
P. G. T. Fogg

Experimental Data

Temperature = 15 °C; 288.15 K. p_1 = 760 mm Hg; 101.3 kPa

Electrolyte	Normality of solution	C_3 /mol dm^{-3}*	Ostwald coefficient, L
(Pure water)			1.215
Barium hydroxide;	0.025	0.0125	1.218
$Ba(OH)_2$; [17194-00-2]	0.1	0.05	1.23
	0.15	0.075	1.24
Calcium hydroxide;	0.04	0.02	1.23
$Ca(OH)_2$; [1305-62-0]			
Ammonia; NH_3; [7664-41-7]	0.01	0.01	1.216
	0.1	0.1	1.218
	0.25	0.25	1.22
	0.5	0.5	1.225
	1	0.1	1.23
	2	0.2	1.235
	3	3	1.24
Sodium hydroxide;	0.01	0.01	1.21
NaOH; [1310-73-2]	0.05	0.05	1.2
	0.1	0.1	1.18
	0.25	0.25	1.128
	0.5	0.5	1.04
	1	1	0.885
	2	2	0.6
	3	3	0.37
Potassium hydroxide;	0.01	0.01	1.212
KOH; [1310-58-3]	0.1	0.1	1.185
	0.25	0.25	1.13
	0.5	0.5	1.056
	1	1	0.912
	2	2	0.66
	3	3	0.46
Sodium sulfate; Na_2SO_4; [7757-82-6]	0.1	0.05	1.17
	0.25	0.125	1.068
	0.5	0.25	0.94
	1	0.5	0.72
	2	1	0.34
Sulfuric acid; H_2SO_4; [7664-93-9]	0.1	0.05	1.19
	0.5	0.25	1.12
	1	0.5	1.04
	2	1	0.9
	3	1.5	0.78

*C_3 = concentration of electrolyte.

Auxiliary Information

Method/Apparatus/Procedure:

Purified ethyne was absorbed in a measured volume of aqueous solution with vigorous shaking and temperature control by a themostat. Each solution was subsequently boiled under reflux and the evolved ethyne collected. The volume of ethyne was subsequently reduced to NTP and the Ostwald coefficient calculated.

Source and Purity of Materials:

Ethyne was prepared from calcium carbide and water. It was subsequently purified by allowing it to pass through a solution of potassium bichromate, sulfuric acid and a solution of sodium carbonate.

Estimated Error:

No information.

Components:

(1) Ethyne; C_2H_2; [74-86-2]
(2) Water; H_2O; [7732-18-5]

Original Measurements:

L. W. Winkler, Z. Phys. Chem. **55**, 344 (1906).

Prepared By:

P. G. T. Fogg

Experimental Data

t/°C	T/K	Bunsen coefficient α	x_1
0	273.15	1.73	0.001 41
10	283.15	1.31	0.001 07
20	293.15	1.03	0.000 84
30	303.15	0.84	0.000 68

Auxiliary Information

No information.

Components:
(1) Ethyne; C_2H_2; [74-86-2]
(2) Water; H_2O; [7732-18-5]

Original Measurements:
R. Schoen, Z. Physiol. Chem. **127**, 243 (1923)

Variables:
T/K = 290.65–316.15; p_1 /kPa = 53.8–86.9

Prepared By:
P. G. T. Fogg

Experimental Data

t/°C	T/K	P_{total}/ mm Hg	%C_2H_2 in gas	Vol. of C_2H_2 in 1 cm^3 of water*	Bunsen coefficient, α	x_1 at p_1 = 101.3 kPa
17.5	290.65	760	76.0	0.832	1.095	0.000 890
17.5	290.65	760	77.0	0.846	1.099	0.000 893
17.5	290.65	760	78.5	0.862	1.098	0.000 893
27.5	300.65	760	53.1	0.473	0.891	0.000 726
30	303.15	760	53.1	0.443	0.834	0.000 681
31	304.15	762	84.7	0.728	0.860	0.000 701
36	309.15	752	66.9	0.504	0.753	0.000 616
36.5	309.65	756	57.3	0.431	0.752	0.000 615
37	310.15	765	62.8	0.466	0.742	0.000 607
37	310.15	756	73.9	0.551	0.746	0.000 610
37.5	310.65	756	56.9	0.421	0.740	0.000 605
37.5	310.65	756	71.4	0.523	0.732	0.000 599
38	311.15	756	71.6	0.518	0.723	0.000 592
39	312.15	764	73.5	0.528	0.718	0.000 588
39.5	312.65	759	69.3	0.494	0.713	0.000 583
40	313.15	772	85.8	0.610	0.711	0.000 582
41.5	314.65	768	53.4	0.373	0.699	0.000 572
43	316.15	762	61.1	0.411	0.673	0.000 551

*Volumes of gas were corrected to 273.15 K and 101.3 kPa and correspond to the solubility at the experimental partial pressure which was equal to the total pressure multiplied by the fraction of ethyne in the gas stream.

The author multiplied these volumes by 760/(p_1 /mm Hg) to obtain values of the Bunsen coefficient α.

Auxiliary Information

Method/Apparatus/Procedure:
Water was saturated with a mixture of air and ethyne in measured proportions at a total pressure equal to atmospheric pressure. The dissolved ethyne was estimated by reaction with mercuric cyanide solution. Full experimental details were described by the author.

Source and Purity of Materials:
Ethyne was obtained from a cylinder. Traces of acetone were removed by storing the gas over water.

Estimated Error:
No information.

Components:
(1) Ethyne; C_2H_2; [74-86-2]
(2) Water; H_2O; [7732-18-5]
(3) Ferriferrocyanide, (Prussian blue); [14038-43-8], [12240-15-2]
Ferric hydroxide; $Fe(OH)_3$; [1309-33-7]

Original Measurements:
A. Gatterer, J. Chem. Soc. **129**, 299–316 (1926).

Variables:
T/K = 283.15–303.15

Prepared By:
P. G. T. Fogg

Experimental Data

Colloid	conc.$_3$ /N	conc$_3$ /mol dm^{-3}	t/°C	T/K	Ostwald coefficient	x_1*
(Pure water)			10	283.15	1.382	0.001
			15	288.15	1.239	0
			20	293.15	1.126	0
			25	298.15	1.030	0
			30	303.15	0.952	0
Prussian blue	0.250	0.0208	10	283.15	1.358	
			15	288.15	1.212	
			20	293.15	1.102	
			25	298.15	1.007	
			30	303.15	0.929	
	0.548	0.0457	10	283.15	1.339	
			15	288.15	1.199	
			20	293.15	1.088	
			25	298.15	0.994	
			30	303.15	0.915	
	1.028	0.0857	10	283.15	1.282	
			15	288.15	1.145	
			20	293.15	1.044	
			25	298.15	0.953	
			30	303.15	0.882	
Ferric hydroxide	0.871	0.2903	10	283.15	1.364	
			15	288.15	1.227	
			20	293.15	1.111	
			25	298.15	1.018	
			30	303.15	0.940	
	0.521	0.1737	10	283.15	1.364	
			15	288.15	1.224	
			20	293.15	1.111	
			25	298.15	1.016	
			30	303.15	0.936	
	0.336	0.1120	10	283.15	1.383	
			15	288.15	1.241	
			20	293.15	1.126	
			25	298.15	1.126	
			30	303.15	0.950	
	0.120	0.0400	10	283.15	1.379	
			15	288.15	1.236	
			20	293.15	1.126	
			25	298.15	1.026	
			30	303.15	0.945	

*Calculated by the compiler with allowance for the vapor pressure of water.

Auxiliary Information

Method/Apparatus/Procedure:

An Ostwald apparatus was used. Solutions were boiled under vacuum to remove air and transferred to a vacuum mixing vessel at 25 °C. The gas was saturated with water vapor at the same temperature. Ferric-ferrocyanide was prepared as described by Zsigmondy.[1] A solution of sodium ferrocyanide (0.5 mol dm^{-3}) was mixed with ferric chloride solution (0.67 mol dm^{-3}). The precipitate was dissolved in a small quantity of sodium ferrocyanide and the solution concentrated by heating in vacuum. The ferric hydroxide sol was prepared by diluting a solution of ferric hydroxide dissolved in acetic acid and boiling until the ratio of acetic acid to ferric hydroxide was between 1:30 and 1:60. The solution was then concentrated by evaporation under reduced pressure. Solutions under test were prepared by dilution of the stock solutions and concentrations measured by gravimetric and volumetric methods.

Source and Purity of Materials:

(1) From CaC_2; purified by chromic acid, potassium hydroxide and then by dissolution in acetone. Purity 97%–100% by volume as indicated by reaction with ammoniacal cuprous chloride.
(2) Distilled.
(3) See above.

Estimated Error:

Error in estimation of volumes ±0.4% (author)

References:

[1]Zsigmondy, *Kolloid Chemie*, 3rd ed. (1920), p. 300.

Components:

(1) Ethyne; C_2H_2; [74-86-2]
(2) Water; H_2O; [7732-18-5] Methanol; CH_4O; [67-56-1]
Dimethylbenzene; C_8H_{10}; [1330-20-7]

Original Measurements:

J. Vitovec, Collect. Czech. Chem. Comm. **33**, 1203–1310 (1968).

Variables:

T/K=293.15; p_1 /kPa=101.32

Prepared By:

P. G. T. Fogg

Experimental Data

Solvent	T/K	Absorption/kg m^{-3}	x_1 at p_1=101.3 kPa*
Water	293.15	1.17	0.00081
Methanol	293.15	13.23	0.02017
Dimethylbenzene	293.15	4.48	0.0206

The compiler has assumed that a mixture of dimethylbenzene isomers was used for the experiment and has taken the density of the solvent to be the average of the values for the three isomers.
*Calculated by the compiler.

Auxiliary Information

Method/Apparatus/Procedure:

A static method was used as described in Vitovec and Fried.[1] A gas buret, fitted to be a water manometer, was first evacuated and then filled with ethyne which had been presaturated with solvent vapor. The water in the manometer had been presaturated with ethyne. The solvent under test was introduced into a magnetically stirred vessel. Water at constant temperature circulated round the buret, manometer, and solvent vessel. Absorption of ethyne was recorded at different times until the solution was saturated. Measurements were carried out in triplicate for each set of conditions. Pressures were corrected to allow for the vapor pressure of the solvent.

Source and Purity of Materials:

(1) Ethyne from a pressure vessel used for welding was purified as described in Ref. 1. The final purity was 99.5%.
(2) Water—freshly distilled; methanol—chemically pure reagent; dimethylbenzene—technical grade.

Estimated Error:

No information.

References:

[1]J. Vitovec and V. Fried, Collect. Czech. Chem. Comm. **25**, 1522 (1960).

Components:
(1) Ethyne; C_2H_2; [74-86-2]
(2) Water; H_2O; [7732-18-5]
(3) Butyne-1,4-diol; [$C_4H_6O_2$]; [110-65-6]

Original Measurements:
P. B. Jadkar and R. V. Chaudhari, J. Chem. Eng. Data **25**, 115–117 (1980).

Variables:
T/K = 280–328; concentration of butyne-1,4-diol

Prepared By:
P. G. T. Fogg

Experimental Data

Concentration of butyne-1,4-diol/mol cm^{-3}	T/K	Solubility of C_2H_2/ 10^{-5} mol cm^3 atm^{-1}	x_1
0	280	6.98	0.001 256
0	285	5.91	0.001 064
0	298	4.17	0.000 753
0	308	3.04	0.000 551
3	298	4.26	
4.9	280	8.53	
4.9	285	6.85	
4.9	298	4.77	
4.9	308	3.76	
4.9	317	3.00	
4.9	328	2.38	
8.8	298	6.01	
9.2	285	9.60	
9.2	298	6.29	
9.2	308	5.05	
9.2	317	4.05	
9.2	328	3.14	

Auxiliary Information

Method/Apparatus/Procedure:
A static method was used. A gas buret, fitted to a water manometer, was first evacuated and then filled with ethyne which had been presaturated with solvent vapor. The water in the manometer had been presaturated with ethyne.
2-Butyne-1,4-diol solution was introduced into a magnetically stirred vessel. Water at constant temperature circulated around the buret, manometer, and solvent vessel. Absorption of ethyne was recorded at different times until the solution was saturated. Measurements were carried out in triplicate for each set of conditions. Pressures were corrected to allow for the vapor pressure of the solvent. Volumes were corrected to 101.3 kPa and 273.15 K. 2-Butyne-1,4-diol content of the solution was estimated by UV spectrometry.

Source and Purity of Materials:
(1) Ethyne, from a cylinder, passed through silica gel to remove acetone. Gas chromatographic analysis indicated a purity of 99.8%.
(2) Water was distilled and degassed.
(3) 2-butyne-1,4-diol was *Fluka* grade (Swiss make; purity 99.8%).

Estimated Error:
δT/K = ±0.05 (authors).

Components:
(1) Ethyne; C_2H_2; [74-86-2]
(2) Water; H_2O; [7732-18-5]
(3) Methanal, (*formaldehyde*); CH_2O; [50-00-0]

Original Measurements:
P. B. Jadkar and R. V. Chaudhari, J. Chem. Eng. Data **25**, 115–117 (1980).

Variables:
T/K = 280–323; p_1 = 101.3 kPa; Concentration of $CH_2O/10^{-3}$ mol cm^{-3} = 0–12.78

Prepared By:
P. G. T. Fogg

Experimental Data

Concentration of formaldehyde/10^{-3} mol cm^{-3}	T/K	Solubility of C_2H_2/ 10^{-5} mol cm^3 atm^{-1}	x_1
0	280	6.98	0.001 256
0	285	5.91	0.001 064
0	298	4.17	0.000 753
0	308	3.04	0.000 551
1.62	298	4.18	
3.25	298	4.17	
6.57	280	6.64	
6.57	285	5.73	
6.57	298	4.01	
6.57	308	3.09	
6.57	317	2.31	
6.57	328	1.76	
9.82	298	4.62	
12.78	280	9.01	
12.78	285	7.63	
12.78	298	5.30	
12.78	308	4.13	
12.78	317	3.22	
12.78	328	2.62	

Auxiliary Information

Method/Apparatus/Procedure:
A static method was used. A gas buret, fitted to a water manometer, was first evacuated and then filled with ethyne which had been presaturated with solvent vapor. The water in the manometer had been presaturated with ethyne.
2-Butyne-1,4-diol solution was introduced into a magnetically stirred vessel. Water at constant temperature circulated round the buret, manometer and solvent vessel. Absorption of ethyne was recorded at different times until the solution was saturated. Measurements were carried out in triplicate for each set of conditions. Pressures were corrected to allow for the vapor pressure of the solvent. Volumes were corrected to 101.3 kPa and 273.15 K. 2-Butyne-1,4-diol content of the solution was estimated by UV spectrometry.

Source and Purity of Materials:
(1) Ethyne, from a cylinder, passed through silica gel to remove acetone. Gas chromatographic analysis indicated a purity of 99.8%.
(2) Water was distilled and degassed.
(3) Formaldehyde solution (38% w/v) was supplied by HOC Ltd.

Estimated Error:
δT/K = ±0.05 (authors).

Components:
(1) Ethyne; C_2H_2; [74-86-2]
(2) Water; H_2O; [7732-18-5]

Original Measurements:
H. Hiraoka, Rev. Phys. Chem. Jpn. **24**, 13–18 (1954).

Variables:
T/K = 274.15–303.15; P/kPa = 490–3923

Prepared By:
P. G. T. Fogg

Experimental Data

t/°C	T/K	Total pressure P/kg cm^2	Total pressure P/kPa	Solubility*/cm^3 g^{-1}	Mole fraction** x_1
1	274.15	5	490	7.82	0.0063
10	283.15	5	490	6.07	0.004 89
10	283.15	10	981	11.7	0.009 39
10	283.15	15	1471	17	0.013 58
20	293.15	5	490	4.81	0.003 88
20	293.15	10	981	9.4	0.007 56
20	293.15	15	1471	13.8	0.011 06
20	293.15	20	1961	17.7	0.014 14
20	293.15	25	2452	20.9	0.016 65
20	293.15	30	2942	24.2	0.019 23
20	293.15	35	3432	26.5	0.021 02
30	303.15	5	490	3.88	0.003 13
30	303.15	10	981	7.83	0.006 3
30	303.15	15	1471	11.5	0.009 23
30	303.15	20	1961	14.8	0.011 85
30	303.15	30	2942	20.7	0.016 49
30	303.15	40	3923	25.6	0.020 32

*The solubility was recorded as the volume of gas, corrected to a partial pressure of 101.3 kPa and a temperature of 273.15 K, which was absorbed by one gram of water at the temperature and pressure of the experiment.
**Calculated by the compiler.

Auxiliary Information

Method/Apparatus/Procedure:
The gas was bubbled into water in a pressure vessel and the equilibrium total pressure measured on a Bourdon type gauge. A sample was then transferred into an analyzer consisting of two connected burettes. The volume of gas remaining in the water when the pressure was reduced to barometric pressure was estimated from Winkler's data.[1] The volume of gas/volume of water was measured at prevailing barometric pressure and temperature. The volume of gas was then adjusted to a partial pressure of 101.3 kPa and temperature of 273.15 K with appropriate allowance for the partial pressure of water.

Source and Purity of Materials:
(1) Ethyne had a purity 99.5%–99.6%.
(2) Water was distilled and freed from carbon dioxide.

Estimated Error:
No information.

References:
[1]L. W. Winkler, Zeit. Phys. Chem. **55**, 344 (1906).

Components:
(1) Ethyne; C_2H_2 ; [74-86-2]
(2) Water; H_2O; [7732-18-5]
(3) Urea; CH_4N_2O; [57-13-6];
1,2-Dimethylbenzenesulfonic acid, sodium salt; $C_6H_6O_3SNa$; [1300-72-7]
1,4-Dimethylbenzenesulfonic acid, sodium salt; $C_6H_6O_3SNa$; [1300-72-7]
Phenol, sodium salt; C_6H_5ONa; [139-02-6]

Original Measurements:
British Oxygen Company; quoted by S. A. Miller in *Acetylene—Its Properties, Manufacture and Uses* (Academic, New York, 1965), Vol. I.

Variables:
T/K = 298.15; P/kPa = 101.3

Prepared By:
P. G. T. Fogg

Experimental Data

Solid	C(solid)/mol dm^{-3}	Solubility of gas/g kg^{-1} of solution
Urea	9.49	0.71
1,2-Dimethylbenzenesulfonic acid	1.6	1.8
1,4-Dimethylbenzenesulfonic acid	1.02	1.1
Phenol, sodium salt	4	0.58

C(solid) = concentration of solid in aqueous solution before dissolution of gas.

Auxiliary Information

Method/Apparatus/Procedure:
No information.

Source and Purity of Materials:
No information.

3.2. Aqueous Solutions of Electrolytes and Nonelectrolytes

Components:
(1) Ethyne; C_2H_2 ; [74-86-2]
(2) Aqueous Solutions of Electrolytes and Nonelectrolytes

Evaluator:
Peter G. T. Fogg, University of North London, London, United Kingdom.

Critical Evaluation

Addition of electrolytes usually reduces the solubility of gases in aqueous solutions. The effect may be expressed in various ways. The Sechenov relationship may be written

$$(1/\text{conc. electrolyte})\log_{10}(S^0/S) = \text{Sechenov coefficient.}$$

The value of the Sechenov coefficient depends on the units used for concentration of electrolyte and of gas. The Sechenov coefficient may be represented in various ways to indicate the particular units used. Common forms are:

$$[(1/c_1\ /\text{mol dm}^{-3})]\log_{10}[(c_{10}\ /\text{mol dm}^{-3})/(c_1\ /\text{mol dm}^{-3})] = k_{\text{SCC}}\ /\text{dm}^3\ \text{mol}^{-1}$$

$$[(1/(m_1\ /\text{mol kg}^{-1})]\log_{10}[(m_{10}\ /\text{mol kg}^{-1})/(m_1\ /\text{mol kg}^{-1})] = k_{\text{SMM}}\ /\text{kg mol}^{-1}$$

$$[(1/m_1\ /\text{mol kg}^{-1})]\log_{10}[x_{01}/x_1] = k_{\text{SMX}}\ /\text{kg mol}^{-1}$$

$$[(1/c_1\ /\text{mol dm}^{-3})]\log_{10}[x_{01}/x_1] = k_{\text{SCX}}\ /\text{dm}^3\ \text{mol}^{-1}$$

$$[(1/m_1\ /\text{mol kg}^{-1})]\log_{10}[(c_{10}\ /\text{mol dm}^{-3})/(c_1\ /\text{mol dm}^{-3})] = k_{\text{SCM}}\ /\text{dm}^3\ \text{mol}^{-1}.$$

The interconversions between various forms of the Sechenov coefficient have been discussed in detail by Clever.[1]

TABLE 2. Approximate Sechenov coefficients, k_{SMM} , from data published by Flid and Golynets.[2] Concentration of salt—mol kg^{-1} (water); concentration of gas—cm^3(NTP) kg^{-1} (water)

Salt	T/K 298.2	323.2	343.2	Salt	T/K 298.2	323.2	343.2
Al_2SO_4	0.652	0.464	0.218	KNO_3	0.029	0.012	−0.006
$CdBr_2$	0.113	0.076	0.021	Li_2SO_4	0.191	0.186	0.097
$CdCl_2$	0.075	0.084	0.037	LiCl	0.072	0.080	0.016
CdI_2	0.045	0.018	0.003	$MgSO_4$	0.249	0.179	0.093
$CdSO_4$	0.216	0.136	0.070	$MnSO_4$	0.222	0.195	0.109
Cr_2SO_4	0.451	0.358	0.176	NaCl	0.077	0.046	0.027
$Fe_2(SO_4)_3$*	0.201	0.265	0.250	$NaNO_3$	0.044	0.026	0.019
$FeSO_4$*	0.186	0.170	0.042	NH_4Cl	0.010	0.016	0.005
K_2SO_4	0.215	0.223	0.203	$NiSO_4$	0.282	0.210	0.110
KBr	0.038	0.037	0.011	$ZnCl_2$	0.043	0.028	0.006
KCl	0.055	0.037	0.022	$ZnSO_4$	0.224	0.148	0.063

*Plus H_2SO_4(0.7 mol kg^{-1}).

Available values of the Sechenov coefficient for $CdCl_2$, $Fe_2(SO_4)_3$,* K_2SO_4, Li_2SO_4, NH_4Cl, and $ZnSO_4$ pass through a maximum over the temperature range (Table 2). In the case of other salts the values decrease with increase in temperature.

Available values of the solubility of ethyne (/cm^3 kg^{-1}(H_2O)): increase with increase in temperature for Al_2SO_4, $CdSO_4$, $MgSO_4$, NaCl, $NiSO_4$, $ZnCl_2$, and $ZnSO_4$; decrease with increase in temperature for CdI_2 ,K_2SO_4 , and $NaNO_3$; pass through minimum values for $CdBr_2$, $CdCl_2$, Cr_2SO_4 , $Fe_2(SO_4)_3$, $FeSO_4$, KBr, KCl, KNO_3 , Li_2SO_4, LiCl, $MnSO_4$, and NH_4Cl.

Manchot *et al.*[3] and also Onda *et al.*[4] measured solubilities in electrolyte solutions at 298.15 K. Values of k_{SCC} for all electrolyte solutions investigated at more than one concentration of salt are given in Table 3. Values of k_{SCC} were obtained by plotting values of $\log_{10}$ (Ostwald coefficient) against concentration of salt. The value for zero concentration was calculated from the recommended data for solubility in pure water. The number of data points includes the point for pure water. In general data from different authors show good consistency as can be seen by values of the standard deviation for k_{SCC} . An exception is the data point for NH_4Cl from Onda *et al.* which is inconsistent with data from Manchot *et al.* and has not been used to calculate the Sechenov coefficient.

TABLE 3. Values of k_{SCC} at 298.15 K from data published by Manchot *et al.* (M); Onda *et al.* (O); and Flid and Golynets (F)

Salt	k_{SCC}	s.d.	Data pts.	Auth.	Salt	k_{SCC}	s.d.	Data pts.	Auth.
$(NH_4)_2SO_4$	0.174	0.003	3	M	$Mg(NO_3)_2$	0.098	0.001	3	M
$Al(NO_3)_3$	0.160	0.005	3	M	$MgCl_2$	0.171	0.004	3	M
$Al_2(SO_4)_3$	0.686	0.010	4	M,F	$MgSO_4$	0.259	0.004	4	M,F
$AlCl_3$	0.270	0.000	3	M	$MnSO_4$	0.238	0.005	4	M,F
$BaCl_2$	0.207	0.003	3	M	Na_2SO_4	0.295	0.001	3	M
$Ca(NO_3)_2$	0.117	0.003	3	M	NaBr	0.090	0.0005	4	M
$CaCl_2$	0.186	0.006	6	M,O	NaCl	0.097	0.003	7	M,F,O
$CoSO_4$	0.247	0.002	3	M	$NaNO_3$	0.065	0.001	5	M,F
$Cr_2(SO_4)_3$	0.426	0.083	4	M,F	NH_3Br	0.029	0.001	4	M
$FeCl_3$	0.189	0.006	3	M	NH_4Cl	0.035	0.002	4	M
K_2SO_4	0.250	0.034	4	M,F	NH_4NO_3	0.003	0.002	4	O
KBr	0.063	0.002	5	M,F	$NiSO_4$	0.280	0.016	4	M,F
KCl	0.075	0.002	4	M,F	$Zn(NO_3)_2$	0.113	0.002	3	M
KNO_3	0.043	0.001	4	M,F	$ZnSO_4$	0.238	0.006	4	M,F

Billitzer[5] measured the solubility in solutions of sulfuric acid to 1.5 mol dm^{-3} at 288.15 K. The value of k_{SCC} is consistent over this range at 0.127 with a linear variation of $\log_{10} L$ with concentration (Fig. 1).

Flid and Golynets[2] made measurements at 298.15–343.15 K and concentrations of sulfuric acid to 25.1 mol kg^{-1}(H_2O) (Fig. 2). There is a complex variation of solubility of gas with concentration of acid over this temperature and concentration range. The initial slope at 298.15 K corresponds to a value of k_{SCC} of 0.0775.

Billitzer measured solubilities in sodium hydroxide and in potassium hydroxide solutions to 3 mol dm^{-3} at 288.15 K. Both solutions show similar salting out effect with slight curvature in the plot of $\log_{10} L$ against c_2 /mol cm^3 (Figs. 3 and 4). Billitzer also measured solubilities in sodium sulfate solution to 1 mol dm^{-3} at 288.15 K. Solubilities decrease with increase in salt concentration and again these measurements also show a slight curvature in the plot of $\log_{10} L$ against salt concentration (Fig. 5). The value of k_{SCC} from these data is 0.459 compared with a value of 0.304 from data for 298.15 published by Manchot *et al.*

Billitzer's measurements at 283 K on ammonia solutions of concentrations from 0.01 to 3.0 mol dm^{-3} indicate an increase in solubility with increase in concentration of ammonia with a nonlinear variation of $\log_{10} L$ with c_2 /mol dm^{-3} (Fig. 6). Hannaert *et al.*[6] measured the solubility over a range of temperatures at a much high concentration of ammonia (about 13 mol dm^{-3}). Their data indicate an Ostwald coefficient of about 1.24 at 288 K. Direct comparison of data is not possible but the two sets of data are not incompatible.

Miller[7] quoted data for the solubility of ethyne in solutions of urea, sodium salt of phenol, and of dimethylbenzene sulfonic acids. No comparative data are available for comparison.

Gatterer[8] measured the effects of colloidal ferriferrocyanide and of ferric hydroxide on the solubility in water of ethyne. The effects are very small and in each case there is an approximately linear decrease in Ostwald coefficient with increase of concentration of colloid.

Jadkar and Chaudhari[9] measured the effect of adding butyne-1-4-diol to water. The solubility of ethyne increases nonlinearly with concentration of diol. Data are self-consistent but no similar data are available for comparison. They also measured solubilities in water plus methanal. At 280–298 K the solubility was shown to decrease to minima at about 6.5 mol dm^{-3} of methanal. At 308 K solubility is approximately constant to about 6.57 mol dm^{-3} of methanal and increase with addition of further methanal.

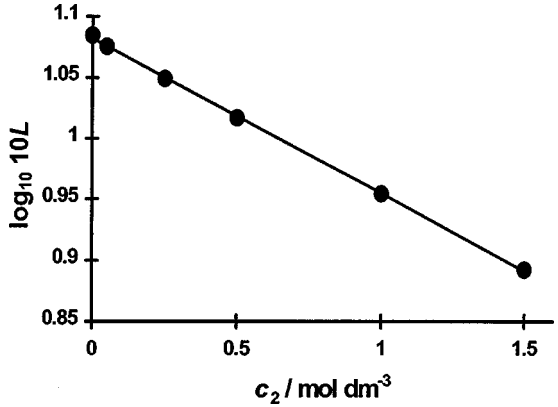

FIG. 1. Variation of the Ostwald coefficient for ethyne L with concentration c_2 of sulfuric acid at 288 K; 101.3 kPa from measurement by Billitzer.

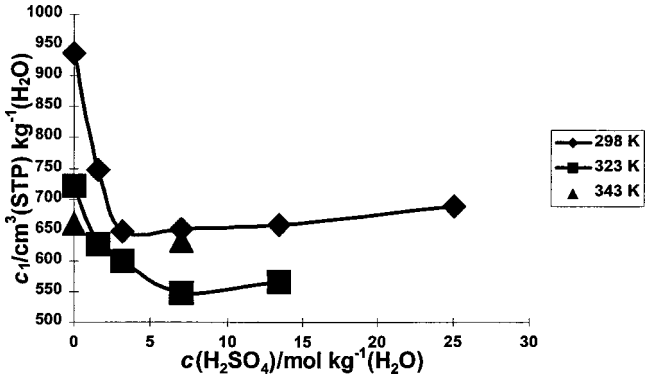

FIG. 2. Variation of solubility of ethyne with concentration of sulfuric acid in aqueous solution from data published by Flid and Golynets.

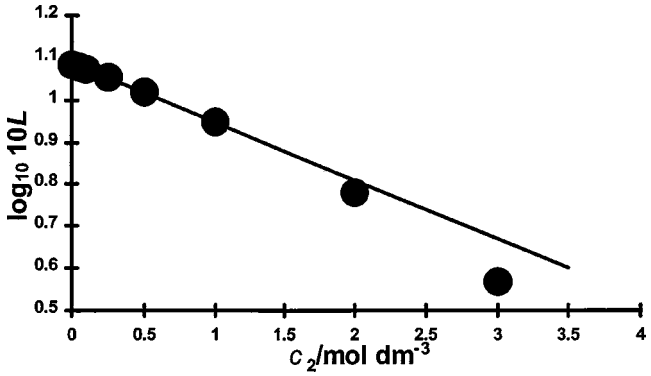

FIG. 3. Variation of the solubility of ethyne with concentration c_2 of sodium hydroxide in aqueous solution at 288 K; 101.3 kPa.

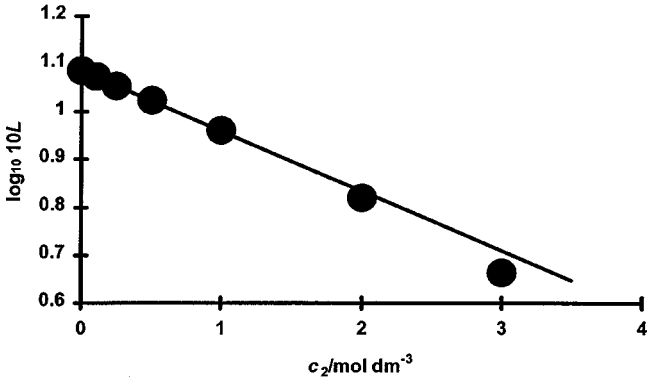

FIG. 4. Variation of the solubility of ethyne with concentration c_2 of potassium hydroxide in aqueous solution at 288 K; 101.3 kPa from measurement by Billitzer.

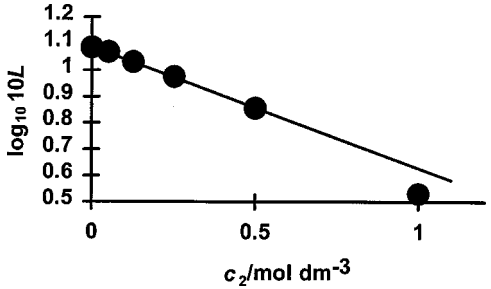

FIG. 5. Variation of the solubility of ethyne with concentration c_2 of sodium sulfate in aqueous solution at 288 K; 101.3 kPa from measurements by Billitzer.

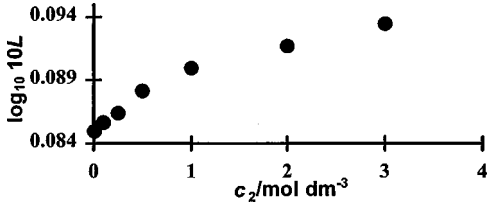

FIG. 6. Variation of the solubility of ethyne with concentration c_2 of ammonia in aqueous solution at 288 K; 101.3 kPa.

References:

[1]H. L. Clever, in *Nitrogen and Air*, edited by R. Battino, IUPAC Solubility Data Series, Vol. 10 (Pergamon, Oxford, UK, 1982), p. xxix.

[2]R. M. Flid and Yu. F. Golynets, Izv. VUZ, ser. Khim. i Khim. Tekhnol. **2** (2), 173–179 (1959).

[3]von W. Manchot, M. Jahrstorfer, and H. Zepter, Z. Anorg. Allg. Chem. **141**, 45–81 (1924).

[4]K. Onda, E. Sada, Kobayashi, Jr., S. Kito, and Y. Ito, J. Chem. Eng. Jpn. **3**, 137–142 (1970).

[5]J. Billitzer, Zeit. Phys. Chem. **40**, 535–544 (1902).

[6]H. Hannaert, M. Haccuria, and M. P. Mathieu, Ind. Chim. Belge **32**, 156–164 (1967).

[7]British Oxygen Co. Ltd., reported by S. A. Miller, *Acetylene—Its Properties, Manufacture and Uses* (Academic, New York, 1965), Vol. I.

[8]A. Gatterer, J. Chem. Soc. **129**, 299–316 (1926).

[9]P. B. Jadkan and R. V. Chaudhari, J. Chem. Eng. Data **25**, 115–7 (1980).

Components:
(1) Ethyne; C_2H_2 ; [74-86-2]
(2) Water; H_2O; [7732-18-5];
(3) Sulfuric acid; H_2SO_4 ; [8014-95-7]

Original Measurements:
R. M. Flid, and Yu. F. Golynets, Izv. VUZ, Ser. Khim. Khim. Tekhnol. **2** (2), 173–179 (1959).

Variables:
T/K=298.2–343.2;
p_1 /kPa=101.3

Prepared By:
Yu. P. Yampolskii

Experimental Data

p_1 /kPa	Concentration of acid/mol kg^{-1}(H_2O)	t/°C	T/K	Solubility*/(cm^3 kg^{-1}(H_2O))
101.3	0	25	298.2	937
		50	323.2	721
		70	343.2	661
	1.55	25	298.2	748
		50	323.2	628
	3.14	25	298.2	648
		50	323.2	600
	7.00	25	298.2	651
		50	323.2	548
		70	343.2	633
	13.40	25	298.2	658
		50	323.2	566
	25.10	25	298.2	689

*Volume of gas, reduced to 273.15 K and 101.3 kPa, dissolved by 1 kg of water.

Auxiliary Information

Method/Apparatus/Procedure:
The solubility of carefully purified acetylene[1] was measured in a glass apparatus with the temperature controlled by a thermostat. The measurement was performed automatically under a constant pressure of acetylene.[2]

Source and Purity of Materials:
No information.

Estimated Error:
Reproducibility: 0.4% at 25 °C; 1% at 50 and 70 °C; δT/K =0.015.

References:
[1]R. M. Flid, I. I. Moiseev, and E. M. Kalmykova, Zh. Fiz. Khim. **31**, 904 (1957).
[2]Yu. F. Golynets, Dissertation, Moscow, 1954.

Components:
(1) Ethyne; C_2H_2 ; [74-86-2]
(2) Water; H_2O; [7732-18-5]
(3) Single salts or mixtures of salts

Original Measurements:
K. Onda, E. Sada, Kobayashi, Jr.; S. Kito, and Y. Ito, J. Chem. Eng. Jpn. **3**, 137–142 (1970).

Variables:
T/K=298.15;
P/kPa=101.3; Conc. of salts/mol l^{-1}=0.32–3.50

Prepared By:
C. L. Young

Experimental Data

Concentration of salt/mol l^{-1}	Ionic strength/mol l^{-1}*	Bunsen coefficient α*
Sodium chloride; NaCl; [7647-14-5]		
1.302	1.302	0.6942
Calcium chloride; $CaCl_2$; [10043-52-4]		
0.318	0.955	0.8418
0.888	2.665	0.6510
1.533	4.598	0.4872
Nitric acid, ammonium salt, (*ammonium nitrate*); NH_4NO_3 ; [6484-52-2]		
1.219	1.219	0.9289
2.070	2.070	0.9022
3.496	3.496	0.8989

*Quoted in original paper.

Concentration of NaCl/mol l^{-1}	Conc. of 2nd salt/mol l^{-1}	Ionic strength/mol l^{-1}*	Bunsen coefficient α*
Sodium chloride+calcium chloride			
0.557	0.186	1.114	0.7803
0.951	0.317	1.901	0.6676
1.728	0.576	3.455	0.4883
2.429	0.810	4.858	0.3774
Sodium chloride+ammonium nitrate			
0.608	0.608	1.217	0.8147
1.062	1.062	2.125	0.7270
1.763	1.763	3.527	0.6084
2.804	2.804	5.608	0.4654

*Quoted in original paper. Ratio of ionic strength of sodium chloride to that of the second salt given as 1:1.

Concentration/mol l^{-1}**				
NaCl	$CaCl_2$	NH_4NO_3	Ionic strength/mol l^{-1}*	Bunsen coefficient α*
0.473	0.158	0.473	1.420	0.8017
0.848	0.283	0.848	2.543	0.6955
1.134	0.378	1.134	3.403	0.6216
1.698	0.566	1.698	5.095	0.4996

*Quoted in original paper.
**Calculated from ionic strength and statement in paper that ratio of ionic strength of three salts was 1:1:1.

Auxiliary Information

Method/Apparatus/Procedure:

Concentrated solution prepared by weighing, less concentrated solutions prepared by subsequent dilution. Equilibrium established between 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 Onda *et al.*[1]

Source and Purity of Materials:

(1) Commercial sample, purity 99.6 mol %.
(2) No details give.
(3) Analytical grade samples.

Estimated Error:

δT/K = ±0.2;
$\delta\alpha$ = ±2%.

References:

K. Onda, E. Sada, Kobayashi, Jr., S. Kito, and Y. Ito, J. Chem. Eng. Jpn. **3**, 18 (1970).

Components:

(1) Ethyne; C_2H_2 ; [74-86-2]
(2) Water; H_2O; [7732-18-5]
(3) Various salts

Original Measurements:

von W. Manchot, M. Jahrstorfer, and H. Zepter, Z. Anorg. Allg. Chem. **141**, 45–81 (1924).

Variables:

T/K − 298.15; concentration of salt

Prepared By:

C. L. Young

Experimental Data

Density, d^4_{25}, of salt solution	Concentration of salt/10^3 mol m^{-3} (solution)	Concentration of salt/mol kg^{-1}(water)	S_1 /cm^3	S_2 /cm^3
Aluminum chloride; $AlCl_3$; [7446-70-0]				
1.0672	0.6229	0.6330	62.3	58.4
1.1150	1.075	1.1066	47.1	42.2
Aluminum nitrate; $Al(NO_3)_3$; [7779-38-6]				
1.0822	0.5558	0.5767	75.5	69.8
1.1502	1.0215	1.0955	62.9	54.7
Aluminum sulfate; $Al_2(SO_4)_3$; [10043-01-3]				
1.1558	0.517	0.5277	41.6	36.0
1.2381	0.814	0.8486	25.4	20.5
Ammonium bromide; NH_4Br; [12124-97-9]				
1.054	1.068	1.1253	84.4	80.1
1.11	2.137	2.3723	78.8	71
1.2215	4.273	5.3226	68.6	56.2
Ammonium chloride; NH_4Cl; [12125-02-9]				
1.0141	1.087	1.137	82.7	81.6
1.0294	2.174	2.381	74.7	72.6
1.06	4.347	5.254	64.3	60.6
Ammonium sulfate; $(NH_4)_2SO4$; [7783-20-2]				
1.0911	1.374	1.5109	52.4	48.0
1.1501	2.305	2.7268	36.6	31.5
Barium chloride; $BaCl_2$; [10361-37-2]				
1.1085	.6306	.6453	67.5	60.9
1.2266	1.312	1.3762	49.1	40
Calcium chloride; $CaCl_2$; [10043-52-4]				
1.0806	.9544	.9792	60.6	56.1
1.1675	2.0421	2.1705	39.1	33.5
Calcium nitrate; $Ca(NO_3)_2$; [10124-37-5]				
1.1503	1.365	1.4736	64.8	56.3
1.2927	2.73	3.2316	44.1	34.1
Chromium sulfate; $Cr_2(SO_4)_3$; [10101-53-8]				
1.1657	0.57	0.605	56.7	48.7
1.3280	1.14	1.294	32.4	24.4
Cobalt sulfate; $CoSO_4$; [10124-43-3]				
1.1139	0.797	0.8048	58.8	52.8
1.2238	1.594	1.6321	37.1	30.3
Ferric chloride; $FeCl_3$; [7705-08-5]				
1.1030	0.828	0.8549	63.0	57.1
1.1638	1.329	1.4016	51.6	44.3
Ferric sulfate; $Fe_2(SO_4)_3$; [10028-22-5]				
1.2240	0.66	0.687	45.8	37.4
1.4319	1.32	1.460	22.7	15.8
Ferrous sulfate; $FeSO_4$; [7720-78-7]				
1.1017	0.72	0.7256	61.6	55.9
1.2011	1.438	1.4634	41.1	34.2
Magnesium nitrate; $Mg(NO_3)_2$; [10377-60-3]				
1.0916	0.95	0.9993	74.3	68.1
1.1821	1.9	2.1105	59.8	50.6
Magnesium chloride; $MgCl_2$; [7786-30-3]				
1.0802	1.1036	1.1318	58.4	54.1

1.1501	2.1278	2.2458	39.7	34.5
Magnesium sulfate; $MgSO_4$; [7757-82-6]				
1.0999	0.8965	0.9038	54.8	49.8
1.1944	1.793	1.8323	31.1	26.1
Manganese sulfate; MnSO4; [7785-87-7]				
1.1283	0.98	0.9997	54.8	48.6
1.2507	1.96	2.0529	31.4	25.1
Nickel sulfate; $NiSO_4$; [7786-81-4]				
1.1096	0.738	0.7414	59.9	54
1.2156	1.476	1.4951	38	31.2
Potassium bromide; KBr; [7758-02-3]				
1.0866	1.09	1.1392	77.9	71.9
1.175	2.18	2.3811	65.5	55.8
1.3459	4.36	5.2723	47.8	35.5
Potassium chloride; KCl; [7447-40-7]				
1.0807	1.84	1.9563	65.3	60.5
1.1588	3.69	4.1758	48.1	41.5
Potassium nitrate; KNO_3; [7757-79-1]				
1.0618	1.076	1.129	82.4	77.6
1.1232	2.152	2.376	73.7	65.7
Potassium sulfate; K_2SO_4; [7757-82-6]				
1.0753	0.594	0.6112	64.9	60.3
Sodium bromide; NaBr; [7647-15-6]				
1.0829	1.12	1.1575	72.7	67.1
1.1668	2.24	2.3925	57.9	49.6
1.3307	4.48	5.1517	36.1	27.1
Sodium chloride; NaCl; [7647-14-5]				
1.042	1.12	1.147	70.6	67.8
1.085	2.26	2.372	54.1	49.9
1.166	4.52	5.012	32	27.4
Sodium nitrate; $NaNO_3$; [7631-99-4]				
1.0556	1.08	1.1205	78.5	74.4
1.1106	2.16	2.3301	66.7	60
1.2189	4.32	5.0724	49	40.2
Sodium sulfate; Na_2SO_4; [7757-82-6]				
1.0538	0.467	0.4734	67.0	63.6
1.1111	0.966	0.9925	47.6	42.8
Zinc nitrate; $Zn(NO_3)_2$; [7779-38-6]				
1.121	0.829	0.8599	74.5	66.4
1.2406	1.658	1.7893	59.7	48.1
Zinc sulfate; $ZnSO_4$; [7733-02-0]				
1.1359	0.915	0.9259	54.9	48.3
1.2666	1.83	1.8843	31.9	25.2

S_1—volume of ethyne absorbed per 100 cm^3 of salt solution.
S_2—volume of ethyne absorbed per 100 g of salt solution.
Both S_1 and S_2 are reduced to 101.325 kPa and 273.15 K.

Auxiliary Information

Method/Apparatus/Procedure:
Measurement of volume of gas absorbed by means of gas buret and pipet. Volume absorbed appears to be taken as independent of pressure.[1] Density of the aqueous solution determined by Sprengel pyknometer.

Source and Purity of Materials:
(1) Purity about 99 mole%.
(2) Purified by fractional crystallization.

Estimated Error:
No information.

References:
von W. Manchot, Z. Anorg. Allg. Chem. **141**, 38 (1924).

Components:
(1) Ethyne; C_2H_2; [74-86-2]
(2) Sulfuric acid; H_2SO_4; [7664-93-9]
(3) Sodium sulfate; Na_2SO_4; [7757-82-6]
(4) Water; H_2O; [7732-18-5]

Original Measurements:
K. A. Kobe and F. H. Kenton, Ind. Eng. Chem. Anal. Ed. **10**, 76–77 (1938).

Variables:
T/K = 298.15
p_1 /kPa = 101.325 (1 atm)

Prepared By:
P. L. Long and H. L. Clever

Experimental Data

t/°C	T/K	Vol. Solvent/cm^3	Vol. C_2H_2 absorbed/cm^3	Bunsen coefficient α/cm^3(STP) cm^{-3} atm^{-1}	Ostwald coefficient, L
25	298.15	49.54	17.01; 16.98	0.324	0.343

The solvent is a mixture of 800 g H_2O; 200 g Na_2SO_4 (anhydrous); 40 ml H_2SO_4 (conc. 18 mol l^{-1}).
Molality of the solution: m_2 /mol kg^{-1}=0.90 (H_2SO_4); m_3 /mol kg^{-1}=1.76 (Na_2SO_4).

Auxiliary Information

Method/Apparatus/Procedure:
The apparatus is described in detail in an earlier paper.[1] The apparatus consisted of a gas buret, a pressure compensator, and a 200 cm^3 absorption bulb and mercury leveling bulb. The absorption bulb was attached to a shaking mechanism. The solvent and the gas were placed in the absorption bulb. The bulb was shaken until equilibrium was reached. The remaining gas was returned to the buret. The difference in the final and initial volumes was taken as the volume of gas absorbed.

Source and Purity of Materials:
(1) Ethyne. Source not given. Purity stated to be 99+ percent.
(2),(3) Sulfuric acid and sodium sulfate. Sources not given. Analytical grade.
(4) Water. Distilled.

Estimated Error:
$\delta\alpha/cm^3 = \pm 0.001$ (authors).

References:
K. A. Kobe and J. S. Williams, Ind. Eng. Chem. Anal. Ed. **7**, 37 (1935).

Components:
(1) Ethyne; C_2H_2 ; [74-86-2]
(2) Water; H_2O; [7732-18-5]
(3) Inorganic salts.

Original Measurements:
R. M. Flid and Yu. F. Golynets, Izv. VUZ, Ser. Khim. Khim. Tekhnol. **2**(2), 173–179 (1959).

Variables:
T/K = 298.2–343.2;
p_1 /kPa = 101.3

Prepared By:
Yu. P. Yampolskii

Experimental Data
p_1 /kPa = 101.3

Salt	Concentration of salt/ mol kg^{-1}(H_2O)	t/°C	T/K	Solubility*/ (cm^3) kg^{-1}(H_2O)
(Pure water)	0	25	298.2	937
		50	323.2	721
		70	343.2	661
Lithium chloride; LiCl; [7447-41-8]	3.48	25	298.2	528
		50	323.2	381
		70	343.2	581
Sodium nitrate; $NaNO_3$; [7631-99-4]	5.4	25	298.2	540
		50	323.2	524
		70	343.2	524
Sodium chloride; NaCl; [7647-14-5]	5.41	25	298.2	358
		50	323.2	407
		70	343.2	471
Potassium nitrate; KNO_3 ; [7757-79-1]	3.5	25	298.2	740
		50	323.2	653
		70	343.2	692
Potassium chloride; KCl; [7447-40-7]	4.24	25	298.2	548
		50	323.2	504
		70	343.2	535
Potassium bromide; KBr; [7758-02-3]	5.2	25	298.2	594
		50	323.2	462
		70	343.2	578
Ammonium chloride; NH_4Cl [12125-02-9]	6.11	25	298.2	818
		50	323.2	572
		70	343.2	619
Cadmium chloride; $CdCl_2$; [10108-64-2]	5.1	25	298.2	387
		50	323.2	269
		70	343.2	430
Cadmium bromide; $CdBr_2$; [7789-42-6]	1.9	25	298.2	572
		50	323.2	517
		70	343.2	602
Cadmium iodide; CdI_2 ; [7790-80-9]	1.43	25	298.2	808
		50	323.2	680
		70	343.2	655
Zinc chloride; $ZnCl_2$; [7646-85-7]	7.84	25	298.2	428
		50	323.2	438
		70	343.2	598
Lithium sulfate; Li_2SO_4 ; [10377-48-7]	2.44	25	298.2	321
		50	323.2	254
		70	343.2	383
Potassium sulfate; K_2SO_4 ; [7778-80-5]	0.56	25	298.2	710
		50	323.2	541
		70	343.2	509
Magnesium sulfate; $MgSO_4$; [7487-88-9]	2.6	25	298.2	211
		50	323.2	247
		70	343.2	379
Zinc sulfate; $ZnSO_4$; [7446-19-7]	3.53	25	298.2	152
		50	323.2	216
		70	343.2	397
Cadmium sulfate; $CdSO_4$; [10124-36-4]	2.64	25	298.2	252
		50	323.2	315
		70	343.2	432
Manganese sulfate; $MnSO_4$; [7785-87-7]	1.6	25	298.2	413
		50	323.2	352
		70	343.2	443
Ferrous sulfate; $FeSO_4$; [7720-78-7] plus H_2SO_4(0.7 mol kg-1)	1.27	25	298.2	544
		50	323.2	439
		70	343.2	585
Nickelous sulfate; $NiSO_4$; [7786-81-4]	1.88	25	298.2	276
		50	323.2	291
		70	343.2	410
Aluminum sulfate; $Al_2(SO_4)_3$ [10043-01-3]	0.79	25	298.2	286
		50	323.2	310
		70	343.2	445
Chromic sulfate; $Cr_2(SO_4)_3$; [10101-53-8]	0.88	25	298.2	376
		50	323.2	349
		70	343.2	463
Ferric sulfate; $Fe_2(SO_4)_3$; [10028-22-5] plus H_2SO_4 (0.7 mol kg-1)	1.11	25	298.2	395
		50	323.2	366
		70	343.2	495

*Volume of gas, reduced to 273.15 K and 101.3 kPa, dissolved by 1 kg of water.

Auxiliary Information

Method/Apparatus/Procedure:
The solubility of carefully purified acetylene[1] was measured in a glass apparatus with the temperature controlled by a thermostat. The measurement was performed automatically under a constant pressure of acetylene.[2]

Source and Purity of Materials:
(3) Salts were labeled *Chemically Pure* or *Pure for Analysis*.

Estimated Error:
Reproducibility: 0.4% at 25 °C; 1% at 50 and 70 °C; δT/K = 0.015.

References:
[1]R. M. Flid, I. I. Moiseev, and E. M. Kalmykova, Zh. Fiz. Khim. **31**, 904 (1957).
[2]Yu. F. Golynets, Dissertation, Moscow, 1954.

3.3. Alkanes, Cyclic Alkanes, Alkenes, and Alkynes

Components:
(1) Ethyne; C_2H_2; [74-86-2]
(2) Alkanes, Cyclic Alkanes, Alkenes and Alkynes

Evaluator:
Peter G. T. Fogg, University of North London, London, United Kingdom.

Critical Evaluation

1-Buten-3-yne

Solubility in 1-buten-3-yne (*vinylacetylene*)[1] was measured by Kaszonyi and Harustiak.[2] At 293.2 K and a partial pressure of 101.3 kPa the mole fraction solubility is 0.0361. No other data on this system are available for comparison.

Hexane

The solubility in hexane was measured by Ryutani[3] from 253.2 to 263.2 K at partial pressures from 689 to 1479 kPa. Extrapolation to a partial pressure of 101.3 kPa by use of the Krichevsky–Il'inskaya equation indicates a mole fraction solubility of 0.029 at 253.2 K and 0.027 at 258.2 K. These may be compared with a value of 0.024 from data given by Leites and Ivanovskii.[4] However extrapolation of the Ryutani data over such a wide pressure range may be unreliable.

Miyano and Hayduk[5] published solubilities in hexane for 273.2–309.2 K at a partial pressure of 101.3 kPa. Their data plus the data point from Leites and Ivanovski fit the equation

$$\ln x_1 = -30.216 + 1841.5/(T/\mathrm{K}) + 3.4576 \ln (T/\mathrm{K})$$

standard deviation in values of $x_1 = 3.8\times 10^{-5}$.

This equation is recommended and is valid for the range 248–309 K.

The Ryutani data can be accepted on a tentative basis until confirmed by other workers. Data reported by Tilquin *et al.*[6] are not consistent with other data for the system.

Miyano and Hayduk also measured solubilities in mixtures of hexane and hexadecane. Solubility in hexane increases with addition of hexadecane. The data are self-consistent and are likely to be reliable.

Octane

Solubilities in octane were reported by Shenderei[7] for 13.3–101.3 kPa at 217–263 K. The data are self-consistent and fit the equation

$$\ln x_1 = -61.181 + 3125.5 + 5/(T/\mathrm{K}) + 8.1387 \ln (T/\mathrm{K})$$

standard deviation in values of $x_1 = 3.8\times 10^{-4}$.

This equation is valid from 217 to 263 K.

Ryutani reported data for 689–1479 kPa at 253.15–273.15 K. Densities of solutions and the corresponding volume changes on dissolution of gas were reported. The evaluator used the Krichevsky–Il'inskaya equation as a basis for extrapolation of the solubilities to approximate values for a partial pressure of gas of 101.3 kPa. The extrapolated values for 266.15 and 253.15 K lie within 9% of values from the equation above. The extrapolated value for 258.15 K differs by 3% from the value corresponding to the equation. The extrapolated value for 273.15 is 23% below the value from the equation. The Ryutani data therefore support the equation within the limits of its validity.

Hexadecane

Solubilities in hexadecane at 298.15–323.15 and 101.3 kPa have been reported by Miyano and Hayduk.[5] No other data for this system are available for comparison. Solubilities are higher than those in hexane under the same conditions.

Cyclohexane

Miyano and Hayduk reported solubilities in cyclohexane at 283.15–323.15 K and 101.3 kPa. Krauss and Gestrich[8] reported solubilities at 283.15–313.15 K and 101.3 kPa which are appreciable higher than Miyano and Hayduk's values. Mole fraction solubilities at 283.15 K from the two sources are 0.01110 (M & H) and 0.0187 (K & G). The evaluator considers that the Miyano and Hayduk values are likely to be the more reliable but confirmation by other workers is required.

Dicyclopentadiene

Hölemann[9] reported the mole fraction solubility in dicyclopentadiene at 298.15 K and 101.3 kPa as 0.022 56. No other measurements on this system are available.

Tetrahydronaphthalene

Krauss and Gestrich measured the solubility in 1,2,3,4-tetrahydronaphthalene at 283.15–313.15 K. No other measurements are available for comparison.

References:

[1] A. Neumann and R. Mann, Chem. Ing. Tech. **41**, 708–711 (1969).
[2] A. Kaszonyi and M. Harustiak, Chem. Listy **86**, 53–56 (1992).
[3] B. Ryutani, Nippon Kagaku Zasshi **80**, 1407–1415 (1959).
[4] I. L. Leites and F. P. Ivanovskii, Khim. Prom. (**9**), 653–657 (1962).
[5] Y. Miyano and W. Hayduk, Can. J. Chem. Eng. **59**, 746–751 (1981).
[6] B. Tilquin, L. Decannière, R. Fontaine, and P. Claes, Ann. Soc. Sc. Bruxelles (Belgium) **81**, 191–199 (1967).
[7] E. R. Shenderei, Khim. Prom-St. (Moscow) **41**, 580–585 (1965).
[8] W. Krauss and W. Gestrich, Chem.-Tech. (Heidelberg) **6**, 513–516 (1977).
[9] P. Hölemann and R. Hasselmann, *Forschungsberichte des Wirtschafts- und Verkehrsministeriums Nord-Westfalen, No. 109* Forschungsstelle für Acetylen (Westdeutscher Verlag, Köln-Opladen, Germany, 1954).

Components:
(1) Ethyne; C_2H_2 ; [74-86-2]
(2) Hexane; C_6H_{14} ; [110-54-3]
Octane; C_8H_{18} ; [111-65-9]

Original Measurements:
B. Ryutani, Nippon Kagaku Zasshi **80**, 1407–1415 (1959).

Variables:
T/K=253.15–273.15;
P/kPa=689–1479

Prepared By:
Sim-wan Annie Bligh and P. G. T. Fogg

Experimental Data

t/°C	T/K	P/atm	P/kPa*	S[a] (cm^3 g^{-1})	x_1*	Density/g cm^{-3} Solvent	Density/g cm^{-3} Solution	ΔV[b] (cm^3 g^{-1})
Hexane								
−10	263.15	12.6	1277	141.1	0.3542	0.7236	0.6593	0.386
		14.6	1479	283.5	0.5243		0.6583	0.643
−15	258.15	6.8	689	73.9	0.2232		0.7273	0.123
		9.7	983	128.4	0.333		0.7202	0.224
		12.6	1277	238.8	0.4814		0.6956	0.467
		14.6	1479	379.8	0.5962		0.6584	0.822
−20	253.15	6.8	689	83.9	0.246	0.7323	0.7339	0.131
		9.7	983	150.6	0.3693		0.7175	0.275
		12.6	1277	292.9	0.5324		0.6844	0.598
		13.7	1388	438.7	0.6304		0.6558	0.945
Octane								
0	273.15	6.8	689	21.6	0.1002	0.7189	0.7026	0.068
		9.7	983	43.4	0.1828		0.6996	0.112
		12.6	1277	64.4	0.2492		0.6917	0.164
		14.6	1479	86.9	0.3093		0.6889	0.209
−7	266.15	6.8	689	36	0.1565		0.7153	0.077
		9.7	983	55.6	0.2227		0.7053	0.133
		12.6	1277	87.9	0.3118		0.6966	0.203
		14.6	1479	124.5	0.3908		0.6903	0.281
−10	263.15					0.7271		
−15	258.15	6.8	689	41.4	0.1758		0.7143	0.113
		9.7	983	68.9	0.262		0.7013	0.187
		12.6	1277	448.1	0.6978		0.6867	0.292
		14.6	1479	186.1	0.4896		0.6803	0.425
−20	253.15	6.8	689	44.5	0.1866	0.7353	0.7182	0.105
		9.7	983	84	0.3021		0.7068	0.194
		12.6	1277	211	0.5209		0.6871	0.456

*Calculated by the compiler.
[a]S is the volume/cm^3 of gas, corrected to 273.15 K and 101.3 kPa, dissolved by the weight/g of solvent.
[b]ΔV is the change in volume of the liquid due to dissolution of gas.

Auxiliary Information

Method/Apparatus/Procedure:
Absorption was measured by a static method. Densities of saturated solutions were measured by the balancing column method[1] in which saturated solution and mercury in one side of a U-tube were balanced against mercury in the other side of the U-tube with both sides of the tube subject to the same pressure of gas. Heights of liquid columns were measured by a travelling microscope.

Source and Purity of Materials:
(1) Dried with silica gel; purity 99.5%–99.6%.
(2) Hexane; Reagent Grade; 68.3–69.0 °C (760 mm Hg); n_D^{20} 1.3943
Octane; Super Reagent Grade; bpt 124.5 (760 mm Hg); n_D^{20} 1.3980.

Estimated Error:
δT/K=±0.1 (author).

References:
[1]Weissberger, *Technique of Organic Chemistry*, Vol. I, Physical Methods, Part I (Interscience, New York, 1949), p. 285.

Components:
(1) Ethyne; C_2H_2; [74-86-2]
(2) 2-Propanone, (*acetone*); C_3H_6O; [67-64-1]; Methylbenzene, (*toluene*); C_7H_8; [108-88-3]
(3) Hexane; C_6H_{14}; [110-54-3];
Trichloromethane, (*chloroform*); $CHCl_3$; [67-66-3]
N,N-Dimethylformamide; C_3H_7NO; [68-12-2]

Original Measurements:
I. L. Leites and F. P. Ivanovskii, Khim. Prom. (**9**), 653–657 (1962).

Variables:
T/K=243.15–298.15;
p_1 /kPa=101.3;
x_2=0–1

Prepared By:
P. G. T. Fogg

Experimental Data
p_1=101.3 kPa

Component 2	Component 3	t/°C	T/K	x_2*	x_3*	$\log_{10} H$**	x_1***
2-Propanone	Hexane	−25	248.15	0.00	1.00	4.50	0.024
				0.25	0.75	3.93	0.089
				0.50	0.50	3.59	0.195
				0.75	0.25	3.40	0.303
				1.00	0.00	3.32	0.364
2-Propanone	Trichloromethane	−30	243.15	0.00	1.00	4.10	0.060
				0.25	0.75	4.06	0.066
				0.50	0.50	3.83	0.112
				0.75	0.25	3.50	0.240
				1.00	0.00	3.17	0.514
Methylbenzene	*N,N*-dimethylformamide	25	298.15	0.00	1.00	3.82	0.115
				0.25	0.75	3.90	0.096
				0.50	0.50	4.03	0.071
				0.75	0.25	4.24	0.044
				1.00	0.00	4.55	0.021
Methylbenzene	Trichloromethane	−30	243.15	0.00	1.00	4.09	0.062
				0.25	0.75	4.13	0.056
				0.50	0.50	4.12	0.058
				0.75	0.25	4.08	0.063
				1.00	0.00	4.01	0.074

*Mole fraction before dissolution of ethyne.
**H is a Henry's constant defined as $x_1/(p_1$ /mm Hg).
***Mole fraction solubility at p_1=101.3 kPa.

Data were presented in graphical form with smooth curves drawn through experimental points marked on the graphs. The compiler has used a computer based digitization program to obtain values from the smooth curves.

Auxiliary Information

Method/Apparatus/Procedure:
A static method was used as described previously.[1] The absorption apparatus was contained in a metal cryostat cooled with solid CO_2 and acetone.

Source and Purity of Materials:
(1) Ethyne was purified as described earlier.[1]
(2) Solvents were purified by fractional distillation.

Estimated Error:
δT/K=±0.05; $\delta x_1/x_1$=±0.01 (authors).
An additional error $\delta x_1/x_1$=±0.02 was introduced when data were digitized by the compiler.

References:
[1]G. E. Braude, I. L. Leites, and I. V. Dedova, Khim. Prom. **4**, 232 (1961).

Components:
(1) Ethyne; C_2H_2; [74-86-2]
(2) Hexane; C_6H_{14}; [110-54-3]

Original Measurements:
B. Tilquin, L. Decannière, R. Fontaine, and P. Claes, Ann. Soc. Sc. Bruxelles (Belgium) **81**, 191–199 (1967).

Variables:
T/K=288.15;
P/kPa=4.11–8.13

Prepared By:
C. L. Young

Experimental Data

t/°C	T/K	Ostwald coeff. L*	x_1	Henry's constant, H/atm**
15	288.15	8.515	0.0447	22.4

*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.
**Calculated by compiler for a gas partial pressure of 101.325.

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.[1]

Source and Purity of Materials:
(1) Source not given; minimum purity specified as 99.0 mole percent.
(2) *Fluka pure grade*; minimum purity specified as 99.0 mol %.

Estimated Error:
δT/K=0.05;
$\delta x_1/x_1$=0.01 (estimated by compiler).

References:
[1]S. Rzad and P. Claes, Bull. Soc. Chim. Belges **73**, 689 (1964).

Components:
(1) Ethyne; C_2H_2; [74-86-2]
(2) Hydrocarbons

Original Measurements:
Y. Miyano and W. Hayduk, Can. J. Chem. Eng. **59**, 746–751 (1981).

Variables:
T/K=273.15–323.15;
P/kPa=101.3

Prepared By:
P. G. T. Fogg

Experimental Data

Solvent	t/°C	T/K	Oswald coefficient, L	x_1
Hexane; C_6H_{14};	0	273.15	3.06	0.0170
[110-54-3]	25	298.15	2.42	0.0130
	36	309.15	2.26	0.0119
Cyclohexane; C_6H_{12};	10	283.15	2.43	0.0111
[110-82-7]	25	298.15	2.12	0.009 39
	50	323.15	1.79	0.007 56
Hexadecane; $C_{16}H_{34}$;	25	298.15	1.43	0.0170
[544-76-3]	35	308.15	1.27	0.0147
	50	323.15	1.21	0.0136
Benzene; C_6H_6;	10	283.15	6.64	0.0247
[71-43-2]	25	298.15	5.27	0.0190
	50	323.15	3.81	0.0132

Auxiliary Information

Method/Apparatus/Procedure:
A glass volumetric apparatus, similar to that described earlier,[1] was used. Degassed solvent, came into contact with the gas while it was flowing in a thin film into the solution buret. Dry gas in a gas buret was maintained at barometric pressure by adjustment of mercury level. Temperature was controlled to ±0.05 K by circulation of an ethanediol–water mixture through the jackets surrounding the solubility apparatus. The proportion of solvents in the mixtures was calculated from densities measured by a Digital Precision Density Meter. Gas solubilities were corrected to a partial pressure of 101.325 kPa.

Source and Purity of Materials:
(1) Ethyne supplied by *Matheson Company of Canada*; minimum purity 99.6%.
(2) Hexane—from *Fisher Chemicals*; minimum purity 99.0 mol%;
Cyclohexane, benzene—from *J. T. Baker*; purity >99 mol%;
Hexadecane—from *Matheson, Coleman and Bell*; purity 99.0 mol%.

Estimated Error:
δT/K= ±0.05 (authors).

References:
[1]W. Hayduk and S. C. Cheng, Can. J. Chem. Eng. **48**, 93 (1970).

Components:
(1) Ethyne; C_2H_2; [74-86-2]
(2) Hexane; C_6H_{14}; [110-54-3]. 1-Butanol; $C_4H_{10}O$; [71-36-3]
(3) Hexadecane; $C_{16}H_{34}$; [544-76-3]. 1,2-Ethanediol; $C_2H_6O_2$; [107-21-1]

Original Measurements:
Y. Miyano, and W. Hayduk, Can. J. Chem. Eng. **59**, 746–751 (1981).

Variables:
T/K=298.15;
p_1 /kPa=101.3

Prepared By:
P. G. T. Fogg

Experimental Data
p_1=101.325 kPa T=298.15 K

Solvent 2	Solvent 3	Mole fraction of 2 in mixture of 2 and 3	Mole fraction solubility of C_2H_2, x_1
Hexane	Hexadecane	1	0.013
		0.7181	0.0141
		0.632	0.0145
		0.5195	0.0149
		0.2858	0.0162
		0	0.017
Butanol	1,2-Ethanediol	1	0.0149
		0.9054	0.0151
		0.8352	0.0153
		0.6466	0.0147
		0.5543	0.014
		0.5509	0.0139
		0.4192	0.013
		0.1694	0.009 74
		0.0725	0.008 32
		0	0.0072

Auxiliary Information

Method/Apparatus/Procedure:
A glass volumetric apparatus, similar to that described earlier,[1] was used. Degassed solvent, came into contact with the gas while it was flowing in a thin film into the solution buret. Dry gas in a gas buret was maintained at barometric pressure by adjustment of mercury level. Temperature was controlled to ±0.05 K by circulation of an ethanediol–water mixture through the jackets surrounding the solubility apparatus. The proportion of solvents in the mixtures was calculated from densities measured by a Digital Precision Density Meter. Gas solubilities were corrected to a partial pressure of 101.325 kPa.

Source and Purity of Materials:
(1) Ethyne supplied by Matheson Company of Canada; minimum purity 99.6%.
(2) Hexane from Fisher Chemicals; minimum purity 99.0 mol%; Butanol,1,2-ethanediol from J. T. Baker; purity >99 mol%; Hexadecane—from Matheson, Coleman and Bell; minimum purity 99.0 mol%.

Estimated Error:
δT/K=±0.05 (authors).

References:
[1]W. Hayduk and S. C. Cheng, Can. J. Chem. Eng. **48**, 93 (1970).

Components:
(1) Ethyne; C_2H_2; [74-86-2]
(2) Octane; C_8H_{18}; [111-65-9]

Original Measurements:
E. R. Shenderei, Khim. Prom-st. (Moscow) **41**, 580–585 (1965).

Variables:
T/K=217–263;
p_1 /kPa=13–101

Prepared By:
A. Skrzecz and P. G. T. Fogg

Experimental Data

t/°C	T/K*	p_1 /mm Hg	p_1 /kPa*	x_1	S/cm^3 g^{-1}**
−10	263.15	100	13.30	0.0025	0.49
		300	40.00	0.0076	1.46
		500	66.70	0.0126	2.46
		760	101.30	0.0191	3.76
−20	253.15	100	13.30	0.0030	0.58
		300	40.00	0.0090	1.77
		500	66.70	0.0150	2.95
		760	101.30	0.0228	4.55
−30	243.15	100	13.30	0.0036	0.69
		300	40.00	0.0107	2.10
		500	66.70	0.0178	3.51
		760	101.30	0.0271	5.40
−40.9	232.25	100	13.30	0.0044	0.86
		300	40.00	0.0132	2.60
		500	66.70	0.0218	4.33
		760	101.30	0.0333	6.70
−55.98	217.17	100	13.30	0.0066	1.22
		300	40.00	0.0198	3.88
		500	66.70	0.0330	6.61
		760	101.30	0.0502	10.40

The author found that the temperature dependence of the Henry constant fitted the equation

$$\log_{10}(H/\text{mm Hg}) = 6.892 - 595/(T/\text{K}).$$

*Calculated by the compiler.
**Solubility, S, given as the volume of gas, reduced to 273.15 K and 101.3 kPa, dissolved by 1 g of solvent.

Auxiliary Information

Method/Apparatus/Procedure:
Acetylene sublimed into the apparatus at −76 to −78 °C. The method was described in detail in Ref. 1. No more details were reported in the paper.

Source and Purity of Materials:
(1) Source not specified (obtained from calcium carbide or a commercial sample from a gas cylinder); purification: dissolved in acetone with activated carbon and then stored in the solid phase; no impurities detected by glc.
(2) Source not specified; twice distilled; boiling point 125.5 °C; ρ^{20} 0.7035 g cm^{-3}; n_D^{20} 1.3973.

Estimated Error:
No information.

References:
[1]E. R. Shenderei, Ya. D. Zel'venskii, and F. P. Ivanovskii, Gaz. Prom-st. (Moscow) **12**, 36 (1958).

Components:
(1) Ethyne; C_2H_2; [74-86-2]
(2) 1-Buten-3-yne (*vinylacetylene*); C_4H_4; [689-97-4]

Original Measurements:
A. Kaszonyi, and M. Harustiak, Chem. Listy **86**, 53–56 (1992).

Variables:
T/K = 293.2

Prepared By:
A. Skrzecz and P. G. T. Fogg

Experimental Data

t/°C	T/K	p_1 /kPa	Bunsen coefficient α/cm^3(STP) cm^{-3}	x_1*
20	293.2	101.3	10.90	0.0361

*Calculated by compiler.

Auxiliary Information

Method/Apparatus/Procedure:
Gas was added from the burette to the thermostated vessel fitted with a magnetic stirrer containing about 2–3 cm^3 of absorbent. When equilibrium was reached and the volume of gas had been measured a further 2–4 cm^3 of liquid were added and new volume change measured. This procedure reduced experimental errors.

Source and Purity of Materials:
No information.

Estimated Error:
No information.

Components:
(1) Ethyne; C_2H_2; [74-86-2]
(2) Cyclohexane; C_6H_{12}; [110-82-7]
1,2,3,4-Tetrahydronaphthalene, (*tetralin*); $C_{10}H_{12}$; [119-64-2]

Original Measurements:
W. Krauss and W. Gestrich, Chem.-Tech. (Heidelberg) **6**, 513–516 (1977).

Variables:
T/K = 283–383; p_1 /kPa = 101.3

Prepared By:
C. L. Young

Experimental Data
p_1 /kPa = 101.3

Solvent	T/K	Solubility, S/mol dm^{-3} bar^{-1}	x_1
Cyclohexane	283.15	0.1756	0.0187
	293.15	0.1482	0.0160
	303.15	0.1266	0.0138
	313.15	0.1092	0.0121
Tetralin	283.15	0.1051	0.0142
	293.15	0.09201	0.0125
	303.15	0.08125	0.0112
	313.15	0.07232	0.0100

Auxiliary Information

Method/Apparatus/Procedure:
The authors used volumetric apparatus in which gas was dissolved in liquid in a glass cell. Pressure measured. Amount of gas dissolved estimated from pressure measurements when gas was repeatedly expanded into known volume. Details in source. Values of solubility calculated from equations and graphs in original source.

Source and Purity of Materials:
No information.

Estimated Error:
δT/K = ±0.1;
δx_1 = ±2%.

Components:
(1) Ethyne; C_2H_2; [74-86-2]
(2) Dicyclopentadiene; $C_{10}H_{12}$; [77-73-6]

Original Measurements:
P. Hölemann and R. Hasselmann, *Forschungsberichte des Wirtschafts- und Verkehrsministeriums Nord-Westfalen*, No. 109 Forschungsstelle für Acetylen (Westdeutscher Verlag, Köln-Opladen, Germany, 1954).

Variables:
T/K=298;
p_1 /kPa=96.1

Prepared By:
P. G. T. Fogg

Experimental Data

t/°C	T/K	p_1 /Torr*	p_1 /kPa**	Sol. coefficient***	x_1(1 atm)
25	298.15	721	96.1	3.7	0.0184

*Maximum pressure of measurements.
**Calculated by compiler.
***The solubility coefficient was defined as mg(gas)/(g(solvent)$\times p_1$ /atm). This was constant over the pressure range studied, i.e., data were consistent with Henry's law.

Auxiliary Information

Method/Apparatus/Procedure:
Ostwald type apparatus was used for measurements below 1 atm. The increase in volume of the liquid phase on dissolution of the gas could be measured. The apparatus is fully described in Ref. 1. Measurements were made from low pressures to the maximum values given above. Individual data points were published as plots of mg(gas/g)(solvent) against partial pressure. The points fell very close to straight lines through the origin. Values of the solubility coefficient equal to the slopes of the lines were tabulated by the authors. The mole fraction solubility for a pressure of 101.3 kPa (1 atm) is given above.

Source and Purity of Materials:
(2) The purest obtainable. Further purified by fractional distillation under reduced pressure. Density and vapor pressure were measured at 25 °C.
ρ_{25} /g cm^{-3}=0.9902;
p_2^0/mm Hg=14.6.

Estimated Error:
δT/K= ±0.05;
δp_1 = ±0.5 mm Hg.

References:
[1]P. Hölemann and R. Hasselmann, *Forschungsberichte des Wirtschafts- und Verkehrsministeriums Nord-Westfalen*, No. 14 Forschungsstelle für Acetylen (Westdeutscher Verlag, Köln-Opladen, Germany, 1952).

3.4. Aromatic Hydrocarbons

Components:
(1) Ethyne; C_2H_2; [74-86-2]
(2) Aromatic hydrocarbons

Evaluator:
Peter G. T. Fogg, University of North London, London, United Kingdom.

Critical Evaluation

Benzene

The data on the solubility in benzene were reported by Horiuti[1] (283–318 K; 101.3 kPa), Vitovec and Fried[2] (293–334 K; 101.3 kPa), Miyano and Hayduk[3] (283–323 K, 101.3 kPa), Makitra *et al.*[4] (293 K, 99.2 kPa), and Krauss and Gestrich[5] (283–313 K, 101.3 kPa). Data for the mole fraction solubility at a partial pressure of 101.3 kPa from the first four sources fit the equation:

$$\ln x = -133.287 + 7056.64/(T/\mathrm{K}) + 18.5276 \ln(T/\mathrm{K})$$

standard deviation in values of $x = 7.88\times 10^{-4}$.

This equation is recommended for the temperature range 283–334 K. The data given by Krauss and Gestrich are inconsistent with those from the other sources.

Methylbenzene

Solubilities in methylbenzene were reported by Leites and Ivanovskii[6] (243.15, 298.15 K; 101.3 kPa), Vitovec and Fried (293.25–363.35 K; 101.3 kPa), Hannaert *et al.*[11] (243.15–293.15), Ryutani[7] (253.15–273.15 K; 395–1277 kPa), Krauss and Gestrich (283.15–313.15 K; 101.3 kPa). Data published by Ryutani were extrapolated to 101.3 kPa by the evaluator using the Krichevsky–Il'inskaya equation. Mole fraction solubilities at a partial pressure of 101.3 kPa from the first four sources fit the equation

$$\ln x = -9.6494 + 1710.68/(T/\mathrm{K})$$

standard deviation in values of $x = 4.08\times 10^{-3}$.

This equation may be used for the temperature range 243–363 K but the magnitude of the standard deviation should be borne in mind. The evaluator considers that solubilities calculated from data published by Krauss and Gestrich are inconsistent with data published by other authors.

Dimethylbenzenes

Solubilities in 1,3-dimethylbenzene were measured by Ryutani (253.15–283.15 K; 395–1277 kPa) and by Usyukin and Shleinikov[8] (233.2–293.2 K; 101.3 kPa). Extrapolation of Ryutani's data to 101.3 kPa by use of the Krichevsky–Il'inskaya equation gives solubilities about 25% less than data from Usykin and Shleinikov.

Vitovec and Fried published solubilities in 1,4-dimethylbenzene at 293–393 K, corrected to a partial pressure of 101.3 kPa and also at 279–398 K, at a total pressure of 98.7 kPa. The data are consistent but no other data on this isomer are available for comparison. The data are, however, consistent with measurements by Hannaert *et al.* on solubilities at lower temperatures in mixed isomers containing 5% methylbenzene and 5% ethylbenzene and with a single value at 293 K for technical grade dimethylbenzene given in a later paper by Vitovec.[9] Data for a mixture of isomers given by Sukiasyan[10] and extrapolated to a partial pressure of 101.3 kPa are about 20% below the values calculated from data given by Hannaert *et al*. This difference may be related to a difference in the proportions of isomers and impurities.

References:
[1]J. Horiuti, Sci. Pap. Inst. Phys. Chem. Res. (Jpn) **17**, 125–256 (1931/1932).
[2]J. Vitovec and V. Fried, Coll. Czech. Chem. Comm. **25**, 1552–1556 (1960).
[3]Y. Miyano and W. Hayduk, Can. J. Chem. Eng. **59**, 746–751 (1981).
[4]R. G. Makitra, F. B. Moin, Ya. N. Pirig, and T. I. Politanskaya, Zh. Prikl. Khim. **53**, 1529–1531 (1980); J. App. Chem. USSR **53**, 1179–1181 (1980).
[5]W. Krauss and W. Gestrich, Chem.-Tech. (Heidelberg) **6**, 513–516 (1977).
[6]I. L. Leites and F. P. Ivanovskii, Khim. Prom. (**9**), 654–657 (1962).
[7]B. Ryutani, Nippon Kagaku Zasshi **80**, 1407–1415 (1959).
[8]I. P. Usyukin and V. M. Shleinikov, Novosti Nefti i Gaz Techn. Neftepererabotka i Neftekhim. (**12**), 33–39 (1961).
[9]J. Vitovec, Collect. Czech. Chem. Comm. **33**, 1203–1310 (1968).
[10]A. G. Sukiasyan, Arm. Khim. Zh. **22**, 173–178 (1969).
[11]H. Hannaert, M. Haccuria, and M. P. Matthieu, Ind. Chim. Belg. **32**, 156–164 (1967).

Components:
(1) Ethyne; C_2H_2; [74-86-2]
(2) Benzene; C_6H_6; [71-43-2]

Original Measurements:
J. Horiuti, Sci. Pap. Inst. Phys. Chem. Res. (Jpn) **17**, 125–256 (1931/1932).

Variables:
T/K = 283.15–318.15;
p_1 /kPa = 101.325 (1 atm)

Prepared By:
M. E. Derrick and H. L. Clever

Experimental Data

T/K	Mol fraction x_1	Bunsen coefficient α/cm^3(STP)cm^{-3} atm^{-1}	Ostwald coefficient L/cm^3 cm^{-3}
283.15	0.022 84	5.966	6.184
288.15	0.020 71	5.366	5.661
293.15	0.018 86	4.847	5.202
298.15	0.0173	4.412	4.816
303.15	0.015 83	4.009	4.449
308.15	0.014 64	3.679	4.15
313.15	0.013 45	3.357	3.849
318.15	0.012 55	3.108	3.62

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.

Auxiliary Information

Method/Apparatus/Procedure:
The apparatus consisted of a gas buret, a solvent reservoir, and an absorption pipet. The volume of the pipet was determined at various meniscus heights by weighing a quantity of water. The meniscus height was read with a cathetometer. The dry gas was introduced into the degassed solvent and the gas and solvent mixed with a magnetic stirrer until saturation. Care was taken to prevent solvent vapor from mixing with the solute gas in the gas buret The volume of gas was determined from the gas buret readings. The volume of solvent was determined from the meniscus height in the absorption pipet.

Source and Purity of Materials:
(1) Ethyne. Prepared by the reaction of calcium carbide and water. The gas was passed through several wash solutions, dried, condensed by liquid air, and fractionated from liquid air several times.
(2) Benzene. Merck. Extra pure and free of sulfur. Refluxed with sodium amalgam, distilled. bpt (760 mm Hg) 80.18 °C.

Estimated Error:
δT/K = 0.05;
$\delta x_1 / x_1 = 0.01$.

Components:
(1) Ethyne; C_2H_2; [74-86-2]
(2) Benzene; C_6H_6; [71-43-2]

Original Measurements:
J. Vitovec and V. Fried, Coll. Czech. Chem. Comm. **25**, 1552–1556 (1960).

Variables:
T/K = 293.25–393.15;
p_1 /kPa = 101.3

Prepared By:
P. G. T. Fogg

Experimental Data
p_1 = 760 mm Hg = 101.325 kPa

t/°C	T/K	x_1	Bunsen coefficient α
20.2	293.35	0.0186	4.72
30.3	303.45	0.016	3.99
40.3	313.45	0.0141	3.48
50.3	323.45	0.0123	2.99
60.4	333.55	0.0109	2.6

Auxiliary Information

Method/Apparatus/Procedure:
Ethyne bubbled through four flasks containing solvent and connected in series. The gas flow was 3.5–4 dm^3 h^{-1}. The dissolved ethyne was estimated as silver acetylide.[1] The authors corrected solubilities to a partial pressure of 760 mm Hg by use of Henry's law.

Source and Purity of Materials:
(1) About a tenth of the gas from a cylinder of ethyne was discarded. This removed much of the nitrogen and water vapor. Gas from the cylinder then passed through a tower containing activated charcoal to remove acetone, through sodium hypochlorite solution, sulfuric acid, a solution of pyrogallol in sulfuric acid, and granulated potassium hydroxide. It finally passed over activated charcoal into a manometer and flowmeter directly into the absorption apparatus.
(2) A chemically pure sample of benzene was distilled with a 40-plate column. Density, refractive index, and boiling point agreed with literature values.

Estimated Error:
Analysis of solutions accurate to ±1% (authors).

Components:
(1) Ethyne; C_2H_2; [74-86-2]
(2) Miscellaneous solvents

Original Measurements:
R. G. Makitra, F. B. Moin, Ya. N. Pirig, and T. I. Politanskaya, Zh. Prikl. Khim. **53**, 1529–1531 (1980); J. Appl. Chem. USSR **53**, 1179–1181 (1980).

Variables:
T/K=293.15;
P/kPa=99.2

Prepared By:
P. G. T. Fogg

Experimental Data
t=20 °C; T=293.15 K P=730 mm Hg; 99.2 kPa

Solvent x_1**	Solubility*	$-\log_{10} x_1$	
Tetrachloromethane; CCl_4; [56-23-5]	0.6	2.62	0.0024
Nitrobenzene; $C_6H_5NO_2$; [98-95-3]	5.4	1.65	0.0226
Benzene; C_6H_6; [71-43-2]	4.7	1.77	0.0171
Acetic acid, ethyl ester, (*ethyl acetate*); $C_4H_8O_2$; [141-78-6]	18.2	1.16	0.0685
2-Propanone, (*acetone*); C_3H_6O; [67-64-1]	18.9	1.26	0.0548
N,N-Dimethylformamide; C_3H_7NO; [68-12-2]	33.5	1.01	0.0977
1-Methyl-2-pyrrolidinone, (*N-methylpyrrolidone*); C_5H_9NO; [872-50-4]	38.7	0.87	0.134
1,4-Dioxane; $C_4H_8O_2$; [123-91-1]	16.6	1.26	0.0556
Trichloromethane; $CHCl_3$; [67-66-3]	5.4	1.75	0.0178
Tetrahydrofuran; C_4H_8O; [109-99-9]	18.4	1.23	0.0586
Cyclohexanone; $C_6H_{10}O$; [108-94-1]	14	1.25	0.0564
Phosphoric acid, tributyl ester, (*tributyl phosphate*); $C_{12}H_{27}O_4P$; [126-73-8]	6.2	1.18	0.0658
Sulfinylbismethane, (*dimethylsulfoxide*); C_2H_6OS; [67-68-5]	20	1.26	0.0556
Quinoline; C_9H_7N; [91-22-5]	5.4	1.59	0.0258

*Volume of gas measured at 730 mm Hg and 293.15 K dissolved by one volume of solvent.
**Calculated by the compiler from values of ln x_1.

Auxiliary Information

Method/Apparatus/Procedure:
A static method was used. No details were given by the authors.

Source and Purity of Materials:
(2) The authors stated that solvents were purified by the usual methods and that their properties were in agreement with literature values.

Estimated Error:
No information.

Components:
(1) Ethyne; C_2H_2; [74-86-2]
(2) Methylbenzene; C_7H_8; [108-88-3]

Original Measurements:
B. Ryutani, Nippon Kagaku Zasshi **80**, 1407–1415 (1959).

Variables:
T/K=253.15–273.15;
P/kPa=395–1277

Prepared By:
Sim-wan Annie Bligh and P. G. T. Fogg

Experimental Data

t/°C	T/K	P/atm	P/kPa*	S^a (cm^3 g^{-1})	x_1*	Density/g cm^{-3} Solvent	Density/g cm^{-3} Solution	ΔV^b (cm^3 g^{-1})
0	273.15	3.9	395	31.7	0.1164		0.8574	0.073
		6.8	689	66.9	0.2176		0.8428	0.149
		9.7	983	114.9	0.3232		0.8237	0.247
		12.6	1277	176.5	0.4232		0.7943	0.389
−5	268.15	3.9	395	42.7	0.1507		0.8648	0.09
		6.8	689	73.7	0.2345		0.8444	0.158
		9.7	983	156.7	0.3944		0.8294	0.303
		12.6	1277	227.2	0.4857		0.7854	0.488
−7	266.15					0.8773		
−10	263.15	3.9	395	53.4	0.1817		0.8732	0.092
		6.8	689	112.9	0.3194		0.8514	0.211
		9.7	983	190.8	0.4423		0.8188	0.376
		12.6	1277	313.9	0.5661		0.7672	0.665
−15	258.15	3.9	395	63.5	0.2088		0.8708	0.122
		6.8	689	134	0.3578		0.8422	0.262
		9.7	983	256.1	0.5156		0.8041	0.506
		12.6	1277	539.6	0.6917		0.7276	1.133
−20	253.15	3.9	395	87.5	0.2667		0.8726	0.156
		6.8	689	192.3	0.4443		0.8436	0.346
		9.7	983	390	0.6185		0.7813	0.758

*Calculated by the compiler.
[a]S is the volume/cm^3 of gas, corrected to 273.15 K and 101.3 kPa, dissolved by the weight/g of solvent.
[b]ΔV is the change in volume of the liquid due to dissolution of gas.

Auxiliary Information

Method/Apparatus/Procedure:
Absorption was measured by a static method. Densities of saturated solutions were measured by the balancing column method[1] in which saturated solution and mercury in one side of a U-tube were balanced against mercury in the other side of the U-tube with both sides of the tube subject to the same pressure of gas. Heights of liquid columns were measured by a traveling microscope.

Source and Purity of Materials:
(1) Dried with silica gel; purity 99.5%–99.6%.
(2) *Pure Grade*; bpt (760 mm Hg) 110.7 °C n_D^{20} 1.3293.

Estimated Error:
δT/K= ±0.1 (author).

References:
[1]Weissberger, *Technique of Organic Chemistry*, Vol. I, Physical Methods, Part I (Interscience, New York, 1949), p. 285.

Components:
(1) Ethyne; C_2H_2; [74-86-2]
(2) Methylbenzene; C_7H_8; [108-88-3]
1,4-Dimethylbenzene; C_8H_{10}; [106-42-3]

Original Measurements:
J. Vitovec and V. Fried, Coll. Czech. Chem. Comm. **25**, 1552–1556 (1960).

Variables:
T/K = 293.25–393.15;
p_1 /kPa = 101.3

Prepared By:
P. G. T. Fogg

Experimental Data
p_1 = 760 mm Hg = 101.325 kPa

Solvent	t/°C	T/K	x_1	Bunsen coefficient α
Methylbenzene	20.1	293.25	0.0199	4.24
	20.1	293.25	0.0197	4.2
	30.1	303.25	0.017	3.57
	40.1	313.25	0.0142	2.96
	40.1	313.25	0.0144	2.98
	50.1	323.25	0.0126	2.58
	60.1	333.25	0.0108	2.18
	70.1	343.25	0.0095	1.9
	80.1	353.25	0.008 65	1.7
	80.1	353.25	0.008 93	1.76
	90.2	363.35	0.007 85	1.52
1,4-Dimethylbenzene	20.2	293.35	0.0208	3.86
	30.2	303.35	0.0179	3.27
	40.3	313.45	0.0154	2.78
	50.4	323.55	0.0136	2.43
	60.5	333.65	0.0119	2.1
	70.6	343.75	0.0104	1.82
	80	353.15	0.009 82	1.69
	90	363.15	0.008 91	1.52
	100.6	373.75	0.008	1.34
	110	383.15	0.007 47	1.2
	120	393.15	0.0066	1.08

Auxiliary Information

Method/Apparatus/Procedure:
Ethyne bubbled through four flasks containing solvent and connected in series. The gas flow was 3.5–4 $dm^3\ h^{-1}$. The dissolved ethyne was estimated as silver acetylide.[1] The authors corrected solubilities to a partial pressure of 760 mm Hg by use of Henry's law.

Source and Purity of Materials:
(1) About a tenth of the gas from a cylinder of ethyne was discarded. This removed much of the nitrogen and water vapor. Gas from the cylinder then passed through a tower containing activated charcoal to remove acetone, through sodium hypochlorite solution, sulfuric acid, a solution of pyrogallol in sulfuric acid and granulated potassium hydroxide. It finally passed over activated charcoal into a manometer and flowmeter directly into the absorption apparatus.
(2) A chemically pure sample of methylbenzene was distilled with a 40-plate column. 1,4-Dimethylbenzene was prepared from technical grade material by repeated freezing, drying with sodium and distillation. Densities, refractive indices and boiling points of the two solvents agreed with literature values.

Estimated Error:
Analysis of solutions accurate to ±1% (authors).

Components:
(1) Ethyne; C_2H_2; [74-86-2]
(2) Methylbenzene, (*toluene*); C_7H_8; [108-88-3]
Dimethylbenzenes (*xylenes*); C_8H_{10}; [1330-20-7]

Original Measurements:
H. Hannaert, M. Haccuria, and M. P. Mathieu, Ind. Chim. Belge **32**, 156–164 (1967).

Variables:
T/K = 243.15–293.15

Prepared By:
E. L. Boozer and H. L. Clever

Experimental Data

T/K	$100x_1$ /mol %	$Kp\nu$/atm at 293.15*	Enthalpy of dissolution (ΔH/kcal mol^{-1})	A
Methylbenzene, (*toluene*)				
243.15–293.15	1–3	45	3.3	4
Dimethylbenzenes (*xylenes*)				
243.15–293.15	1–4	50.3	3.56	4

*$\log_{10}(KP\nu/\text{atm}) = A - (\Delta H/\text{cal mol}^{-1})/(2.3R(T/\text{K}))$.

The author's definitions are:
$K = y_1/x_1$ = mole fraction gas in gas phase/mole fraction gas in liquid phase,
P/atm = total pressure; ν = coefficient of fugacity.
The function $KP\nu$/atm is equivalent to a Henry's constant in the form $H_{1,2}$ /atm = (f_1 /atm)/x_1, where f_1 is the fugacity.

Auxiliary Information

Method/Apparatus/Procedure:
The static pressure over a saturated solution was measured.

Source and Purity of Materials:
(1) Ethyne. Commercial product. Purified by passage over activated carbon and vacuum fusion. Purity 99.8%–99.9%.
(2) Methylbenzene. Qualité UCB, density, ρ^{20}/g cm^{-3} = 0.8689. Dimethylbenzenes. Merck and Co. Mixture of 90% dimethylbenzenes, 5% methylbenzene, and 5% ethyl benzene.

Estimated Error:
10%–15% (authors).

Components:
(1) Ethyne; C_2H_2; [74-86-2]
(2) Benzene; C_6H_6; [71-43-2]; Methylbenzene, (*toluene*); C_7H_8; [108-88-3]

Original Measurements:
W. Krauss and W. Gestrich, Chem. Tech. (Heidelberg) **6**, 513–516 (1977).

Variables:
T/K = 283–383;
p_1 /kPa = 101.3

Prepared By:
C. L. Young

Experimental Data
p_1 /kPa = 101.3

Solvent x_1	T/K	Solubility, S/mol dm^{-3} bar^{-1}	Mole fraction of ethyne in liquid
Benzene	283.15	0.1719	0.015 07
	293.15	0.1475	0.013 11
	303.15	0.1279	0.011 52
	313.15	0.1119	0.010 22
Methylbenzene	283.15	0.1678	0.0176
	293.15	0.1436	0.0152
	303.15	0.1242	0.0133
	313.15	0.1084	0.0118

Auxiliary Information

Method/Apparatus/Procedure:
The authors used volumetric apparatus in which gas was dissolved in liquid in a glass cell. Pressure measured. Amount of gas dissolved estimated from pressure measurements when gas was repeatedly expanded into known volume. Details in source. Values of solubility calculated from equations and graphs in original.

Source and Purity of Materials:
No information.

Estimated Error:
δT/K = ±0.1;
δx_1 = ±2%.

Components:
(1) Ethyne; C_2H_2; [74-86-2]
(2) 1,3-Dimethylbenzene; C_8H_{10}; [108-38-3]

Original Measurements:
B. Ryutani, Nippon Kagaku Zasshi **80**, 1407–1415 (1959).

Variables:
T/K = 253.15–283.15;
P/kPa = 395–1277

Prepared By:
Sim-wan Annie Bligh and P. G. T. Fogg

Experimental Data

t/°C	T/K	P/atm	P/kPa*	S^a (cm^3 g^{-1})	x_1*	Density/g cm^{-3} Solvent	Density/g cm^{-3} Solution	ΔV^b (cm^3 g^{-1})
10	283.15	3.9	395	36.6	0.1492	0.8729	0.8605	0.066
		6.8	689	62.1	0.2293		0.8475	0.12
		9.7	983	86.5	0.2929		0.8365	0.171
		12.6	1277	126.4	0.3771		0.8359	0.228
0	273.15	6.8	689	77.4	0.2705	0.8819	0.857	0.139
		9.7	983	95	0.3127		0.8216	0.219
		12.6	1277	157.6	0.4302		0.8122	0.325
−10	263.15	3.9	395	51.6	0.1982	0.8908	0.8751	0.089
		6.8	689	100.1	0.3241		0.8575	0.181
		9.7	983	144.6	0.4092		0.8222	0.3
		11.7	1186	171.5	0.451		0.8156	0.35
−20	253.15	3.9	395	69.2	0.2489	0.8997	0.8769	0.122
		6.8	689	127.3	0.3788		0.8363	0.263
		9.7	983	260.6	0.5552		0.7943	0.533
		11.7	1186	427.3	0.6718		0.7383	0.973

*Calculated by the compiler.
[a]S is the volume/cm^3 of gas, corrected to 273.15 K and 101.3 kPa, dissolved by the weight/g of solvent.
[b]ΔV is the change in volume of the liquid due to dissolution of gas.

Auxiliary Information

Method/Apparatus/Procedure:
Absorption was measured by a static method. Densities of saturated solutions were measured by the balancing column method[1] in which saturated solution and mercury in one side of a U-tube were balanced against mercury in the other side of the U-tube with both sides of the tube subject to the same pressure of gas. Heights of liquid columns were measured by a traveling microscope.

Source and Purity of Materials:
(1) Dried with silica gel; purity 99.5%–99.6%.
(2) *Pure Grade*; bpt (760 mm Hg) 138.3 °C n_D^{20} 1.4950.

Estimated Error:
δT/K = ±0.1 (author).

References:
[1]Weissberger, *Technique of Organic Chemistry*, Vol. I, Physical Methods, Part I (Interscience, New York, 1949), p. 285.

Components:
(1) Ethyne; C_2H_2; [74-86-2]
(2) Various solvents

Original Measurements:
I. P. Usyukin and V. M. Shelinikov, Novosti Nefti i Gaz Techn. Neftepererabotka i Neftekhim. **12**, 33–39 (1961).)

Variables:
T/K = 203.2–293.2;
p_1 /kPa = 101.3

Prepared By:
P. G. T. Fogg and Yu. P. Yampolskii

Experimental Data

t/°C	T/K*	Bunsen coefficient α	x_1*	t/°C	T/K*	Bunsen coefficient α	x_1*
2-Propanone; C_3H_6O; [67-64-1]				Methyl acetate; $C_3H_6O_2$; [79-20-9]			
−70	203.2	444	0.567	−70	203.2	236	0.429
−60	213.2	306	0.477	−60	213.2	183	0.371
−50	223.2	233	0.413	−50	223.2	148	0.326
−40	233.2	164	0.334	−40	233.2	115	0.276
−30	243.2	120	0.271	−30	243.2	87	0.226
−20	253.2	80	0.201	−20	253.2	63	0.176
−10	263.2	56	0.151	−10	263.2	46	0.137
0	273.2	40	0.114	0	273.2	35.5	0.110
10	283.2	28	0.084	10	283.2	27	0.087
20	293.2	20	0.062	20	293.2	19.5	0.065
Methanol; CH_5O; [67-56-1]				Diethyl ether; $C_4H_{10}O$; [60-29-7]			
−70	203.2	284	0.319	−70	203.2	230	0.487
−60	213.2	172.5	0.223	−60	213.2	192	0.445
−50	223.2	114.1	0.161	−50	223.2	155	0.396
−40	233.2	77.5	0.117	−40	233.2	118	0.336
−30	243.2	52.2	0.083	−30	243.2	84	0.268
−20	253.2	38	0.062	−20	253.2	55	0.195
−10	263.2	28	0.047	−10	263.2	35	0.135
0	273.2	20	0.034	0	273.2	21.5	0.089
10	283.2	15	0.026	10	283.2	12	0.052
20	293.2	11.5	0.021	20	293.2	7.2	0.033
N,N-Dimethylformamide; C_3H_7NO; [68-12-2]				1,3-Dimethylbenzene; C_8H_{10}; [108-38-3]			
−60	213.2	273	0.471	−40	233.2	34	0.151
−50	223.2	234	0.435	−30	243.2	25.3	0.118
−40	233.2	190	0.386	−20	253.2	18.3	0.089
−30	243.2	150	0.334	−10	263.2	14.3	0.071
−20	253.2	108	0.266	0	273.2	11.6	0.059
−10	263.2	79	0.211	10	283.2	10.8	0.056
0	273.2	60	0.170	20	293.2	10.1	0.053
10	283.2	46	0.137				
20	293.2	37	0.114				
1-Methyl-2-pyrrolidinone; C_5H_9NO; [872-50-4]				1,2-Dichloroethane; $C_2H_4Cl_2$; [107-06-2]			
−20	253.2	125	0.346	−20	253.2	27	0.084
−10	263.2	90	0.277	−10	263.2	22.6	0.072
0	273.2	63	0.213	0	273.2	18.6	0.061
10	283.2	47.5	0.170	10	283.2	14.3	0.048
20	293.2	38.4	0.143	20	293.2	10	0.034

*Calculated by a compiler.

Auxiliary Information

No information.

Components:
(1) Ethyne; C_2H_2; [74-86-2]
(2) Xylene fraction

Original Measurements:
A. G Sukiasyan, Arm. Khim. Zh. **22**, 173–178 (1969).

Variables:
T/K = 258–278

Prepared By:
A. Skrzecz and P. G. T Fogg

Experimental Data

t/°C	T/K	p_1 /Torr	p_1 /kPa*	Absorption α/cm^3(STP) cm^{-3}	x_1*
−15	258.1	700	93.3	6.80	0.035 14
−10	263.1			5.80	0.030 27
−5	268.1			5.05	0.026 58
0	273.1			4.38	0.023 25
5	278.1			3.74	0.020 01
−15	258.1	550	73.3	6.70	0.034 64
−10	263.1			5.71	0.029 81
−5	268.1			4.88	0.025 71
0	273.1			3.91	0.020 80
5	278.1			3.21	0.017 22

*Calculated by compiler.

Auxiliary Information

Method/Apparatus/Procedure:
The static method was used. Gas was added from the burette to the thermostated vessel containing about 5 cm^3 of absorbent. The volume of dissolved gas was calculated from the difference of gas volumes in the burette before and after experiment. Volumes were recalculated to STP.

Source and Purity of Materials:
(1) Source not specified; purity 99.7%.
(2) Xylene fraction, *GOST* 2706-44, containing 70% *m*-xylene, 8% *p*-xylene, 21% *o*-xylene. Analysis by glc indicated benzene as an impurity.

Estimated Error:
No information.

Components:
(1) Ethyne; C_2H_2; [74-86-2]
(2) Naphthalene; $C_{10}H_8$; [91-20-3]

Original Measurements:
V. S. Mislavskaya and S. M. Khodeeva, Zh. Fiz. Khim. **43**, 2376–2377 (1969).

Variables:
T/K= 317–322

Prepared By:
A. Skrzecz and P. G. T. Fogg

Experimental Data

		g(1)/100 g solution		x_1*	
t/°C	T/K*	(1)-rich phase	(2)-rich phase	(1)-rich phase	(2)-rich phase
44.0	317.1	64.7	64.5	0.9006	0.8998
42.2	315.3		59.5		0.8785
44.4	317.5	69.1	60.2	0.9167	0.8816
44.6	317.7		54.9		0.8570
45.4	318.5	78.5		0.9382	
46.6	319.7		48.1		0.8202
47.2	320.3	85.2		0.9659	
48.4	321.5	89.7		0.9772	
48.5	321.6	91.8	47.1	0.9822	0.8142

*Calculated by the compiler.

Auxiliary Information

Method/Apparatus/Procedure:
Measurements were made by the visual method[1] using ampoules fitted with a valve.[2] No more details were reported in the paper.

Source and Purity of Materials:
(1) Source not specified; "purified and dried" in a laboratory; critical temperature 35.5 °C and critical density, 0.213 g cm^{-3}, were in agreement with literature data.
(2) Source not specified; sublimated; melting point 80.3 °C was in agreement with literature data.

Estimated Error:
No information.

References:
[1]I. R. Krichevskii and G. A. Sorina, Zh. Fiz. Khim. **33**, 1151 (1959).
[2]E. S. Lebedeva and S. M. Khodeeva, Zh. Fiz. Khim. **35**, 2602 (1961).

3.5. Alcohols

Components:
(1) Ethyne; C_2H_2; [74-86-2]
(2) Alcohols

Evaluator:
Peter G. T. Fogg, University of North London, London, United Kingdom.

Critical Evaluation

Methanol

Solubilities in methanol at a partial pressure of 101.3 kPa have been given or may be calculated from data obtained by numerous groups. Many authors measured solubilities over pressure ranges. In some cases the total pressure is reported, in other cases the partial pressure of ethyne. The vapor pressure of pure methanol is 3.9 kPa at 273 K. The difference between total pressure and partial pressure of ethyne becomes more significant the higher the temperature and the lower the total pressure.

Solubilities at 101.3 kPa from papers by Mohai and Maleczkine[1] and by Hannaert *et al.*[2] appear to be out of line. Solubilities at a partial pressure of 101.3 kPa from other sources fit the equation:

$$\ln x_1 = 27.5744 + 394.666/(T/\mathrm{K}) - 5.76631 \ln(T/\mathrm{K})$$
$$\text{standard deviation in values of } x_1 = 5.59\times10^{-3}.$$

This is valid for the temperature range 198–323 K.

In the opinion of the evaluator the most reliable data for the temperature range 273–323 K are those provided by Miyano and Hayduk,[3] Miller,[4] and by Hölemann and Hasselmann.[5] These data fit the equation:

$$\ln x_1 = -199.324 + 10\,157.13/(T/\mathrm{K}) + 28.299 \ln(T/\mathrm{K})$$
$$\text{standard deviation in values of } x_1 = 8.35\times10^{-4}.$$

This is valid for the temperature range 273–323 K.

Measurements over pressure ranges by various authors are consistent within about the same limits as the solubilities at a partial pressure of 101.3 kPa.[6–8]

Shleinikov[10–12] measured the effect of 10 vol % of dichloroethane, 1,3-dimethylbenzene, ammonia, benzene, 1,2,3-propanetriol, and of 2-propanone on the solubility of ethyne in methanol at various temperatures. Dichloroethane lowers solubility but in all other cases solubility is increased. The work gives a general indication of relative effects of different additives but details need confirmation.

Braude and Shakhova[9] investigated the effect of addition of water to methanol at various temperatures. The data are self-consistent and show a linear decrease of mole fraction solubility with increase in mass % water.

Ethanol

Fewer measurements of the solubility in ethanol are available. Solubility at 195–293 K and about 101.3 K have been published by Arbuzova *et al.*[13] Mohai and Maleczkine reported data for 198–248 K and 26.5–106.4 kPa. Kireev and Romanchuk[14] published data for 273 K and 13.3–101.3 kPa. The data from the three sources are consistent. Solubility at a partial pressure of ethyne of 101.3 kPa fit the equation:

$$\ln x_1 = 18.1102 + 770.877/(T/\mathrm{K}) - 4.39046 \ln(T/\mathrm{K})$$
$$\text{standard deviation in values of } x_1 = 6.73\times10^{-3}.$$

This equation is valid for the temperature range 198–293 K.

Other alcohols

Solubility in 1-butanol has been measured by Arbuzova *et al.*[13] (195–293 K; approx. 101.3 kPa), by Granzhan and Kvasova[15] (273–303 K; 16.3–100.8 kPa), by Miyano and Hayduk (273–323 K; 101.3 kPa) and by Holemann (298 K; to 117 kPa). Data for a partial pressure of 101.3 kPa from these sources fit the equations below.

$$\ln x_1 = 13.0725 + 975.203/(T/\mathrm{K}) - 3.58797 \ln(T/\mathrm{K})$$
$$\text{standard deviation in values of } x_1 = 2.00\times10^{-2}.$$

This equation is valid for the temperature range 195–323 K.

$$\ln x_1 = -10.0269 + 1769.10/(T/\mathrm{K})$$
$$\text{standard deviation in values of } x_1 = 3.70\times10^{-3}.$$

This equation is valid for the temperature range 263–323 K.

Arbuzova *et al.* measured the effect of adding potassium hydroxide to ethanol and to 1-butanol. In each case potassium hydroxide lowers solubility. The data are of qualitative value.

Miyano and Hayduk also measured solubilities in mixtures of 1-butanol and ethanediol. Solubility in ethanediol markedly increases with addition of butanol with an apparent peak at about 0.8 mole fraction of of butanol. The data are self consistent and are likely to be reliable but no similar data are available for comparison.

Cauquil[16] measured the solubility in cyclohexanol at 299 K; 101.3 kPa. No comparable data are available.

Hölemann and Hasselmann measured the solubility in 1-propene-3-ol at 298 K; 103.7 kPa. No comparable data are available.

Isham[17] reported solubility in tetrahydrofurfuryl alcohol at 298 K; 101.3 kPa. No comparable data are available.

References:

[1]B. Mohai and M. Maleczkine, Veszpremi. Vegyip. Egyet. Kozlemen **3**, 211–220 (1959).
[2]H. Hannaert, M. Haccuria, and M. P. Mathieu, Ind. Chim. Belge **32**, 156–164 (1967).
[3]Y. Miyano and W. Hayduk, Can. J. Chem. Eng. **59**, 746–751 (1981).
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[11]G. N. Bakhtyukova, I. P. Usyukin, V. M. Shleinikov, and V. N. Kir'yakov, Neftepererabotka Neftekhim. (**5**), 37–42 (1965).
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[15]V. A. Granzhan and V. V. Kvasova, Zh. Fiz. Khim. **49**, 2720 (1975); Deposited VINITI 1884-75.
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Components:
(1) Ethyne; C_2H_2; [74-86-2]
(2) Methanol; CH_4O; [67-56-1]; 1-Butanol; $C_4H_{10}O$; [71-36-3]
1-Propene-3-ol, (*allyl alcohol*); C_3H_6O; [107-18-6]
1,2-Ethanediol, (*ethylene glycol*); $C_2H_6O_2$; [107-21-1]

Original Measurements:
P. Hölemann and R. Hasselmann, *Forschungsberichte des Wirtschafts- und Verkehrsministeriums Nord-Westfalen*, No. 109 Forschungsstelle für Acetylen (Westdeutscher Verlag, Köln-Opladen, Germany, 1954).

Variables:
T/K = 298 K; p_1 /kPa = 0 – 117

Prepared By:
P. G. T. Fogg

Experimental Data

Solvent	t/°C	T/K	p_1 /Torr*	p_1 /kPa**	Sol. coefficient***	x_1(1 atm)
Methanol	25	298.15	587	78.2	16.4	0.0198
Butanol	25	298.15	877	116.9	6.3	0.0176
1-Propene-3-ol	25	298.15	778	103.7	7.3	0.0160
Ethanediol	25	298.15	624	83.2	3.5	0.0083

*Maximum pressure of measurements.
**Calculated by compiler.
***The solubility coefficient was defined as mg(gas)/(g(solvent)$\times p_1$ /atm).

This was constant over the pressure range studied, i.e., data were consistent with Henry's law.

Auxiliary Information

Method/Apparatus/Procedure:
Ostwald type apparatus was used. This is fully described in Ref. 1. Measurements were made over a pressure from low pressures to the maximum values given above. Individual data points were published as plots of mg(gas/ g) (solvent) against partial pressure. The points fell very close to straight lines through the origin. Values of the solubility coefficient equal to the slopes of the lines were tabulated.

Source and Purity of Materials:
Solvents were the purest obtainable and further purified by fractional distillation under reduced pressure. Density and vapor pressures were measured at 25 °C.

Solvent	Density/g cm^{-3} Measured	Density/g cm^{-3} Literature	p_2^0/mm Hg
Methanol	0.7941	0.7864 (2)	152
Butanol	0.8041	0.8060 (3)	10.7
1-Propene-3-ol	0.8512	—	43.6
Ethanediol	1.1132	1.1099 (2)	8.5

Estimated Error:
δT/K = ±0.05;
δp_1 = ±0.5 mm Hg (authors).

References:
[1]P. Hölemann and R. Hasselmann, *Forschungsberichte des Wirtschafts- und Verkehrsministeriums Nord-Westfalen*, No. 14 Forschungsstelle für Acetylen (Westdeutscher Verlag, Köln-Opladen, Germany, 1952).
[2]C. Smith and W. Walls, J. Am. Chem. Soc. **53**, 2117 (1931).
[3]J. Butler, D. Thompson, and W. McLennan, J. Chem. Soc. 674 (1933).

Components:
(1) Ethyne; C_2H_2; [74-86-2]
(2) Methanol; CH_4O; [67-56-1]

Original Measurements:
R. Kiyama and H. Hiraoka, Rev. Phys. Chem. Jpn. **25**, 16–20 (1955).

Variables:
T/K = 273.15–303.15;
P/kPa = 101–2942

Prepared By:
P. G. T. Fogg

Experimental Data

	Total pressure		Solubility	
T/K	P/kg cm^{-2}	P/kPa	vol/vol*	x_1
273.15	5	490.3	86.3	0.132
273.15	10	980.7	185.8	0.247
273.15	15	1471	340.9	0.3757
273.15	20	1961.3	734.2	0.5646
283.15	5	490.3	66.4	0.106
283.15	10	980.7	131.7	0.1905
283.15	15	1471	210.7	0.2734
283.15	20	1961.3	322.4	0.3654
283.15	25	2451.7	550.2	0.4957
293.15	5	490.3	52.1	0.086
293.15	10	980.7	98.9	0.152
293.15	15	1471	157.1	0.2211
293.15	20	1961.3	228.4	0.292
293.15	25	2451.7	334.2	0.3764
293.15	30	2942	509.6	0.4793
303.15	5	490.3	37.1	0.0635
303.15	10	980.7	79.7	0.127
303.15	15	1471	120.7	0.1807
303.15	20	1961.3	168	0.2349
303.15	25	2451.7	224.7	0.2911
303.15	30	2942	319.6	0.3687

*The solubility was recorded as the volume of gas, corrected to a partial pressure of 101.3 kPa and a temperature of 273.15 K, which was absorbed by 1 vol. of solvent at the temperature and pressure of the experiment. The value at a pressure of 101.3 kPa was given as the Bunsen coefficient α.

T/K	p_1 /kPa	Bunsen coefficient α	Mole fraction solubility, x_1
273.15	101.3	20	0.034
278.15	101.3	17	0.0294
283.15	101.3	14.8	0.0258
288.15	101.3	12.9	0.0227
293.15	101.3	11.3	0.0201

The authors also gave the equation below for the mole fraction solubility of ethyne at a partial pressure of 1.013 kPa

$$\log_{10} x_1 = -4.8403 + 920.6/(T/\mathrm{K}).$$

Auxiliary Information

Method/Apparatus/Procedure:
An Ostwald type apparatus was used for measurement at atmospheric pressure. Measurements at higher pressures were conducted by bubbling the gas into the solvent contained in a pressure vessel. The equilibrium total pressure was measured with a Bourbon type gauge. A sample was then transferred into an analyzer consisting of two connected burettes. The ratio of volume of gas to volume of solvent was measured at prevailing barometric pressure and temperature. The volume of gas was then adjusted to a partial pressure of 101.3 kPa and temperature of 273.15 K with appropriate allowance for the partial pressure of solvent.[2] The authors used vapor pressure data from Ref. 3 and density data from Ref. 4 for calculation of mole fraction solubilities.

Source and Purity of Materials:
(1) Ethyne prepared from calcium carbide and water had purity of 99.5%–99.6%.
(2) Methanol was fractionated and collected from 64.7–64.8 °C. d_{15}^{15} = 0.799 52. This value corresponds to a purity of 98.91%.[1]

Estimated Error:
No information.

References:
[1]Landolt-Bornstein, *Physikalish-Chemische Tabellen* (*5 auflage*), Vol. 1, p. 453.
[2]H. Hiraoka, Rev. Phys. Chem. Jpn. **24**, 13 (1954).
[3]Landolt-Bornstein, *Physikalish-Chemische Tabellen* (*5 auflage*), Vol. 1, p. 452.
[4]*ibid.*, Vol. 2, p. 1361.

Components:
(1) Ethyne; C_2H_2; [74-86-2]
(2) Methanol; CH_4O; [67-56-1]

Original Measurements:
G. Schay, Gy. Szekely, Gy. Racz, and G. Traply, Periodica Polytech. **2**, 1–24 (1958).

Variables:
T/K = 210–298;
p_1 /kPa = 27.7–102.0

Prepared By:
P. G. T. Fogg

Experimental Data

t/°C	T/K	p_1 /mm Hg	p_1 /kPa	Volume of gas absorbed*/cm^3 g^{-1}	Mole fraction solubility, x_1
−63	210.15	208	27.7	66.9	0.088
		278	37.1	86.6	0.111
		366	48.8	109.0	0.136
		381	50.8	113.0	0.140
		439	58.5	131.0	0.160
		516	68.8	152.0	0.181
		564	75.2	165.0	0.193
−50	223.15	222	29.6	43.6	0.059
		266	35.5	49.3	0.067
		305	40.7	57.5	0.077
		322	42.9	60.1	0.080
		352	46.9	64.5	0.085
		378	50.4	62.4	0.083
		558	74.4	97.0	0.123
		593	79.0	100.0	0.127
		628	83.7	106.0	0.133
		653	87.0	110.0	0.137
		726	96.8	119.0	0.147
		750	100.0	123.0	0.151
−25	248.15	295	39.3	21.8	0.031
		570	76.0	39.8	0.054
		675	90.0	45.8	0.062
		750	100.0	49.0	0.066
0	273.15	341	45.5	9.4	0.013
		506	67.4	13.3	0.019
		552	73.6	15.8	0.022
		668	89.0	16.4	0.023
		765	102.0	18.7	0.026
25	298.15	311	41.5	4.6	0.007
		444	59.2	6.7	0.010
		636	84.8	9.4	0.013

*Volumes of gas were reduced to 273.15 K and 101.3 kPa.

Numerical values of pressures and gas volumes were obtained by the compiler from experimental points on a small scale graph (4 cm ×4 cm) by computer aided digitization. Mole fraction solubilities were calculated by the compiler.

Auxiliary Information

Method/Apparatus/Procedure:
Static methods were used. For measurements above room temperature condensation of solvent vapor in the cooler parts of the system was reduced by use of capillary tubes to connect parts of the apparatus and by measuring the pressure by a null method. A magnetic stirrer was used to stir the solvent in the absorption cell.

Source and Purity of Materials:
No information.

Estimated Error:
No information.

Components:
(1) Ethyne; C_2H_2; [74-86-2]
(2) Methanol; CH_4O; [67-56-1]

Original Measurements:
B. Mohai and M. Maleczkine, Veszpremi. Vegyip. Egyet. Kozlemen **3**, 211–220 (1959).

Variables:
T/K = 198–248;
p_1 /kPa = 25.3–108.9

Prepared By:
C. L. Young

Experimental Data

T/K	p_1 /mm Hg	p_1 /kPa	α**	x_1*
248.2	190	25.3	11.9	0.0167
	209	27.9	13.6	0.0191
	224	29.9	14.6	0.0204
	370	49.3	23.4	0.0324
	381	50.8	25.0	0.0345
	488	65.1	30.9	0.0423
	542	72.3	35.0	0.0476
	608	81.1	36.2	0.0492
	623	83.1	39.5	0.0534
	676	90.1	39.7	0.0537
	726	96.8	43.5	0.0585
	806	107.5	48.9	0.0653
	(760)	(101.3)	(45.5)	0.0611
223.2	192	25.6	37.7	0.0511
	207	27.6	39.2	0.0531
	219	29.2	45.1	0.0606
	309	41.2	55.3	0.0733
	436	58.1	63.1	0.0827
	512	68.3	77.2	0.0994
	551	73.5	79.0	0.1015
	577	76.9	84.4	0.1077
	623	83.1	86.5	0.1100
	669	89.2	92.0	0.1162
	797	106.3	97.7	0.1225
	(760)	(101.3)	(98.0)	0.1230
198±2	261	34.8	106.2	0.1318
	281	37.5	112.5	0.1385
	353	47.1	136.2	0.1630
	495	66.0	182.9	0.2073
	603	80.4	206.0	0.2275
	609	81.2	205.0	0.2266
	662	88.3	313.5	0.2338
	765	102.0	236.1	0.2523
	817	108.9	253.0	0.2656
	(760)	(101.3)	(238)	(0.254)

*Calculated by the compiler.
**(Vol. of gas, reduced to 101.3 kPa and 273.2 K)/cm^3 dissolved by 1 g of solvent.

Values in parentheses are extrapolated to 1 atm.

Auxiliary Information

Method/Apparatus/Procedure:
Volumetric method. Pressure measured when known amounts of gas added, in increments, to a known amount of liquid in a vessel of known dimensions. Corrections were made for the partial pressure of solvent. Details in Ref. 1

Source and Purity of Materials:
No information.

Estimated Error:
δT/K = ±0.1;
$\delta\alpha$ = ±4% or less.

References:
E. Bodor, G. J. Bor, B. Mohai, and G. Siposs, Veszpremi, Vegyip. Egyet. Kozlemen. **1**, 55 (1957).

Components:
(1) Ethyne; C_2H_2; [74-86-2]
(2) Methanol; CH_4O; [67-56-1]

Original Measurements:
B. Ryutani, Nippon Kagaku Zasshi **80**, 1407–1415 (1959).

Variables:
T/K = 253.15–283.15;
P/kPa = 395–1277

Prepared By:
Sim-wan Annie Bligh and P. G. T. Fogg

Experimental Data

t/°C	T/K	P/atm	P/kPa*	S^a (cm^3 g^{-1})	x_1*	Density/g cm^{-3} Solvent	Density/g cm^{-3} Solution	ΔV^b (cm^3 g^{-1})
10	283.15	3.9	395	68.5	0.0901	0.8006	0.7789	0.138
		6.8	689	120.9	0.1488		0.7607	0.252
		9.7	983	180.2	0.2067		0.7479	0.371
		12.6	1277	261.5	0.2743		0.7434	0.509
0	273.15	3.9	395	104.5	0.1312	0.8106	0.7921	0.184
		6.8	689	177.1	0.2038		0.7744	0.326
		9.7	983	261.2	0.2741		0.7602	0.485
		12.6	1277	333.0	0.3250		0.7356	0.657
−10	263.15	3.9	395	144.8	0.1731	0.8206	0.8023	0.239
		6.8	689	231.5	0.2507		0.772	0.429
		9.7	983	364.7	0.3452		0.7651	0.648
		12.6	1277	489.2	0.4142		0.7349	0.924
−20	253.15	3.9	395	187.9	0.2136	0.8305	0.8036	0.317
		6.8	689	311.5	0.3105		0.7657	0.579
		9.7	983	505.1	0.4220		0.7387	0.952
		12.6	1277	913.6	0.5691		0.6841	1.826

*Calculated by the compiler.
[a]S is the volume/cm^3 of gas, corrected to 273.15 K and 101.3 kPa, dissolved by the weight/g of solvent.
[b]ΔV is the change in volume of the liquid due to dissolution of gas.

Auxiliary Information

Method/Apparatus/Procedure:
Absorption was measured by a static method. Densities of saturated solutions were measured by the balancing column method[1] in which saturated solution and mercury in one side of a U-tube were balanced against mercury in the other side of the U-tube with both sides of the tube subject to the same pressure of gas. Heights of liquid columns were measured by a traveling microscope. The method is described in Ryutani.[2]

Source and Purity of Materials:
(1) Dried with silica gel; purity 99.5%–99.6%,
(2) Boiling point (760 mm Hg) 64.7 °C n_D^{20} 1.3293.

Estimated Error:
ΔT/K = ±0.1 (author).

References:
[1]Weissberger, *Technique of Organic Chemistry*, Vol. I, Physical Methods, Part I (Interscience, New York, 1949), p. 285.
[2]B. Ryutani, Nippon Kagaku Zasshi **80**, 1407 (1959).

Components:
(1) Ethyne; C_2H_2; [74-86-2];
(2) Methanol; CH_4O; [67-56-1]

Original Measurements:
G. E. Braude and S. F. Shakhova, Khim. Prom. (**3**), 177–182 (1961).

Variables:
T/K = 195.15–263.15;
p_1 /kPa = 9.02–100.6

Prepared By:
P. G. T. Fogg

Experimental Data

t/°C	T/K	p/mm Hg	p_1 /kPa*	x_1
−78	195.15	67.7	9.02	0.081
		125.9	16.79	0.129
		184.2	24.56	0.178
		247.3	32.97	0.207
		277.3	36.97	0.230
		347.5	46.32	0.267
		408.4	54.46	0.281
		431.4	57.52	0.299
		496.4	66.18	0.337
		529.5	70.59	0.343
		590.5	78.73	0.359
		631.0	84.13	0.387
		685	91.34	0.400
−70	203.15	91.5	12.20	0.061
		183	24.40	0.123
		191.7	25.56	0.123
		412.1	54.94	0.209
		419.1	55.89	0.215
		586.8	78.23	0.267
		600.9	80.11	0.277
		710.7	94.75	0.300
−55	218.15	186.8	24.91	0.059
		404.8	53.97	0.113
		497.1	66.28	0.130
		542.4	72.32	0.139
		593.0	79.05	0.150
		650.5	86.72	0.164
		721.8	96.23	0.171
−40	233.15	87.0	11.60	0.014
		101.0	13.46	0.018
		141.0	18.80	0.023
		148.0	19.73	0.024
		212.5	28.33	0.040
		215.8	28.77	0.033
		285.5	38.07	0.050
		311.6	41.54	0.053
		450.8	60.10	0.073
		482.2	64.29	0.081
		548.2	73.09	0.086
		581.3	77.50	0.092
		617.7	82.36	0.093
		687.4	91.65	0.107
		702.9	93.72	0.103
		741.2	98.82	0.109

−25	248.15	139.0	18.53	0.011
		156.4	20.85	0.014
		173.8	23.17	0.015
		274.6	36.61	0.027
		290.3	38.70	0.028
		298.9	39.85	0.026
		436.2	58.16	0.040
		460.6	61.40	0.043
		537.1	71.60	0.052
		547.5	72.99	0.053
		634.4	84.57	0.060
		646.5	86.19	0.060
		689.9	91.98	0.062
		754.3	100.56	0.0714
−10	263.15	109.4	14.58	0.0045
		158.0	21.06	0.0069
		164.9	21.99	0.0068
		258.7	34.49	0.0134
		283.1	37.74	0.0163
		317.8	42.38	0.0207
		397.7	53.03	0.0258
		411.6	54.88	0.0272
		505.4	67.38	0.0304
		555.7	74.09	0.0328
		562.7	75.02	0.0360
		623.5	83.12	0.0382
		675.6	90.07	0.0422
		727.6	97.01	0.0411
		734.7	97.95	0.0478
		771.1	102.80	0.0470

Data were published in graphical form. The graphs were scanned and digitized by the compiler.

Auxiliary Information

Method/Apparatus/Procedure:

A static method was used. The calibrated absorption cell was made from the stem of a burette and contained a magnetic stirrer. A thermostat controlled the temperature to ±0.2 °C. The apparatus was evacuated to 10^{-2} mm Hg. Methanol was introduced into the cell and degassed under vacuum. The volume and vapor pressure of the methanol were measured after the cell had been immersed in the liquid in a cryostat set to an appropriate temperature. Gas was then introduced into the cell. The pressure and volume of the gas absorbed were measured when the system had reached equilibrium.

Source and Purity of Materials:

(1) Technical ethyne from a cylinder was dissolved in acetone at low temperatures with subsequent desorption at higher temperatures and collection of the middle fraction.
(2) Doubly distilled *pure-grade*. The water content was determined by a Karl-Fischer titration.

Estimated Error:

δT/K=0.2;
$\delta x/x \leqslant 0.02$ (authors).

Components:

(1) Ethyne; C_2H_2; [74-86-2]
(2) Methanol; CH_5O; [67-56-1]

Original Measurements:

I. P. Usyukin and V. M. Shleinikov, Novosti Nefti Gas Tekhn. Neftepererabotka Neftekhim. (**12**), 33–39 (1961).

Variables:

T/K=193–295;
P/kPa=101.3

Prepared By:

Yu. P. Yampolskii

Experimental Data

t/°C	T/K*	Solubility**/cm^3 g^{-1}	x_1	t/°C	T/K*	Solubility**/cm^3 g^{-1}	x_1
−80	193.2	570	0.4517*	−20	253.2		0.0618
−70	203.2	332	0.3160	−14	259.2	38.3	0.0525*
−60	213.2	199	0.2200	−13	260.2	35.6	0.0489*
−56	217.2	159	0.1869*	−10	263.2		0.0455
−50	223.2	133	0.1600	−5	268.2	28.1	0.0390*
−48	225.2	129	0.1572*	0	273.2		0.0338
−40	233.2	91.5	0.1158	5	278.2	21.2	0.0297*
−39	234.2	89.3	0.1143*	10	283.2		0.0260
−31	242.2	63.5	0.0841*	20	293.2		0.0203
−30	243.2	62.3	0.0818	22	295.2	13.0	0.0184*
−22	251.2	47.2	0.0639*				

*Calculated by compiler.
**Volume of gas, reduced to 101.3 kPa and 273.15 K, dissolved by 1 g of solvent.

Auxiliary Information

Method/Apparatus/Procedure:

Ethyne from a saturated aqueous solution was allowed to equilibrate with methanol. The volume of gas absorbed was measured.

Source and Purity of Materials:

No information.

Estimated Error:

No information.

Components:
(1) Ethyne; C_2H_2; [74-86-2]
(2) Methanol; CH_5O; [67-56-1]

Original Measurements:
G. N. Bakhtyukova, I. P. Usyukin, V. M. Shleinikov, and V. N. Kir'yakov, Neftepererabotka Neftekhim. (**5**), 37–42 (1965).

Variables:
T/K = 243–293;
P/MPa = 0.1–1.9

Prepared By:
Yu. P. Yampl'skii

Experimental Data
Mole fraction solubility of C_2H_2, x_1

	T/K					
P/MPa	243.2	253.2	263.2	273.2	283.2	293.2
0.1	0.0905	0.0694	0.0532	0.0395	0.0308	0.0238
0.3	0.224	0.175	0.137	0.0975	0.0775	0.0663
0.5	0.255	0.233	0.188	0.140	0.117	0.101
0.7	0.414	0.316	0.258	0.198	0.159	0.126
0.9	0.502	0.397	0.315	0.252	0.200	0.168
1.1		0.487	0.384	0.301	0.254	0.211
1.3		0.565	0.454	0.352	0.294	0.242
1.5			0.502	0.402	0.328	0.265
1.7			0.570	0.458	0.368	0.294
1.9			0.637	0.507	0.413	0.323

Auxiliary Information

Method/Apparatus/Procedure:
The volume of gas absorbed was measured with an apparatus which was a slightly modified version of that described in Ref. 1.

Source and Purity of Materials:
(1) Technical grade; purified by passing through a trap containing activated charcoal.
(2) Distilled before use.

Estimated Error:
δT/K = ±0.1.

References:
I. P. Usyukin, V. M. Shleinikov, A. V. Timofeev, and G. N. Shchekina, Neftepererabotka Neftekhim. (**11**), 35 (1963).

Components:
(1) Ethyne; C_2H_2; [74-86-2]
(2) Methanol; CH_4O; [67-56-1]

Original Measurements:
British Oxygen Co. Ltd., reported by S. A. Miller, *Acetylene—Its Properties, Manufacture and Uses* (Academic, New York, 1965), Vol. I.

Variables:
T/K = 273.15–313.15;
p_1 /kPa = 506.6–3039.7

Prepared By:
P. G. T. Fogg

Experimental Data

				Solubility		
t/°C	T/K	p_1 /atm	p_1 /kPa	g kg^{-1} of solvent	g dm^{-3} of solution	x_1
10	283.15	5	506.6	112		0.1211
		10	1013.2	230		0.2206
		15	1519.9	368		0.3117
		20	2026.5	536		0.3974
		25	2533.1	748		0.4793
		30	3039.7	1025		0.5578
15	288.15	15	1519.9		176	
20	293.15	5	506.6	92		0.1017
		10	1013.2	186		0.1863
		15	1519.9	293		0.265
		20	2026.5	417		0.3391
		25	2533.1	565		0.4101
		30	3039.7	746		0.4786
30	303.15	5	506.6	77		0.0866
		10	1013.2	154		0.1593
		15	1519.9	238		0.2265
		20	2026.5	333		0.2907
		25	2533.1	443		0.3528
		30	3039.7	572		0.4131
50	323.15	5	506.6	55		0.0634
		10	1013.2	109		0.1183
		15	1519.9	166		0.1696
		20	2026.5	227		0.2183
		25	2533.1	295		0.2663
		30	3039.7	370		0.3129

*Estimated by the compiler.

The author states that the mole fraction solubility in the range 0–60 °C and 7–35 atm (709.3–3546.4 kPa) fits the equation: $x_1 = (p_1/\text{atm})(a - b\log_{10}(p_1/\text{atm}))$ where

$$\log_{10} a = 691/(T/\text{K}) - 3.970 \qquad \log_{10} b = 932/(T/\text{K}) - 5.427.$$

Dilation, V/V_o, at 15 °C over the same pressure range was said to fit the equations:

$$V/V_o = 1.001 + 1.45s, \text{ where } s = \text{wt of ethyne/wt of methanol},$$

$$V/V_o = 1 + 0.0284p_1/\text{atm} + 0.00028(p_1/\text{atm})^2.$$

Auxiliary Information

Method/Apparatus/Procedure:
No information.

Source and Purity of Materials:
No information.

Estimated Error:
No information.

Components:
(1) Ethyne; C_2H_2; [74-86-2]
(2) Methanol (*methyl alcohol*); CH_4O; [67-56-1]

Original Measurements:
V. M. Shleinikov, Zh. Vses. Khim, Obshchest. **11**, 116–117 (1996).

Variables:
T/K = 200–293

Prepared By:
A. Skrzecz and P. G. T. Fogg

Experimental Data

P/atm	P/kPa	t/°C	T/K	Solubility of C_2H_2* (cm^3/cm^3)	x_1**
1	98	−70	203.2	284	0.3038
		−60	213.2	172.5	0.2112
		−50	223.2	114.1	0.1517
		−40	233.2	77.5	0.1093
		−30	243.2	52.2	0.0771
		−20	253.2	38	0.0579
		−10	263.2	28	0.0438
		0	273.2	20	0.032
		10	283.2	15	0.0245
		20	293.2	11.5	0.0191

*Volume of gas measured at 273.15 K and 101.3 kPa dissolved by one volume of solvent.
**Calculated by the compiler.

Auxiliary Information

Method/Apparatus/Procedure:
The method was as described as in Usyukin and Shleinikov.[1] No more details were reported in the paper.

Source and Purity of Materials:
No information.

Estimated Error:
No information.

References:
[1]I. P. Usyukin and V. M. Shleinikov, Neftepererab. Neftekhim. (Moscow) (**12**), 33 (1961).

Components:
(1) Ethyne; C_2H_2; [74-86-2]
(2) Methanol and glycols

Original Measurements:
H. I. Hannaert, M. I. Haccuria, and M. P. Mathieu, Ind. Chim. Belge **32**, 156–164 (1967).

Variables:
T/K = 273–293 or 303

Prepared By:
E. L. Boozer and H. L. Clever

Experimental Data

T/K	$100x_1$ /mol %	$Kp\nu$/atm* at 293.15	Enthalpy of dissolution, ΔH/kcal mol^{-1}	A
Methanol; CH_4O; [67-56-1]				
223.15–293.15	1–10	49	4.3	4.9
1,2-Ethanediol, (*ethylene glycol*); $C_2H_6O_2$; [107-21-1]				
303.15	-	199	-	-
2,2′-[1,2-Ethanediy1bis(oxy)]bisethanol, (*triethylene glycol*); $C_6H_{14}O_4$; [112-27-6]				
303.15	-	38.8	-	-

*$\log_{10}(KP\nu/\text{atm}) = A - (\Delta H/\text{cal mol}^{-1})/(2.3R(T/\text{K}))$.

The author's definitions are:
$K = y_1/x_1$ = mole fraction gas in gas phase/mole fraction gas in liquid phase,
P/atm = total pressure; ν = coefficient of fugacity.

The function $KP\nu$/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/Apparatus/Procedure:
The static pressure over a saturated solution was measured.

Source and Purity of Materials:
(1) Ethyne. Commercial product. Purified by passage over activated carbon and vacuum fusion. Purity 99.8%–99.9%.
(2) 2-Propanone. Merck and Co. Vapor pressure, p/mm Hg = 11 at −30 °C and 184 at 20 °C.

Estimated Error:
10%–15% (authors).

Components:
(1) Ethyne; C_2H_2; [74-86-2]
(2) Methanol; CH_4O; [67-56-1]
1-Butanol; $C_4H_{10}O$; [71-36-3]
1,2-Ethanediol; $C_2H_6O_2$; [107-21-1]

Original Measurements:
Y. Miyano and W. Hayduk, Can. J. Chem. Eng. **59**, 746–751 (1981).

Variables:
T/K = 273.15–323.15;
p_1 /kPa = 101.3

Prepared By:
P. G. T. Fogg

Experimental Data

Solvent	t/°C	T/K	Oswald coefficient, L	x_1
Methanol	0	273.15	18.9	0.0326
	25	298.15	10.9	0.0179
	35	308.15	8.98	0.0146
Butanol	0	273.15	6.2	0.0245
	25	298.15	3.99	0.0149
	50	323.15	2.96	0.0104
1,2-Ethandiol	0	273.15	5.42	0.0133
	0.4	273.55	5.31	0.0130
	25	298.15	3.15	0.0072
	50	323.15	2.11	0.0045

Auxiliary Information

Method/Apparatus/Procedure:
A glass volumetric apparatus, similar to that described earlier,[1] was used. Degassed solvent came into contact with the gas while it was flowing in a thin film into the solution buret. Dry gas in a gas buret was maintained at barometric pressure by adjustment of mercury level. Temperature was controlled to ±0.05 K by circulation of an ethanediol–water mixture through the jackets surrounding the solubility apparatus. The proportion of solvents in the mixtures was calculated from densities measured by a Digital Precision Density Meter. Gas solubilities were corrected to a partial pressure of 101.325 kPa.

Source and Purity of Materials:
(1) Ethyne supplied by Matheson Company of Canada; minimum purity 99.6%.
(2) From J. T. Baker; purity>99 mol %.

Estimated Error:
δT/K = ±0.05 (authors).

References:
[1]W. I. Hayduk and S. C. Cheng, Can. J. Chem. Eng. **48**, 93 (1970).

Components:
(1) Ethyne; C_2H_2; [74-86-2]
(2) Methanol (*methyl alcohol*); CH_4O; [67-56-1]
(3) Dichloroethane; $C_2H_4Cl_2$; [1300-21-6]

Original Measurements:
V. M. Shleinikov, Zh. Vses. Khim. Obshchest. **11**, 116–117 (1966).

Variables:
T/K = 203–293

Prepared By:
A. Skrzecz, and P. G. T. Fogg

Experimental Data
The solvent contained 10 vol % of dichloroethane and 90 vol % of methanol before dissolution of ethyne.

p_1 /atm	p_1 /kPa	t/°C	T/K	Solubility of C_2H_2 /(cm^3/cm^3)*
1	98	−70	203.1	302
		−60	213.1	194
		−50	223.1	122.3
		−40	233.1	85.5
		−30	243.1	60
		−20	253.1	42.3
		−10	263.1	31
		0	273.1	21.4
		10	283.1	16
		20	293.1	11.8

*Volume of gas measured at 273.15 K and 101.3 kPa dissolved by 1 vol of solvent.

Auxiliary Information

Method/Apparatus/Procedure:
The method was as described in Ref. 1. No more details were reported in the paper.

Source and Purity of Materials:
No information.

Estimated Error:
No information.

References:
[1]I. P. Usyukin and V. M. Shleinikov, Neftepererab. Neftekhim. (Moscow) (**12**), 33 (1961).

Components:
(1) Ethyne; C_2H_2; [74-86-2]
(2) Methanol (*methyl alcohol*); CH_4O; [67-56-1]
(3) 1,3-Dimethylbenzene, (*m-xylene, 1,3-xylene*); C_8H_{10}; [108-38-3]

Original Measurements:
V. M. Shleinikov, Zh. Vses. Khim. Obshchest. **11**, 116–117 (1966).

Variables:
T/K = 203–293;
p_1 /kPa = 98

Prepared By:
A. Skrzecz and P. G. T. Fogg

Experimental Data
The solvent consisted of 10 vol % 1,3-dimethylbenzene in methanol.

p_1 /atm	p_1 /kPa	t/°C	T/K	Solubility of C_2H_2 /(cm^3/cm^3)*
1	98	−70	203.1	275
		−60	213.1	180.0
		−50	223.1	124.0
		−40	233.1	89.3
		−30	243.1	65.5
		−20	253.1	45.5
		−10	263.1	29.8
		0	273.1	19.0
		10	283.1	11.8
		20	293.1	7.9

*Volume of gas measured at 273.15 K and 101.3 kPa dissolved by 1 vol of solvent.

Auxiliary Information

Method/Apparatus/Procedure:
The method was as described by Usyukin and Shleinikov.[1] No more details were reported in the paper.

Source and Purity of Materials:
No information.

Estimated Error:
No information.

References:
[1]I. P. Usyukin and V. M. Shleinikov, Neftepererab. Neftekhim. (Moscow) (**12**), 33 (1961).

Components:
(1) Ethyne; C_2H_2; [74-86-2]
(2) Methanol (*methyl alcohol*); CH_4O; [67-56-1]
(3) Ammonia; H_3N; [7664-41-7]

Original Measurements:
V. M. Shleinikov, Zh. Vses. Khim. Obshchest. **11**, 116–117 (1966).

Variables:
T/K = 200–293

Prepared By:
A. Skrzecz and P. G. T. Fogg

Experimental Data
The solvent contained of 10 mass % of ammonia and 90 mass % of methanol before dissolution of ethyne.

P/atm	P/kPa	t/°C	T/K	Solubility of C_2H_2* (cm^3/cm^3)
1	98	−70	203.2	329
		−60	213.2	216
		−50	223.2	146
		−40	233.2	108
		−30	243.2	77.2
		−20	253.2	57.9
		−10	263.2	42.7
		0	273.2	32.0
		10	283.2	20.0
		20	293.2	12.7

*Volume of gas measured at 273.15 K and 101.3 kPa dissolved by 1 vol of solvent.

Auxiliary Information

Method/Apparatus/Procedure:
The method was as described by Usyukin and Shleinikov.[1] No more details were reported in the paper.

Estimated Error:
No information.

References:
[1]I. P. Usyukin and V. M. Shleinikov, Neftepererab. Neftekhim. (Moscow) (**12**), 33 (1961).

Components:
(1) Ethyne; C_2H_2; [74-86-2]
(2) Methanol (*methyl alcohol*); CH_4O; [67-56-1]
(3) Benzene; C_6H_6; [71-43-2]

Original Measurements:
V. M. Shleinikov, Zh. Vses. Khim. Obshchest. **11**, 116–117 (1966).

Variables:
T/K = 223–293

Prepared By:
A. Skrzecz and P. G. T. Fogg

Experimental Data
The solvent contained 10 vol % of benzene and 90 vol % of methanol before dissolution of ethyne.

p_1 /atm	p_1 /kPa	t/°C	T/K	Solubility of C_2H_2* (cm^3/cm^3)
1	98	−50	223.2	133
		−40	233.2	98.7
		−30	243.2	70.0
		−20	253.2	44.2
		−10	263.2	31.0
		0	273.2	22.5
		10	283.2	17.0
		20	293.2	13.0

*Volume of gas measured at 273.15 K and 101.3 kPa dissolved by 1 vol of solvent.

Auxiliary Information

Method/Apparatus/Procedure:
The method was as described by Usyukin and Shleinikov.[1] No more details were reported in the paper.

Source and Purity of Materials:
No information.

Estimated Error:
No information.

References:
[1]I. P. Usyukin and V. M. Shleinikov, Neftepererab. Neftekhim. (Moscow) (**12**), 33 (1961).

Components:
(1) Ethyne; C_2H_2; [74-86-2]
(2) Methanol (*methyl alcohol*); CH_4O; [67-56-1]
(3) 1,2,3-Propanetriol, (*glycerol, glycerine*); $C_3H_8O_3$; [56-81-5]

Original Measurements:
V. M. Shleinikov, Zh. Vses. Khim. Obshchest. **11**, 116–117 (1966).

Variables:
T/K = 203–293

Prepared By:
A. Skrzecz and P. G. T. Fogg

Experimental Data
The solvent contained 10 vol % of 1,2,3-propanetriol and 90 vol % of methanol before dissolution of ethyne.

p_1 /atm	p_1 /kPa	t/°C	T/K	Solubility of C_2H_2* (cm^3/cm^3)
1	98	−70	203.2	250
		−60	213.2	190
		−50	223.2	137
		−40	233.2	100
		−30	243.2	68.8
		−20	253.2	49.2
		−10	263.2	38.3
		0	273.2	29.0
		10	283.2	20.3
		20	293.2	15.0

*Volume of gas measured at 273.15 K and 101.3 kPa dissolved by 1 vol of solvent.

Auxiliary Information

Method/Apparatus/Procedure:
The method was as described in Ref. 1. No more details were reported in the paper.

Estimated Error:
No information.

References:
[1]I. P. Usyukin and V. M. Shleinikiv, Neftepererab. Neftekhim. (Moscow) (**12**), 33 (1961).

Components:
(1) Ethyne; C_2H_2; [74-86-2]
(2) Methanol (*methyl alcohol*); CH_4O; [67-56-1]
(3) 2-propanone, (*acetone, propanone, dimethyl ketone*); C_3H_6O; [67-64-1]

Original Measurements:
V. M. Shleinikov, Zh. Vses. Khim. Obshchest. **11**, 116–117 (1966).

Variables:
T/K = 203–293

Prepared By:
A. Skrzecz and P. G. T. Fogg

Experimental Data

The solvent contained of 10 vol % of 2-propanone and 90 vol % of methanol before dissolution of ethyne.

P/atm	P/kPa	t/°C	T/K	Solubility of C_2H_2* (cm^3/cm^3)
1	98	−70	203.2	323
		−60	213.2	198
		−50	223.2	133
		−40	233.2	92.5
		−30	243.2	64.8
		−20	253.2	49.0
		−10	263.2	35.1
		0	273.2	24.8
		10	283.2	18.3
		20	293.2	13.8

*Volume of gas measured at 273.15 K and 101.3 kPa dissolved by 1 volume of solvent.

Auxiliary Information

Method/Apparatus/Procedure:
The method was as described by Usyukin and Shleinikov.[1] No more details were reported in the paper.

Source and Purity of Materials:
No information.

Estimated Error:
No information.

References:
[1] I. P. Usyukin and V. M. Shleinikov, Neftepererab. Neftekhim. (Moscow) (**12**), 33 (1961).

Components:
(1) Ethyne; C_2H_2 ; [74-86-2]
(2) Methanol; CH_4O; [67-56-1]
(3) Water; H_2O; [7732-18-5]

Original Measurements:
G. E. Braude and S. F. Shakhova, Khim. Prom. (**3**), 177–182 (1961).

Variables:
T/K = 195.2–263.2;
p_1 /kPa = 12.4–101.6;
mass %H_2O = 0.05–9.5

Prepared By:
P. G. T. Fogg

Experimental Data

mass %H_2O	t/°C	T/K***	p_1 /mm Hg	p_1 /kPa*	Absorption**	x_1	$K^{\dagger}$/mm Hg	$\beta^{\dagger}$
0.05	−10	263.15	106	14.1	3.5	.0061	15 470	0.251
			318	42.4	12.1	.0207		
			554	73.9	20.3	.0344		
			762	101.6	28.2	.0471		
	−25	248.15	136	18.1	8.6	.0146	8930	0.473
			291	38.8	18.5	.0309		
			536	71.5	33.0	.0539		
			747	99.6	45.4	.0727		
	−40	233.15	93	12.4	11.1	.0186	4808	0.634
			311	41.5	33.3	.0536		
			545	72.7	56.6	.0877		
			696	92.8	70.9	.108		
	−55	218.15	189	25.2	40.3	.0631	2535	0.631
			403	53.7	77.5	.115		
			594	79.2	108.7	.154		
			714	95.2	126.6	.175		
	−70	203.15	192	25.6	85.4	.123	1122	0.598
			409	54.5	162.1	.21		
			587	78.3	223.0	.268		
			709	94.5	261.0	.3		
	−78	195.15	125	16.7	92.7	.131	716	0.571
			280	37.3	181.0	.228		
			496	66.1	316.0	.34		
			687	91.6	435.0	.415		
4.4	−10	263.15	190	25.3	6.4	.0106	18 520	0
			371	49.5	12.2	.02		
			512	68.3	16.9	0.0276		
			749	99.9	25.0	0.0402		
	−25	248.15	143	19.1	7.3	0.0119	12 920	0
			352	46.9	17.6	0.0283		
			575	76.7	28.4	0.0448		
			720	96.0	36.0	0.0561		
	−40	233.15	101	13.5	8.9	0.0143	6730	0.420
			260	34.7	22.7	0.0356		
			496	66.1	42.7	0.0650		
			723	96.4	61.0	0.0903		
	−55	218.15	151	20.1	27.8	0.0427	3130	0.619
			367	48.9	63.7	0.0928		
			599	79.9	98.6	0.1370		
			743	99.1	120.7	0.1620		
9.5	−10	263.15	146	19.5	3.9	0.0061	23 180	0
			293	39.1	8.1	0.0127		

		482	64.3	13.7	0.0212		
		742	98.9	20.3	0.0311		
−25	248.15	132	17.6	5.8	0.0090	15 110	0
		307	40.9	13.4	0.0205		
		501	66.8	21.4	0.0323		
		750	100.0	31.5	0.0468		
−40	233.15	161	21.5	11.5	0.0174	9650	0
		301	40.1	21.0	0.0313		
		543	72.4	36.8	0.0536		
		761	101.5	50.1	0.0716		
−55	218.15	147	19.6	22.1	0.0325	4335	0.422
		275	36.7	39.3	0.0563		
		481	64.1	67.1	0.0925		
		684	91.2	93.5	0.1240		

*Calculated by the compiler.
**Volume of gas, reduced to 273.15 K and 101.3 kPa, dissolved at the temperature and pressure stated by unit volume of liquid. The volume of liquid was measured at the temperature of the experiment.
***Note. The above data appear to be smoothed data. Original data were displayed in graphical form in the paper.
†The authors fitted the data to the Krichevsky–Il'inskaya equation in the form:

$$\log_{10}(p_1/x_1) = \log_{10} H - \beta(1 - x_2^2).$$

The constant H is the limiting value of Henry's law constant at zero pressure. x_2 is the mole fraction of solvent and β is a constant for a particular temperature and solvent mixture.

Auxiliary Information

Method/Apparatus/Procedure:
A static method was used. The calibrated absorption cell was made from the stem of a burette and contained a magnetic stirrer. A thermostat controlled the temperature to ±0.2 °C. The apparatus was evacuated to 10^{-2} mm Hg. Methanol was introduced into the cell and degassed under vacuum. The volume and vapor pressure of the methanol were measured after the cell had been immersed in the liquid in a cryostat set to an appropriate temperature. Gas was then introduced into the cell. The pressure and volume of the gas absorbed were measured when the system had reached equilibrium.

Source and Purity of Materials:
(1) Technical ethyne from a cylinder was dissolved in acetone at low temperatures with subsequent desorption at higher temperatures and collection of the middle fraction.
(2) Doubly distilled "pure grade." The water content was determined by a Karl–Fischer type titration.

Estimated Error:
δT/K = 0.2;
$\delta x/x \leqslant 0.02$ (authors).

Components:
(1) Ethyne; C_2H_2 ; [74-86-2]
(2) Ethanol (*ethyl alcohol*); C_2H_6O; [64-17-5]

Original Measurements:
V. A. Kireev and M. A. Romanchuk, Zh. Obshch. Khim. **6**, 78–80 (1936).

Variables:
T/K = 273;
P/kPa = 13.3–101.3

Prepared By:
A. Skrzecz and P. G. T. Fogg

Experimental Data

t/°C	T/K*	P/mm Hg	P/kPa*	V_1/V_2[a]	x_1*
0	273.1	100	13.3	1.1	0.0029
		200	26.7	2.2	0.0058
		300	40.0	3.3	0.0086
		400	53.3	4.4	0.0115
		500	66.7	5.5	0.0143
		600	80.0	6.7	0.0174
		700	93.3	7.8	0.0202
		760	101.3	8.5	0.0219

[a]Ratio of volume of gas (STP) to volume of solvent.
*Calculated by a compiler.

Auxiliary Information

Method/Apparatus/Procedure:
The solvent was saturated with the gas at constant temperature and pressure until equilibrium was reached. After decreasing the pressure, the volume of the desorbed gas was measured. The method and apparatus were described in Kireev *et al.*[1]

Source and Purity of Materials:
(1) Source not specified; taken from a standard cylinder, technical grade; used as received; $\rho^{20} = 1.0857$ g dm^{-3}.
(2) Source not specified; 97% pure.

Estimated Error:
No information.

References:
[1]V. A. Kireev, S. I. Kaplan, and M. A. Romanchuk, Zh. Obshch. Khim. **5**, 444 (1935).

Components:
(1) Ethyne; C_2H_2 ; [74-86-2]
(2) Ethanol; C_2H_6O; [64-17-5]

Original Measurements:
B. Mohai and M. Maleczkine, Veszpremi. Vegyip. Egyet. Kozlemen **3**, 211–220 (1959).

Variables:
T/K = 198–248;
p_1 /kPa = 21–103

Prepared By:
C. L. Young

Experimental Data

T/K	p_1 /mm Hg	p_1 /kPa	α**	Mole fraction of acetylene in liquid, x_1*
248.2	240	32.0	8.2	0.0166
	260	34.7	9.2	0.0186
	337	44.9	11.5	0.0231
	387	51.6	12.8	0.0256
	408	54.4	13.3	0.0266
	434	57.9	14.3	0.0286
	485	64.7	15.6	0.0311
	506	67.5	15.8	0.0315
	541	72.1	17.4	0.0345
	584	77.9	18.0	0.0357
	611	81.5	19.4	0.0383
	679	90.5	19.9	0.0393
	695	92.7	20.8	0.0410
	725	96.7	21.6	0.0425
	798	106.4	23.0	0.0451
	(760)	(101.3)	(23.5)	0.0461
223.2	199	26.5	21.4	0.0421
	209	27.9	22.2	0.0436
	340	45.3	32.8	0.0632
	353	47.1	34.0	0.0653
	440	58.7	41.5	0.0786
	488	65.1	42.3	0.0800
	559	74.5	47.8	0.0895
	564	75.2	48.2	0.0901
	632	84.3	51.8	0.0962
	730	97.3	54.3	0.100
	(760)	(101.3)	(60.0)	0.110
198±2	157	20.9	58.4	0.107
	157	20.9	59.0	0.108
	161	21.5	60.8	0.111
	420	56.0	136.0	0.218
	480	64.0	153.5	0.240
	492	65.6	150.0	0.236
	566	75.5	168.5	0.257
	617	82.3	179.0	0.269
	637	84.9	192.0	0.283
	668	89.1	192.0	0.283
	(760)	(101.3)	(212.0)	0.304

*Calculated by the compiler.
**(Vol. of gas, reduced to 101.3 kPa and 273.2 K)/cm^3 dissolved by 1 g of solvent.

Values in parentheses are extrapolated to 1 atm.

Auxiliary Information

Method/Apparatus/Procedure:
Volumetric method. Pressure measured when known amounts of gas were added, in increments, to a known amount of liquid in a vessel of known dimensions. Corrections were made for the partial pressure of solvent. Details in Bodor *et al.*[1]

Source and Purity of Materials:
No information.

Estimated Error:
δT/K = ±0.1;
$\delta\alpha$ = ±4% or less.

References:
[1]E. Bodor, G. J. Bor, B. Mohai, and G. Siposs, Veszpremi, Vegyip. Egyet. Kozlemen. **1**, 55 (1957).

Components:
(1) Ethyne; C_2H_2 ; [74-86-2]
(2) Ethanol; C_2H_6O; [64-17-5]; 1-Butanol; $C_4H_{10}O$; [71-36-3]
(3) Potassium hydroxide; HKO; [1310-58-3]

Original Measurements:
G. G. Arbuzova, G. A. Porotikova, and L. V. Makarova, Khim. Prom. st. (Moscow), (**8**), 629–630 (1977).

Variables:
T/K = 195.2–293.2;
P/kPa = 101.3

Prepared By:
P. G. T. Fogg

Experimental Data
Pressure = barometric; assumed to be approximately 101.3 kPa.

Alcohol	% KOH*	t/°C	T/K	Solubility /g kg^{-1}	Solubility x_1**
Ethanol	0	20	293.15	8.16	0.0142
		0	273.15	14.17	0.0245
		−10	263.15	22.5	0.0383
		−50	223.15	74.2	0.1160
		−75	198.15	246.8	0.3039
		−78	195.15	266.8	0.3207
	8	20	293.15	5.29	
		0	273.15	10.1	
		−10	263.15	12.37	
	2	−58	215.15	105.3	
		−75	198.15	182.0	
		−78	195.15	189.8	
Butanol	0	20	293.15	8.52	0.0237
		0	273.15	11.85	0.0326
		−10	263.15	15.31	0.0418
		−50	223.15	68.8	0.1638
		−58	215.15	105.0	0.2301
		−75	198.15	195.0	0.3570
		−78	195.15	211.7	0.3760
	8	20	293.15	5.13	
		0	273.15	6.58	
		−10	263.15	11.33	
	2	−58	215.15	75.6	
		−75	198.15	120.0	
		−78	195.15	139.9	

*As given by the authors. Probably mass of KOH per 100 g of solution.
**Calculated by the compiler.

Auxiliary Information

Method/Apparatus/Procedure:
The method has been described in Bezdel and Teforovich.[1] Alcohol or alcohol plus potassium hydroxide was contained in a vessel of capacity 100 cm^3 which was held in a thermostat. Acetylene, precooled and dried, was bubbled through the solvent for 3 h. Gas which evolved from the solution as the temperature was raised to 20 °C was measured. Residual gas in solution was estimated by use of cuprous chloride.

Source and Purity of Materials:
(1) Industrial acetylene, dried with calcium carbide and purified with hypochlorite. Purity ⩾ 99.4% by volume.
(2) No information.

Estimated Error:
$\delta x_1 / x_1$ = ±5% (compiler);
δT/K = ±0.05 (authors).

References:
[1]L. C. Bezdel and V. P. Teforovich, Gaz. Prom-st. (**8**), 38 (1958).

Components:
(1) Ethyne; C_2H_2 ; [74-86-2]
(2) 1-Butanol; $C_4H_{10}O$; [71-36-3]

Original Measurements:
V. A. Granzhan and V. V. Kvasova, Zh. Fiz. Khim. **49**(10), 2720 (1975); Deposited *VINITI* 1884–75.

Variables:
T/K = 283.2–303.2;
p_1 /kPa = 16.3–100.8

Prepared By:
Yu. P. Yampolskii

Experimental Data

t/°C	T/K*	p_1 /mm Hg	p_1 /kPa*	Absorption**/cm^3 g^{-1}	x_1
0	273.15	152.5	20.3	1.78	0.0059
		270	36.0	2.99	0.0098
		357	47.6	3.83	0.0125
		459	61.2	4.71	0.0154
		511	68.1	5.16	0.0168
		734	97.9	6.86	0.0222
20	293.15	134	17.9	0.99	0.0033
		214	28.5	1.63	0.0054
		273	36.4	2.01	0.0066
		384	51.2	2.78	0.0091
		426	56.8	3.03	0.0099
		516	68.8	3.93	0.0128
		607	80.9	4.50	0.0147
		675	90.0	5.08	0.0165
		720	96.0	5.35	0.0174
30	303.15	122	16.3	0.80	0.0027
		277	36.9	1.57	0.0052
		384	51.2	2.33	0.0076
		526	70.1	3.08	0.0101
		633	84.4	3.78	0.0123
		687	91.6	4.10	0.0134
		756	100.8	4.39	0.0143

*Compiler.
**Volume of gas, reduced to 273.15 K and 101.3 kPa, dissolved by per gram of solvent. The authors gave the following equations for the data:

20 °C p_1 /mm Hg = $41225x_1$;
correlation coefficient 0.9994; standard deviation in p_1 /mm Hg = 9.2
30 °C p_1 /mm Hg = $5245x_1$
correlation coefficient 0.9993; standard deviation in p_1 /mm Hg = 8.2
0 °C $\log_{10}[(p_1/\text{mm Hg})/x_1] = 4.3743 + 3.2880(1 - x_2^2)$
correlation coefficient 0.9996; standard deviation in $\log_{10}[(p_1/\text{mm Hg})] = 0.0009$.

Auxiliary Information

Method/Apparatus/Procedure:
The apparatus was described in Ref. 1.

Source and Purity of Materials:
Ethyne was purified as described in Ref. 1.

Estimated Error:
No information

References:
[1]V. A. Granzhan, O. G. Kirillova, and N. Z. Pin'kovskaya, Zh. Prikl. Khim. **42**, 2381 (1969).

Components:
(1) Ethyne; C_2H_2; [74-86-2]
(2) Cyclohexanol; $C_6H_{12}O$; [108-93-0]

Original Measurements:
G. J. Cauquil, Chim. Phys. **24**, 53–55 (1927).

Variables:
T/K = 299;
p_1 /kPa = 102

Prepared By:
H. L. Clever

Experimental Data

The author stated that 1 l of cyclohexanol absorbs 971 cm^3 ethyne at 26 °C and 766 mm Hg.

The compiler calculated an Ostwald coefficient of L/cm^3 cm^{-3} = 0.971 and a mole fraction solubility of $x_1 = 4.10 \times 10^{-3}$ at 299 K and a gas partial pressure of 101.325 kPa (1 atm).

Auxiliary Information

Method/Apparatus/Procedure:
The apparatus appears to be of the Bunsen type. The initial and final volumes of gas in contact with the liquid were measured. The vapor pressure of the liquid was ignored.

Source and Purity of Materials:
(1) Ethyne. No information.
(2) Cyclohexanol. Distilled, boiling point 160.9 °C at 766 mm Hg. Degassed and tested to be air free.

Estimated Error:
$\delta L/L = \pm 0.05$ (compiler).

3.6. 2-Propane

Components:
(1) Ethyne; C_2H_2; [74-86-2]
(2) 2-Propanone; C_3H_6O; [67-64-1]

Evaluator:
Peter G. T. Fogg, University of North London, London, United Kingdom.

Critical Evaluation

The solubility of ethyne in 2-propanone has been studied by many workers because of the industrial importance of the system.[1–17] Studies have been carried out over a wide range or pressures. In some cases partial pressures and in other cases total pressures were reported. Miller published an evaluation of available data in 1965.[11]

Values of the solubility at a partial pressure of 101.3 kPa from the available data have been re-evaluated for the current work. Where necessary and appropriate, data have been extrapolated or corrected to a partial pressure of 101.3 kPa.

The current evaluator has rejected data which he considered to be unreliable because of the method of measurement or the way in which it was presented in the original literature. Solubilities based on data from Refs. 2, 3, 5–7, 9–11, 13, 17, 20 fit the equations:

$$\ln x_1 = 76.3050 - 1730.62/(T/\mathrm{K}) - 12.8460 \ln(T/\mathrm{K})$$

standard deviation in values of $x_1 = 1.77\times10^{-2}$
valid for 198–323 K;

$$\ln x_1 = -200.951 + 10248.06/(T/\mathrm{K}) + 28.7585 \ln(T/\mathrm{K})$$

standard deviation in values of $x_1 = 6.73\times10^{-3}$
valid for 273–323 K.

Miller[11] published the solubility of ethyne at total pressures from 101 to 3040 kPa. He also published an equation, based on these data, for the solubility of ethyne at a partial pressure of 505–3039 kPa in the range 273–323 K:

$$x_1 = (p_1/\mathrm{atm})(a - b \log_{10}(p_1/\mathrm{atm})).$$

Miller stated that this equation fits experimental measurements to within 1% for values of x_1 of 0.25–0.65.

a and b are given by:

$$\log_{10} a = 703.8/(T/\mathrm{K}) - 3.544$$
$$\log_{10} b = 903.5/(T/\mathrm{K}) - 4.578.$$

Solubilities published by Shleinikov and Nikitin[13] fit this equation with a standard deviation of 5.67%.

Kremann and Hönel[1] and also Maillard and Rosenthal[4] measured the effect of addition of water to 2-propanone. Water has a marked effect on the solubility of ethyne. At 298 K the addition of 10 vol % water lowers solubility by about 30%. The data from each of the sources show the general trend but precise values of data cannot be relied upon.

Maillard and Rosenthal[4] measured the effect of adding sodium iodide to 2-propanaone. At 293 K the reported Ostwald coefficient decreases linearly with mass% of sodium iodide. At 12.9 mass % of sodium iodide the reported Ostwald coefficient decreases linearly with temperature. These data should be treated with caution because corresponding data for the solubility in pure acetone are inconsistent with data from other workers.

Miller reported the effect of addition of 2-propanone to *N,N*-dimethylformamide at 293 K over the whole of the concentration range. The smooth curve is consistent with recommended solubilities in pure 2-propanone and in pure *N,N*-dimethylformamide and the above data for the mixtures are recommended.

Nikitin *et al.*[19] measured solubilities in mixtures of 2-propanone and 4-Methyl-1,3-dioxolane-2-one, (*propylene carbonate*). The data indicate general trends consistent with properties of pure solvents but individual data points need confirmation by other workers.[18]

References:

[1]R. Kremann and H. Hönel, Monatsh. **34**, 1089–1094 (1913).
[2]J. Horiuti, Sci. Pap. Inst. Phys. Chem. Res. (Jpn.) **17**, 125–256 (1931/1932).
[3]V. E. Brameld and M. T. Clark, J. Soc. Chem. Ind. **65**, 58–61 (1946).
[4]A. Maillard and W. Rosenthal, Compt. Rend. **234**, 2546–2548 (1952).
[5]P. Hölemann and R. Hasselmann, Chem. Ing. Tech. **25**(8/9), 466–468 (1953).
[6]H. Lagarde and J. Cambon, Soud. Tech. Conn. **9**, 7–11 (1955).
[7]E. Bodor, Gy. Bor, M. Maleczkine, G. Mesko, B. Mohai, and G. Siposs, Veszppremi Vegytp. Egyet. Kozlemen. **1**, 63–76 (1957).
[8]G. Schay, Gy. Szekely, Gy. Racz, and G. Traply, Periodica Polytech. **2**, 1–24 (1958).
[9]D. S. Tsiklis, A. N. Kofman, and L. I. Shenderei, Zhur. Fiz. Khim. **33**, 2012–2016 (1959); Russ. J. Phys. Chem. **33**(9), 262–265 (1959).
[10]E. R. Shenderei and F. P. Ivanovskii, Zh. Prikl. Khim. **37**, 1557–1562 (1964); J. Appl. Chem. USSR **37**, 1545–1549 (1964).
[11]British Oxygen Co. Ltd; reported by S. A. Miller, *Acetylene—Its Properties, Manufacture and Uses* (Academic, New York, 1965), Vol. I.
[12]H. Hannaert, M. Haccuria, and M. P. Mathieu, Ind. Chim. Belge **32**, 156–164 (1967).
[13]V. M. Shleinikov and M. A. Nikitin, Neftepererab. Neftekhim. (Moscow) **37**(9), 37–42 (1967).
[14]A. P. Voronkov, V. S. Mislavskaya, R. Ya. Mushii, and S. M. Khodeeva, Zhur. Fiz. Khim. **49**, 3128–3130 (1975); Russ. J. Phys. Chem. **49**, 1848–1849 (1975).
[15]G. P. Chukelkova, A. P. Rybkin, and T. N. Kozhichkina, Optimiz. Gazopinaniya Protsessov Gazoplam. Obrab. Met., M. 30–34 (1984).
[16]A. Maillard and W. Rosenthal, Compt. Rend. **234**, 2546–2548 (1952).
[17]I. P. Usyukin and V. M. Shleinikov, Novosti Nefti Gaz Techn. Neftepererabotka Neftekhim. (**12**), 33–39 (1961).
[18]I. L. Leites and F. P. Ivanovskii, Khim. Prom. (**9**), 653–657 (1962).
[19]M. A. Nikitin, D. D. Zykov, and V. M. Shleinikov, Izv. Vyssh. Ucheb Zaved., Khim. Khim. Tekhnol. **18**, 571–575 (1975).
[20]R. G. Makitra, F. B. Moin, Ya. N. Pirig, and T. I. Politanskaya, Zh. Prikl. Khim. **53**, 1529–1531 (1980); J. Appl. Chem. USSR **53**, 1179–1181 (1980).

Components:
(1) Ethyne; C_2H_2; [74-86-2]
(2) 2-Propanone; C_3H_6O; [67-64-1]
(3) Water; H_2O; [7732-18-5]

Original Measurements:
R. Kremann and H. Hönel, Monatsh. **34**, 1089–1094 (1913).

Variables:
T/K=273.2; 298.2;
P/kPa=101.3 kPa;
%H_2O=0–100 by volume

Prepared By:
P. G. T. Fogg

Experimental Data
Total pressure=barometric (approx. 101.3 kPa).

t/°C	T/K	vol %H_2O	Solubility* mol dm^{-3}	Solubility* g dm^{-3}
0	273.2	0	1.333	34.65
		5	1.168	30.36
		10	0.978	25.43
		20	0.544	14.15
		35	0.323	8.40
		50	0.220	5.72
25	298.2	0	0.585	15.21
		5	0.508	13.22
		10	0.408	10.62
		20	0.300	7.80
		35	0.172	4.46
		50	0.086	2.22
		75	0.047	1.23
		100	0.038	0.98

*Averages of values given by the authors.

Auxiliary Information

Method/Apparatus/Procedure:
Ethyne bubbled through the solvent. Dissolved gas was estimated by adding the solution dropwise to 5% alcoholic solution of silver nitrate. Ethyne reacted with silver nitrate according to the equation:

$$C_2H_2+3AgNO_3=C_2Ag_2.AgNO_3+2HNO_3.$$

The silver complex was allowed to settle and supernatant liquid separated off. Excess silver nitrate was estimated by titration with sodium chloride solution.

Source and Purity of Materials:
No information.

Estimated Error:
No information.

Components:
(1) Ethyne; C_2H_2; [74-86-2]
(2) 2-Propanone (*acetone*); C_3H_6O; [67-64-1]

Original Measurements:
J. Horiuti, Sci. Pap. Inst. Phys. Chem. Res. (Jpn.) **17**, 125–256 (1931/1932).

Variables:
T/K=273.15–313.15;
p_1 /kPa: 101.325 (1 atm)

Prepared By:
M. E. Derrick and H. L. Clever

Experimental Data

T/K	Mol fraction x_1	Bunsen coefficient α/cm^3(STP)cm^{-3} atm^{-1}	Ostwald coefficient L/cm^3 cm^{-3}	C_2H_2 concentration (g dm^{-1})
273.15	0.1096	38.6	38.60	39.58
278.15	0.09779	33.78	34.40	
283.15	0.08727	29.6	30.68	
288.15	0.07771	25.91	27.33	
293.15	0.06947	22.8	24.47	
298.15	0.06233	20.16	22.00	16.38
303.15	0.05592	17.84	19.80	
308.15	0.05032	15.85	17.88	
313.15	0.04538	14.12	16.19	

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.

Auxiliary Information

Method/Apparatus/Procedure:
The apparatus consisted of a gas buret, a solvent reservoir, and an absorption pipet. The volume of the pipet was determined at various meniscus heights by weighing a quantity of water. The meniscus height was read with a cathetometer. The dry gas was introduced into the degassed solvent. The gas and solvent were mixed with a magnetic stirrer until saturation. Care was taken to prevent solvent vapor from mixing with the solute gas in the gas buret The volume of gas was determined from the gas buret readings, the volume of solvent was determined from the meniscus height in the absorption pipet.

Source and Purity of Materials:
(1) Ethyne. Prepared by the reaction of calcium carbide and water. The gas was passed through several wash solutions, dried, condensed by liquid air, and fractionated from liquid air several times.
(2) Acetone. Nippon Pure Chemical or Merck. Extra pure grade. Recrystallized with sodium sulfite and stored over calcium chloride. Fractionated, boiling point (760 mm Hg) 56.09 °C.

Estimated Error:
δT/K=0.05; $\delta x_1/x_1$=0.01.

Components:
(1) Ethyne; C_2H_2; [74-86-2]
(2) 2-Propanone, (*acetone*); C_3H_6O; [67-64-1]

Original Measurements:
V. E. Brameld and M. T. Clark, J. Soc. Chem. Ind. **65**, 58–61 (1946).

Variables:
p_1 /kPa = 101.3;
T/K = 203.2–313.2

Prepared By:
P. G. T. Fogg

Experimental Data
p_1 = 1 atm = 101.3 kPa

t/°C	T/K	mass ratio* ×1000	x_1**	t/°C	T/K	mass ratio* ×1000	x_1**
−70	203.2	657	0.5944	−10	263.2	81.6	0.1540
−65	208.2	568	0.5589	−5	268.2	72.1	0.1385
−60	213.2	478	0.5160	0	273.2	68.7	0.1329
−55	218.2	417	0.4819	5	278.2	61.0	0.1198
−50	223.2	336	0.4284	10	283.2	53.5	0.1066
−45	228.2	288	0.3911	15	288.2	46.4	0.0938
−40	233.2	217	0.3262	20	293.2	39.4	0.0808
−35	238.2	184.5	0.2916	25	298.2	32.7	0.0680
−30	243.2	152	0.2532	30	303.2	30.0	0.0627
−25	248.2	127	0.2207	35	308.2	25.7	0.0542
−20	253.2	112	0.1999	40	313.2	24.4	0.0516
−15	258.2	95.1	0.1750				

t/°C = 30; T/K = 303.2

p_1 /atm	p_1 /kPa	mass ratio* ×1000	x_1**	p_1 /atm	p_1 /kPa	mass ratio* ×1000	x_1**
0.742	75.1	22.6	0.0480	0.982	99.5	29.2	0.0612
0.76	77.0	23.2	0.0492	0.999	101.2	29.7	0.0621
0.805	81.6	24.4	0.0516	1.047	106.1	31.0	0.0647
0.835	84.6	25.0	0.0528	1.054	106.8	31.2	0.0651
0.897	90.9	26.5	0.0558	1.164	117.9	34.0	0.0705
0.905	91.7	27.2	0.0572				

*Given by authors as milligram of gas per gram of solvent.
**Calculated by the compiler.

Auxiliary Information

Method/Apparatus/Procedure:
The apparatus consisted of a system of manometers and storage vessels connected to a vacuum pump. The system was flushed with acetylene before measurements were carried out. Acetone was added to an evacuated absorption vessel which could be detached from the rest of the apparatus. The quantity of acetone was equal to the increase in weight of the vessel. When connected to the rest of the system the absorption vessel was surrounded by a thermostatically controlled bath. The vapor pressure of the pure acetone at the temperature of the measurement was measured by a manometer. In most measurements acetylene at barometric pressure was passed into the absorption vessel until the liquid was saturated with gas. The pressure of gas was then raised to a total pressure equal to barometric plus the vapor pressure of pure acetone at the temperature of measurement. The system was agitated and when absorption was complete, the increase in weight of the absorption vessel was taken to be equal to the weight of gas absorbed at a partial pressure equal to barometric pressure. Similar measurements were carried out to measure absorption at other partial pressures. In the case of measurements at 10 °C or lower some of the absorbed gas was released, prior to weighing at room temperature, into a weighed auxiliary vessel containing activated coconut charcoal. In this way dangerous buildup of pressure was avoided. Allowance was made for small quantities of air in the acetylene but there was no mention of allowance for differences between barometric pressure and standard atmospheric pressure.

Source and Purity of Materials:
No information.

Components:
(1) Ethyne; C_2H_2 ; [74-86-2]
(2) 2-Propanone (*acetone*); C_3H_6O; [67-64-1]

Original Measurements:
A. Maillard and W. Rosenthal, Compt. Rend. **234**, 2546–2548 (1952).

Variables:
T/K = 293.15–303.15;
p_1 /kPa = 101.3

Prepared By:
P. G. T. Fogg

Experimental Data

t/°C	T/K	Ostwald coefficient, L[a]	Mole fraction solubility, x_1 at p_1 = 101.3 kPa[b]
20	293.15	23.77	0.0576
22	295.15	22.61	0.0546
24	297.15	21.45	0.0516
26	299.15	20.22	0.0485
28	301.15	19.21	0.0459
30	303.15	17.84	0.0425

[a]Defined as concentration of gas in the liquid phase/concentration in gas phase.
[b]Calculated by the compiler.

Auxiliary Information

Method/Apparatus/Procedure:
The authors stated that equilibrium pressures were measured as a function of composition and that temperature was controlled by a thermostat. No other details were given. Data were presented in the form of small scale graphs (4.5×5.0 cm or less). The compiler obtained data from the graphs by use of a scanner and digitizing program.

Source and Purity of Materials:
No information.

Estimated Error:
$\delta L = \pm 0.1$ (estimated error in taking data from the graphs).

Components:
(1) Ethyne; C_2H_2 ; [74-86-2]
(2) 2-Propanone; C_3H_6O; [67-64-1]

Original Measurements:
P. Hölemann and R. Hasselmann, Chem. Ing. Tech. **25**(8/9), 466–468 (1953).

Variables:
T/K276–298;
p_1 /kPa 141–2553

Prepared By:
P. G. T. Fogg

Experimental Data

t/°C	T/K	p_1 /atm	p_1 /kPa	V_2	V_1	ρ_2 /g cm^{-3}	x_1
3	276.2	1.39	140.81	12.5	556	0.8107	0.125 34
3	276.15	2.94	297.82	29.98	2719	0.8107	0.226 12
3	276.15	4.87	493.33	24.48	3382	0.8107	0.308
3	276.15	8.74	885.36	22.55	5258	0.8107	0.428 96
3	276.15	12.61	1277.4	47.07	6447	0.8107	0.548 89
3	276.15	15.52	1572.2	9.66	5510	0.8107	0.647 59
3	276.15	20.36	2062.5	18.65	19885	0.8107	0.774 52
3	276.15	23.26	2356.2	18.35	26275	0.8107	0.821 84
15	288.2	2.94	297.82	33.02	2266	0.7949	0.183 99
15	288.15	3.9	395.07	29.91	2597	0.7949	0.221 96
15	288.15	3.9	395.07	34.3	2961	0.7949	0.220 97
15	288.15	6.81	689.85	36	5253	0.7949	0.324 07
15	288.15	9.71	983.62	47.22	9877	0.7949	0.407 33
15	288.15	11.65	1180.1	20.63	5465	0.7949	0.465 35
15	288.15	13.58	1375.7	20.21	6455	0.7949	0.512 06
15	288.15	20.36	2062.5	27.26	16634	0.7949	0.667 21
15	288.15	20.36	2062.5	39.9	24810	0.7949	0.671 38
15	288.15	25.2	2552.8	18	16334	0.7949	0.748 84
15	288.15	30.03	3042	17.03	21419	0.7949	0.805 16
25	298.15	2.94	297.82	43.86	2204	0.7865	0.143 01
25	298.15	3.9	395.07	30.68	2091	0.7865	0.184 56
25	298.15	4.87	493.33	31	2618	0.7865	0.219 02
25	298.15	5.84	591.59	31	3125	0.7865	0.2508

Auxiliary Information

Method/Apparatus/Procedure:
A measured volume of acetone was introduced into a pressure vessel. The temperature was controlled by circulation of water through a jacket. Ethyne, at a measured pressure, was passed through the acetone until the solution was saturated. The ethyne evolved at lower pressure was measured and the composition of the saturated solution at the higher pressure calculated.

Source and Purity of Materials:
(1) Ethyne from a cylinder had less than 0.8% impurities.
(2) 2-Propanone was purified by double distillation; boiling point = 56.5 °C, 758.2 mm Hg; ρ^{25} = 0.7865 g cm^{-3}.

Estimated Error:
δT/K = ±0.25.

Components:
(1) Ethyne; C_2H_2 ; [74-86-2]
(2) 2-Propanone, (*acetone*); C_3H_6O; [67-64-1]

Original Measurements:
H. Lagarde and J. Cambon, Soud. Tech. Conn. **9**, 7–11 (1955).

Variables:
T/K = 288.15 K;
p_1 /kPa = 371–3119

Prepared By:
P. G. T. Fogg

Experimental Data
T = 288.15 K.

p_1 /kg cm^{-2}	p_1 /kPa*	Solubility° V_{gas}/V_{solv}	Mole fraction* x_1	$\Delta_{mass}/\Delta_{vol}$‡
3.78	371	24.13	0.219	0.508
7.83	768	23.46	0.370	0.543
12.62	1238	24.30	0.506	0.539
14.72	1444	25.12	0.558	0.529
17.50	1716	26.41	0.619	0.526
21.09	2068	29.52	0.696	0.525
22.16	2173	30.91	0.719	0.514
24.87	2439	34.62	0.769	0.505
27.41	2688	41.30	0.820	0.498
30.48	2989	54.55	0.876	0.484
31.80	3119	65.84	0.901	

*Calculated by the compiler.
°Volume of gas, measured at 101.3 kPa and 288.15 K, dissolved by 1 vol of pure solvent at 288.15 K and the partial pressure of acetylene specified.
‡Mass of dissolved gas divided by the increase in volume of the liquid.

Auxiliary Information

Method/Apparatus/Procedure:
The apparatus consisted of a light alloy cylinder fitted with a narrow bore glass gauge to measure the height of liquid and also a pressure gauge. A measured quantity of solvent was introduced followed by ethyne. The weight of gas introduced was found from the increase in weight of the cylinder and contents. The cylinder and contents were held in a thermostat bath. When equilibrium was attained the final pressure was recorded. The height of liquid in the glass gauge was measured with a cathetometer to determine the increase in volume of the liquid phase.

Source and Purity of Materials:
(1) Purified by distillation; less than 0.05% of impurities.
(2) Pure industrial solvent; gaseous impurities removed under vacuum.

Estimated Error:
δT/K = ±0.002 (authors).

Components:
(1) Ethyne; C_2H_2 ; [74-86-2]
(2) 2-Propanone (*acetone*) C_3H_6O; [67-64-1]

Original Measurements:
E. Bodor, G. J. Bor, M. Maleczkine, G. Mesko, B. Mohai, and G. Siposs, Veszppremi Vegyip. Egyet. Kozlemen. **1**, 63–76 (1957).

Variables:
T/K = 198–318;
p_1 /kPa = 4.3–97.2

Prepared By:
C. L. Young

Experimental Data

T/K	p_1 /mm Hg	p_1 /kPa	α**	Mole fraction of acetylene in liquid, x_1*
318.2	32	4.3	1.34	0.003 46
	36	4.8	0.95	0.002 46
	156	20.8	4.33	0.0111
	165	22	5.23	0.0134
	201	26.8	6.67	0.0170
	207	27.6	5.75	0.0147
295.2	164	21.9	6.1	0.0156
	164	21.9	6.93	0.0176
	274	36.5	11.65	0.0293
	303	40.4	11.95	0.0300
	400	53.3	16.1	0.0400
	405	54	16.95	0.0421
	482	64.3	21.2	0.0473
	504	67.2	20.9	0.0521
	527	70.3	20.9	0.0514
273.2	316	42.1	22.7	0.0556
	318	42.4	22.8	0.0558
	400	53.3	28.2	0.0681
	400	53.3	28.3	0.0683
	508	67.7	35.1	0.0834
	514	68.5	35.9	0.0851
	610	81.3	41.5	0.0971
	613	81.7	42.1	0.0984
	692	92.3	47.3	0.1092
	738	98.4	49.3	0.1133
	−760	101.3	−55	0.125
248.2	158	21.1	26.8	0.0649
	173	23.1	24.6	0.0599
	318	42.4	50.7	0.116
	410	54.7	62.8	0.140
	464	61.9	66.1	0.146
	540	72	75.6	0.164
	608	81.1	84.9	0.180
	633	84.4	88.6	0.187
	711	94.8	101.9	0.209
	712	94.9	96.6	0.200
	−760	101.3	−105	0.214
232.2	160	21.3	49.9	0.114
	162	21.6	46.2	0.107
	172	22.9	51.3	0.117
	313	41.7	70.3	0.154
	485	64.7	95.2	0.198
	515	68.7	105	0.214
	579	77.2	110.6	0.223

	628	83.7	115.2	0.230
	729	97.2	118.9	0.236
	818	109.1	129	0.251
	−760	101.3	−125	0.245
223.2	206	27.5	89.2	0.188
	227	30.3	92.5	0.193
	295	39.3	114.6	0.229
	412	54.9	154.3	0.286
	420	56	152.2	0.283
	539	71.9	175	0.312
	592	78.9	189.5	0.329
	622	82.9	196.7	0.338
	725	96.7	231.2	0.375
	726	96.8	220.6	0.364
	−760	101.3	−235	0.378
213.2	210	28	151.2	0.282
	224	29.9	153	0.284
	225	30	155.8	0.288
	338	45.1	193.8	0.334
	362	48.3	208.4	0.351
	504	67.2	253.8	0.397
	544	72.5	276	0.417
	672	89.6	313.7	0.448
	828	110.4	348	0.474
	−760	101.3	−350	0.476
198±2	142	18.9	181.8	0.320
	174	23.2	218.3	0.361
	189	25.2	222	0.365
	264	35.2	278.1	0.419
	266	35.5	302	0.439
	391	52.1	378.2	0.495
	425	56.7	389.5	0.502
	595	79.3	578	0.600
	728	97.1	815	0.679
	729	97.2	768	0.666
	−760	101.3	860	0.690

*Calculated by the compiler.
**(Vol. of gas, reduced to 101.3 kPa and 273.2 K)/cm^3 dissolved by 1 g of solvent.

Values in parentheses are extrapolated to 1 atm.

Auxiliary Information

Method/Apparatus/Procedure:
Volumetric method. Pressure measured when known amounts of gas were added, in increments, to a known amount of liquid in a vessel of known dimensions. Corrections were made for the partial pressure of solvent. Details in Ref. 1.

Source and Purity of Materials:
No information.

Estimated Error:
δT/K = ±0.1;
$\delta\alpha$ = ±4% or less.

References:
[1]E. Bodor, G. J. Bor, B. Mohai, and G. Siposs, Veszpremi, Vegyip. Egyet. Kozlemen. **1**, 55 (1957).

Components:
(1) Ethyne; C_2H_2 ; [74-86-2]
(2) 2-Propanone; C_3H_6 ; [67-64-1]

Original Measurements:
G. Schay, Gy. Szekely, Gy. Racz, and G. Traply, Periodica Polytech. **2**, 1–24 (1958).

Variables:
T/K = 223–318;
p_1 /kPa = 16.1–101.0

Prepared By:
P. G. T. Fogg

Experimental Data

t/°C	T/K	p_1 /mm Hg	p_1 /kPa	Volume of gas absorbed*/cm^3 g^{-1}	Mole fraction solubility, x_1
−50	223.15	305	40.6	109	0.222
		388	51.7	134	0.26
		497	66.3	164.8	0.302
		549	73.1	175	0.314
−25	248.15	758	101	90.8	0.192
0	273.15	170	22.7	11.4	0.029
		255	34.1	17	0.043
		322	42.9	20.9	0.052
		388	51.7	26.5	0.065
		410	54.6	26.1	0.064
		423	56.4	28.1	0.069
		499	66.5	33.3	0.08
		554	73.8	35.2	0.085
		573	76.3	36.7	0.088
		596	79.4	39.5	0.094
		650	86.7	43.4	0.102
25	298.15	197	26.2	6.6	0.017
		242	32.3	8.3	0.021
		405	54	13.8	0.035
		420	56	13.6	0.034
		530	70.6	18	0.045
45	318.15	121	16.1	2.4	0.006
		145	19.3	3	0.008
		263	35	5.7	0.015

*Volumes of gas were reduced to 273.15 K and 101.3 kPa. Numerical values of pressures and gas volumes were obtained by the compiler from experimental points on a small scale graph (4 cm×4 cm) by computer aided digitization. Mole fraction solubilities were calculated by the compiler.

Auxiliary Information

Method/Apparatus/Procedure:
Static methods were used. For measurements above room temperature condensation of solvent vapor in the cooler parts of the system was reduced by use of capillary tubes to connect parts of the apparatus and by measuring the pressure by a null method. A magnetic stirrer was used to stir the solvent in the absorption cell.

Source and Purity of Materials:
No information.

Estimated Error:
No information.

Components:
(1) Ethyne; C_2H_2 ; [74-86-2]
(2) 2-Propanone; C_3H_6O; [67-64-1]

Original Measurements:
D. S. Tsiklis, A. N. Kofman, and L. I. Shenderei, Zhur. Fiz. Khim. **33**, 2012–2076; Russ J. Phys. Chem. **33**(9), 262–265 (1959).

Variables:
T/K= 193–233;
p_1 /kPa= 15.6–121.7

Prepared By:
P. G. T. Fogg

Experimental Data

t/°C	T/K	p/mm Hg	p/kPa	Solubility mg/g	Solubility x_1
−40	233.15	335	44.7	70	0.134
		497	66.3	132	0.228
		508	67.8	145	0.244
		571	76.1	194	0.302
		648	86.4	178	0.285
		758	101.1	237	0.345
		913	121.7	295	0.397
−50	223.15	313	41.7	143	0.242
		409	54.5	144	0.243
		467	62.3	185	0.292
		552	73.6	227	0.336
		673	89.8	289	0.392
		710	94.7	294	0.396
		765	102	339	0.431
		754	100.5	396	0.469
		633	84.4	309	0.408
−60	213.15	287	38.3	139	0.237
		460	61.3	226	0.335
		585	78	293	0.395
		574	76.5	309	0.408
		533	71.1	341	0.432
		548	73	354	0.441
		643	85.7	432	0.491
		797	106.3	528	0.541
		830	110.7	573	0.561
		830	110.7	618	0.58
−70	203.15	162	21.6	146	0.246
		191	25.5	146	0.246
		327	43.6	237	0.346
		364	48.5	275	0.38
		404	53.9	312	0.41
		385	51.4	357	0.443
		466	62.2	378	0.457
		535	71.4	538	0.545
		579	77.2	633	0.585
		631	84.1	580	0.564
		627	83.6	592	0.569
		642	85.6	625	0.582
		715	95.3	797	0.64
		799	106.5	896	0.667
−80	193.15	117	15.6	154	0.256
		205	27.4	237	0.345
		253	33.7	278	0.383
		286	38.1	315	0.413
		293	39.1	393	0.467
		428	57.1	595	0.57
		461	61.5	599	0.572
		464	61.9	701	0.61
		519	69.2	820	0.647
		567	75.6	850	0.655
		648	86.4	846	0.654
		640	85.4	879	0.662

The compiler obtained numerical data by computer aided digitization of graphical data.

Auxiliary Information

Method/Apparatus/Procedure:
Ethyne passed from a flask into a measured quantity of 2-propanone in a tube cooled by 2-propanone/solid carbon dioxide in a Dewar flask. The quantity of ethyne was calculated from the temperature, volume, and change of pressure in the flask. The liquid in the tube was magnetically stirred until equilibrium was achieved. The pressure of the gas above the liquid was measured by a glass manometer in which the pressure of the ethyne was balanced against pressure of air.

Source and Purity of Materials:
(1) Ethyne from a cylinder was dissolved in 2-propanone at −60 °C. The solution was then warmed slightly and the first gas to be evolved was discarded. The ethyne which was subsequently evolved was passed through activated charcoal and collected in a flask.
(2) 2-propanone was dried with alumina gel and redistilled twice; ρ^{20}= 0.7913 g cm^{-3}.

Estimated Error:
$\delta x/x = \pm 10\%$ at −80 °C. Greater precision at higher temperatures (authors).

Components:
(1) Ethyne; C_2H_2 ; [74-86-2]
(2) 2-Propanone, (*acetone*); C_3H_6O; [67-64-1]

Original Measurements:
E. R. Shenderei and F. P. Ivanovskii, Zh. Prikl. Khim. **37**, 1557–1562 (1964); J. Applied Chem. USSR **37**, 1545–1549 (1964).

Variables:
T/K = 253.15–333.45;
p_1 /kPa = 9.3–92.5

Prepared By:
P. G. T. Fogg

Experimental Data

t/°C	T/K*	p_1 /mmHg	p_1 /kPa*/cm^3 g^{-1}	S**/cm^3 g^{-1}	x_1	Henry's law constant H/mm Hg***	Henry's law constant H/kPa*
−20	253.15	130	17.3	18.44	0.0450	2560	341.3
		155	20.7	22.12	0.0547		
		234	31.2	32.11	0.0774		
		271	36.1	39.67	0.0896		
		321	42.8	43.02	0.1011		
		383	51.1	51.30	0.1182		
		423	56.4	55.13	0.1259		
		542	72.3	69.75	0.1542		
		670	89.3	83.65	0.1794		
−30.7	242.45	147	19.6	31.39	0.0758	1630	217.3
		148	19.7	30.78	0.0745		
		253	33.7	51.46	0.1186		
		356	47.5	69.23	0.1532		
		437	58.3	82.24	0.1769		
		496	66.1	89.61	0.1898		
		497	66.3	91.39	0.1930		
		567	75.6	102.25	0.2109		
		599	79.9	104.78	0.2150		
		672	89.6	117.67	0.2352		
−50	223.15	70	9.3	36.89	0.0870	632	84.3
		123	16.4	60.59	0.1367		
		130	17.3	63.37	0.1421		
		178	23.7	83.65	0.1794		
		237	31.6	102.91	0.2120		
		306	40.8	127.58	0.2501		
		350	46.7	139.38	0.2670		
		443	59.1	169.09	0.3065		
		470	62.7	173.82	0.3124		
		555	74.0	194.45	0.3370		
−60.2	212.95	18	2.4	18.56	0.0463	348	46.4
		36	4.8	34.74	0.0833		
		58	7.7	52.40	0.1205		
		58	7.7	51.76	0.1192		
		79	10.5	67.45	0.1499		
		89	11.9	67.54	0.1502		
		99	13.2	80.40	0.1737		
		106	14.1	84.87	0.1816		
		124	16.5	95.27	0.1992		
		129	17.2	98.96	0.2055		
		148	19.7	109.57	0.2255		
		156	20.8	117.06	0.2354		
		158	21.1	115.28	0.2316		
		181	24.1	128.37	0.2512		
		214	28.5	146.37	0.2767		
		219	29.2	149.25	0.2808		
		234	31.2	155.18	0.2886		
		273	36.4	172.54	0.3108		
		296	39.5	183.78	0.3245		
		298	39.7	183.63	0.3243		
		350	46.7	208.34	0.3526		
		380	50.7	220.72	0.3659		
		386	51.5	222.51	0.3677		
		490	65.3	266.69	0.4107		
		495	66.0	266.00	0.4099		
		580	77.3	300.59	0.4400		
		583	77.7	305.00	0.4436		
		647	86.3	329.91	0.4630		
		694	92.5	345.95	0.4749		

*Calculated by the compiler.
**The solubility, S, is the volume of gas, corrected to 273.15 K and 101.3 kPa, dissolved by 1 g of solvent.
***The authors found that experimental data fitted the equation:

$$\log_{10}\frac{f_1}{x_1} = \log_{10} H - \frac{A' x_1}{2.303RT},$$

where f_1 is the fugacity of ethyne and A' is a constant. H is Henry's constant. Plots of $\log_{10} f_1/x_1$ against x_1 were linear. Values of H were found from the intercept at $x_1 = 0$.

Auxiliary Information

Method/Apparatus/Procedure:
No information.

Source and Purity of Materials:
(1) Acetone, air, and other gases were removed from ethyne taken from a cylinder. The purified ethyne was then frozen with liquid nitrogen and stored in the solid state in ampoules. This solid was evaporated at −78 °C as required.
(2) Chemically pure acetone was distilled. Chromatographic analysis indicated no impurities apart from 0.03% water. $\rho^{20} = 0.7913$ g cm^{-3}; $n_D^{20} = 1.3858$.

Estimated Error:
No information.

Components:
(1) Ethyne; C_2H_2 ; [74-86-2]
(2) 2-Propanone; C_3H_6O; [67-64-1]

Original Measurements:
British Oxygen Co. Ltd; reported by S. A. Miller, *Acetylene–Its Properties, Manufacture and Uses* (Academic, New York, 1965), Vol. I.

Variables:
T/K= 183–323;
p_1 /kPa= 1–3018

Prepared By:
P. G. T. Fogg

Experimental Data

t/°C	T/K	p_1 /atm	p_1 /kPa	Solubility /g kg^{-1} of solvent	x_1
−90	183.15	0.01	1	62	0.121
		0.02	2	108	0.194
		0.05	5.1	205	0.314
−80	193.15	0.01	1	29	0.061
		0.02	2	56	0.111
−70	203.15	0.01	1	16	0.034
		0.02	2	32	0.067
		0.05	5.1	72	0.138
		0.1	10.1	124	0.217
		0.2	20.3	204	0.313
−60	213.15	0.01	1	9	0.020
		0.02	2	18	0.039
		0.05	5.1	44	0.089
		0.1	10.1	79	0.150
		0.2	20.3	136	0.233
−50	223.15	0.01	1	5.5	0.012
		0.02	2	10.7	0.023
		0.05	5.1	26.1	0.055
		0.1	10.1	50	0.100
		0.2	20.3	89.5	0.166
		0.5	50.7	181	0.288
−40	233.15	0.01	1	3.2	0.007
		0.02	2	6.4	0.014
		0.05	5.1	16.1	0.035
		0.1	10.1	31.5	0.066
		0.2	20.3	59.3	0.117
		0.5	50.7	125	0.218
		1	101.3	210	0.319
−30	243.15	0.01	1	2	0.004
		0.02	2	4	0.009
		0.05	5.1	10.2	0.022
		0.1	10.1	20.3	0.043
		0.2	20.3	39.2	0.080
		0.5	50.7	88	0.164
		1	101.3	152	0.253
−20	253.15	0.01	1	1.3	0.003
		0.02	2	2.6	0.006
		0.05	5.1	6.6	0.015
		0.1	10.1	13.5	0.029
		0.2	20.3	26.7	0.056
		0.5	50.7	62	0.121
		1	101.3	112	0.200
−10	263.15	0.01	1	0.9	0.002
		0.02	2	1.8	0.004
		0.05	5.1	4.5	0.010
		0.1	10.1	9.1	0.020
		0.2	20.3	18.1	0.039
		0.5	50.7	44	0.089
		1	101.3	83	0.156
0	273.15	0.01	1	0.6	0.001
		0.02	2	1.3	0.003
		0.05	5.1	3.3	0.007
		0.1	10.1	6.5	0.014
		0.2	20.3	13	0.028
		0.5	50.7	32.5	0.068
		1	101.3	62	0.121
10	283.15	0.01	1	0.5	0.001
		0.02	2	1	0.002
		0.05	5.1	2.4	0.005
		0.1	10.1	4.8	0.011
		0.2	20.3	9.6	0.021
		0.5	50.7	24.2	0.051
		1	101.3	46.8	0.095
20	293.15	0.01	1	0.36	0.001
		0.02	2	0.7	0.002
		0.05	5.1	1.8	0.004
		0.1	10.1	3.6	0.008
		0.2	20.3	7.2	0.016
		0.5	50.7	18.1	0.039
		1	101.3	36	0.074
30	303.15	0.01	1	0.28	0.001
		0.02	2	0.6	0.001
		0.05	5.1	1.4	0.003
		0.1	10.1	2.8	0.006
		0.2	20.3	5.6	0.012
		0.5	50.7	13.9	0.030
		1	101.3	27.8	0.058

T/K	Total pressure, P /atm	/kPa	p_1 /kPa	Solubility /g kg^{-1} of 2	/g dm^{-3} of solution	x_1
273.15	1	101.3	93	58	44.3	0.1146
	2	202.6	194.6	109.5	78.3	0.1963
	3	304.0	296.3	158	105.6	0.2606
	5	506.6	499.5	241	146	0.3496
	10	1013.2	1006.2	526	238	0.5399
	15	1519.9	1513.8	912	308	0.6704
278.15	1	101.3	90.2	48.7	37.3	0.0980
	2	202.6	191.8	95.3	68.7	0.1753
	3	304.0	293.4	137	93.7	0.2341
	5	506.6	496.5	208	129	0.3169
	10	1013.2	1004.1	447	215	0.4993
	15	1519.9	1511.8	754	282	0.6271
	20	2026.5	2019.4	1157	334	0.7207
283.15	1	101.3	87	41.1	31.5	0.0840
	2	202.6	188.6	83	60.1	0.1562
	3	304.0	290.3	122	83.7	0.2139

	5	506.6	493.5	182	115.4	0.2887
	10	1013.2	1001.1	384	194	0.4614
	15	1519.9	1508.7	636	257	0.5865
	20	2026.5	2016.4	958	308	0.6812
288.15	1	101.3	82.9	34	26	0.0705
	2	202.6	184.5	72	52.3	0.1384
	3	304.0	286.3	107.2	74.2	0.1930
	5	506.6	490.4	161	103.7	0.2642
	10	1013.2	998.1	335	176	0.4277
	15	1519.9	1505.7	546	235	0.5491
	20	2026.5	2012.3	811	284	0.6440
	25	2533.1	2520	1146	327	0.7188
293.15	1	101.3	78	27.9	21.4	0.0586
	2	202.6	179.8	62.4	45.6	0.1222
	3	304.0	281.8	94.2	65.6	0.1736
	5	506.6	486.4	142.3	92.7	0.2409
	10	1013.2	994	293	159	0.3952
	15	1519.9	1501.6	472	214	0.5129
	20	2026.5	2008.3	689	260	0.6058
	25	2533.1	2515.9	960	300	0.6817
298.15	1	101.3	72.1	22.4	17.1	0.0476
	2	202.6	173.9	53.5	39.2	0.1066
	3	304.0	275.9	82.2	57.6	0.1549
	5	506.6	480.3	126.6	83.4	0.2202
	10	1013.2	987.9	259	144	0.3662
	15	1519.9	1495.6	413	195	0.4795
	20	2026.5	2003.2	597	239	0.5711
	25	2533.1	2510.8	822	277	0.6471
	30	3039.7	3018.5	1099	310	0.7103
303.15	1	101.3	65.2	17.9	13.7	0.0384
	2	202.6	166.8	45.7	33.6	0.0925
	3	304.0	268.7	72.1	50.8	0.1385
	5	506.6	473.2	113	75.2	0.2013
	10	1013.2	980.8	230	132	0.3391
	15	1519.9	1489.5	364	180	0.4481
	20	2026.5	1997.1	521	221	0.5375
	25	2533.1	2504.8	710	259	0.6130
	30	3039.7	3012.4	940	291	0.6771
313.15	1	101.3	46.3	10.4	7.9	0.0227
	2	202.6	147.9	33	24.2	0.0686
	3	304.0	249.9	54	38.4	0.1075
	5	506.6	454.9	92.5	62.1	0.1710
	10	1013.2	963.6	185	110	0.2921
	15	1519.9	1472.3	289	152	0.3920
	20	2026.5	1979.9	408	190	0.4765
	25	2533.1	2487.5	546	224	0.5491
	30	3039.7	2994.2	709	255	0.6126
323.15	2	202.6	124.6	22.7	16.6	0.0482
	3	304.0	227	41.2	29.3	0.0842
	5	506.6	431.6	75.2	50.9	0.1436
	10	1013.2	939.3	150.5	92	0.2513
	15	1519.9	1446.9	234	129	0.3430
	20	2026.5	1954.6	327	162	0.4218
	25	2533.1	2462.2	432	193	0.4907
	30	3039.7	2969.8	554	221	0.5527

It was stated that mole fraction solubility fitted the equation given below to within ±1.0% for the ranges 5–30 atm (506.6–3040 kPa), 0–50 °C, and $x_1 = 0.25–0.65$.

$$x_1 = (p_1/\text{atm})(a - b\ \log_{10}(p_1/\text{atm})),$$

where

$$\log_{10} a = 703.8/(T/\text{K}) - 3.544$$

and

$$\log_{10} b = 903.5/(T/\text{K}) - 4.578.$$

It was also stated that measurements down to −90 °C over the whole range of experimental measurements could be expressed with a standard deviation of 3.5% by the following modified van Laar equation:

$$\log Y = A/\left\{1 + \frac{A}{B}\left(\frac{x_1}{1-x_1}\right)^{4/3}\right\}^2$$

where the activity coefficient is given by

$$\gamma = f/x_1 f^0.$$

f is the fugacity of ethyne in the solution and f^o is the fugacity of liquid ethyne at the same temperature. The author stated that fugacities were calculated from the Clausius equation of state as described by Din.[1] He also stated that a graph was constructed relating A and B with T from these fugacities and experimental solubility values.

The author stated that dilation of 2-propanone caused by dissolution of propanone could be expressed by the following formulas:

0 °C $V/V_o = 0.964 + 1.58s$; range of $s = 0.13–1.0$

$V/V_o = 1 + 0.0593p_1/\text{atm} + 0.00230(p_1/\text{atm})^2$; range of $p_1/\text{atm} = 4–16$

15 °C $V/V_o = 0.981 + 1.58s$; range of $s = 0.1–0.9$

$V/V_o = 1 + 0.0409p_1/\text{atm} + 0.00112(p_1/\text{atm})^2$; range of $p_1/\text{atm} = 4–20$

25 °C $V/V_o = 0.984 + 1.63s$; range of $s = 0.1–0.9$

$V/V_o = 1 + 0.0346p_1/\text{atm} + 0.00073(p_1/\text{atm})^2$; range of $p_1/\text{atm} = 4–25$

40 °C $V/V_o = 0.993 + 1.61s$; range of $s = 0.08–0.7$

$V/V_o = 1 + 0.0283p_1/\text{atm} + 0.00029(p_1/\text{atm})^2$; range of $p_1/\text{atm} = 4–30$

50 °C $V/V_o = 0.995 + 1.62s$; range of $s = 0.07–0.6$

$V/V_o = 1 + 0.0237p_1/\text{atm} + 0.00021(p_1/\text{atm})^2$; range of $p_1/\text{atm} = 4–30$

where s is the weight ratio of ethyne to 2-propanone.

Auxiliary Information

Method/Apparatus/Procedure:
No information.

Source and Purity of Materials:
No information.

Estimated Error:
See above.

References:
[1]F. Din, *Thermodynamic Functions of Gases* (Butterworths, London, 1956), Vol. 2.

Components:
(1) Ethyne; C_2H_2 ; [74-86-2]
(2) 2-Propanone, (acetone); C_3H_6O; [67-64-1]

Original Measurements:
H. Hannaert, M. Haccuria, and M. P. Mathieu, Ind. Chim. Belge **32**, 156–164 (1967).

Variables:
T/K = 273–353

Prepared By:
E. L. Boozer and H. L. Clever

Experimental Data

T/K	$100x_1$ /mol%	$Kp\nu$/atm* at 293.15	Enthalpy of dissolution, ΔH/kcal mol^{-1}	A
243.15–293.15	5	14.4	5.03	4.9
	1.5	15	5.29	5.1

*$\log_{10}(KP\nu/\text{atm}) = A - (\Delta H/\text{cal mol}^{-1})/(2.3R(T/\text{K}))$.

The author's definitions are:
$K = y_1/x_1$ = mole fraction gas in gas phase/mole fraction gas in liquid phase,
P/atm = total pressure; ν = coefficient of fugacity.
The function $KP\nu$/atm is equivalent to a Henry's constant in the form $H_{1,2}$ /atm = $(f_1$ /atm$)/x_1$ where f_1 is the fugacity.

Auxiliary Information

Method/Apparatus/Procedure:
The static pressure over a saturated solution was measured.

Source and Purity of Materials:
(1) Ethyne. Commercial product. Purified by passage over activated carbon and vacuum fusion. Purity 99.8%–99.9%.
(2) 2-Propanone. Merck and Co. Vapor pressure, p/mm Hg = 11 at −30 °C and 184 at 20 °C.

Estimated Error:
10%–15% (authors).

Components:
(1) Ethyne; C_2H_2 ; [74-86-2]
(2) 2-Propanone, (*acetone*); C_3H_6O; [67-64-1]

Original Measurements:
V. M. Shleinikov and M. A. Nikitin, Neftepererab. Neftekhim. (Moscow) **37**(9), 37–42 (1967).

Variables:
T/K = 195–403 K;
p_1 /kPa = 98–2157

Prepared By:
A. Skrzecz and P. G. T. Fogg

Experimental Data

p_1 /atm	p_1 /kPa*	t/°C	T/K*	Solubility/(dm^3/kg^2)	x_1*
1	98	−78	195.1	0.6100	0.6123
		−70	203.1	0.5440	0.5848
		−60	213.1	0.3680	0.4879
		−50	223.1	0.2640	0.4060
		−40	233.1	0.1850	0.3239
		−30	243.1	0.1360	0.2604
		−20	253.1	0.0950	0.1974
		−10	263.1	0.0680	0.1497
		0	273.1	0.0492	0.1130
		10	283.1	0.0360	0.0853
		20	293.1	0.0253	0.0615
		30	303.1	0.0186	0.0459
		40	313.1	0.0130	0.0326
		50	323.1	0.0096	0.0243
2	196	−70	203.1	0.6900	0.6411
		−60	213.1	0.5040	0.5662
		−50	223.1	0.3800	0.4959
		−40	233.1	0.2920	0.4305
		−30	243.1	0.2200	0.3629
		−20	253.1	0.1650	0.2993
		−10	263.1	0.1210	0.2386
		0	273.1	0.0985	0.2032
		10	283.1	0.0720	0.1571
		20	293.1	0.0550	0.1247
		30	303.1	0.0407	0.0953
		40	313.1	0.0314	0.0752
		50	323.1	0.0240	0.0585
		60	333.1	0.0170	0.0422
		70	343.1	0.0109	0.0274
4	392	−60	213.1	0.5620	0.5927
		−50	223.1	0.4580	0.5425
		−40	233.1	0.3680	0.4879
		−30	243.1	0.2980	0.4355
		−20	253.1	0.2400	0.3833
		−10	263.1	0.1930	0.3332
		0	273.1	0.1540	0.2851
		10	283.1	0.1230	0.2416
		20	293.1	0.1000	0.2057
		30	303.1	0.0815	0.1743
		40	313.1	0.0688	0.1512
		50	323.1	0.0553	0.1253
		60	333.1	0.0456	0.1056
		70	343.1	0.0344	0.0818
		80	353.1	0.0278	0.0671

		90	363.1	0.0192	0.0474
6	588	−40	233.1	0.4150	0.5180
		−30	243.1	0.3410	0.4689
		−20	253.1	0.2870	0.4263
		−10	263.1	0.2420	0.3852
		0	273.1	0.2050	0.3467
		10	283.1	0.1710	0.3069
		20	293.1	0.1410	0.2674
		30	303.1	0.1170	0.2325
		40	313.1	0.0990	0.2040
		50	323.1	0.0834	0.1776
		60	333.1	0.0720	0.1571
		70	343.1	0.0624	0.1391
		80	353.1	0.0505	0.1156
		90	363.1	0.0445	0.1033
		100	373.1	0.0360	0.0853
8	785	−30	243.1	0.4280	0.5257
		−20	253.1	0.3620	0.4838
		−10	263.1	0.3040	0.4404
		0	273.1	0.2600	0.4023
		10	283.1	0.2250	0.3681
		20	293.1	0.1910	0.3309
		30	303.1	0.1620	0.2955
		40	313.1	0.1430	0.2702
		50	323.1	0.1210	0.2386
		60	333.1	0.0974	0.2014
		70	343.1	0.0864	0.1828
		80	353.1	0.0698	0.1531
		90	363.1	0.0588	0.1321
		100	373.2	0.0508	0.1162
		110	383.2	0.0400	0.0939
		120	393.2	0.0322	0.0770
10	981	−20	253.1	0.4780	0.5531
		−10	263.1	0.4000	0.5088
		0	273.1	0.3380	0.4667
		10	283.1	0.2840	0.4237
		20	293.1	0.2400	0.3833
		30	303.1	0.2040	0.3456
		40	313.1	0.1720	0.3081
		50	323.1	0.1480	0.2770
		60	333.1	0.1170	0.2325
		70	343.1	0.0990	0.2040
		80	353.1	0.0836	0.1779
		90	363.1	0.0706	0.1546
		100	373.1	0.0570	0.1286
		110	383.1	0.0492	0.1130
		120	393.1	0.0370	0.0874
		130	403.1	0.0237	0.0578
12	1177	−20	253.1	0.6270	0.6188
		−10	263.1	0.5270	0.5771
		0	273.1	0.4370	0.5309
		10	283.1	0.3570	0.4804
		20	293.1	0.3030	0.4396
		30	303.1	0.2450	0.3881
		40	313.1	0.2070	0.3490
		50	323.1	0.1740	0.3106
		60	333.1	0.1410	0.2674

		70	343.1	0.1190	0.2355
		80	353.1	0.0960	0.1991
		90	363.1	0.0815	0.1743
		100	373.1	0.0683	0.1503
		110	383.1	0.0578	0.1302
		120	393.1	0.0415	0.0970
		130	403.1	0.0297	0.0714
14	1373	−20	253.1	1.0500	0.7311
		−10	263.1	0.7130	0.6486
		0	273.1	0.5650	0.5940
		10	283.1	0.4770	0.5526
		20	293.1	0.3660	0.4866
		30	303.1	0.3080	0.4437
		40	313.1	0.2220	0.3650
		50	323.1	0.1980	0.3389
		60	333.1	0.1700	0.3056
		70	343.1	0.1350	0.2590
		80	353.1	0.1100	0.2217
		90	363.1	0.0900	0.1890
		100	373.1	0.0720	0.1571
		110	383.1	0.0600	0.1345
		120	393.1	0.0460	0.1064
16	1569	−10	263.1	1.0500	0.7311
		0	273.1	0.7770	0.6680
		10	283.1	0.6270	0.6188
		20	293.1	0.4820	0.5552
		30	303.1	0.3550	0.4789
		40	313.1	0.2740	0.4150
		50	323.1	0.2100	0.3522
		60	333.2	0.1850	0.3239
		70	343.2	0.1550	0.2864
		80	353.2	0.1210	0.2386
		90	363.1	0.0940	0.1957
		100	373.1	0.0740	0.1608
		110	383.1	0.0620	0.1383
		120	393.1	0.0470	0.1085
18	1764	0	273.1	0.9340	0.7075
		10	283.1	0.7100	0.6477
		20	293.1	0.5520	0.5884
		30	303.1	0.4270	0.5251
		40	313.1	0.3280	0.4593
		50	323.1	0.2520	0.3949
		60	333.1	0.2000	0.3412
		70	343.1	0.1660	0.3006
		80	353.1	0.1330	0.2562
		90	363.1	0.0990	0.2040
		100	373.1	0.0780	0.1680
		110	383.1	0.0630	0.1402
		120	393.1	0.0480	0.1105
20	1961	−10	263.1	1.4500	0.7897
		0	273.1	1.1750	0.7526
		10	283.1	0.8650	0.6913
		20	293.1	0.6350	0.6218
		30	303.1	0.4900	0.5592
		40	313.1	0.3760	0.4933
		50	323.1	0.2760	0.4168
		60	333.1	0.2200	0.3629

		70	343.1	0.1750	0.3118
		80	353.1	0.1400	0.2661
		90	363.1	0.1040	0.2122
		100	373.1	0.0800	0.1716
		110	383.1	0.0640	0.1422
		120	393.1	0.0490	0.1126
22	2157	10	283.1	1.0400	0.7292
		20	293.1	0.8000	0.6744
		30	303.1	0.5860	0.6028
		40	313.1	0.414	0.5174
		50	323.1	0.304	0.4404
		60	333.1	0.2500	0.3930
		70	343.1	0.1900	0.3297
		80	353.1	0.1520	0.2824
		90	363.1	0.1100	0.2217
		100	373.1	0.0850	0.1804
		110	383.1	0.0650	0.1441
		120	393.1	0.0500	0.1146

*Calculated by a compiler.

Auxiliary Information

Method/Apparatus/Procedure:

The method was as described in Refs. 1–3. At temperatures below 20 °C a dynamic method was used. At higher temperatures a static method, with shaking of absorption vessel, was used. When equilibrium was reached, the absorption vessel was cooled to the temperature of 20 °C and the desorbed acetylene was collected in the flask over water saturated with salt. Solubility of acetylene was calculated as the sum of desorbed gas and gas in the solution at pressure of 1 atm and at temperature of 20 °C. The molar volume of acetylene equal to 0.0224 m^3/mole, used by the authors, was adopted in mole fraction calculations. No more details were reported in the paper.

Source and Purity of Materials:

No information.

Estimated Error:

No information.

References:

[1]I. P. Usyukin *et al.*, Neftepererab. Neftekhim. (Moscow) **(11)**, 35 (1963).
[2]G. N. Bakhtyukova *et al.*, Neftepererab. Neftekhim. (Moscow) **(5)**, 37 (1965).
[3]V. N. Kiryakov *et al.*, Khim. Prom-st. **(2)**, 35 (1966).

Components:

(1) Ethyne; C_2H_2 ; [74-86-2]
(2) 2-Propanone; C_3H_6O; [67-64-1]

Original Measurements:

A. P. Voronkov, V. S. Mislavskaya, R. Ya. Mushii, and S. M. Khodeeva, Zhur. Fiz. Khim. **49**, 3128–3130, (1975); Russ. J. Phys. Chem. **49**, 1848–1849 (1975).

Variables:

T/K = 273.2–373.2;
P/kPa = 9 – 7802

Prepared By:

P. G. T. Fogg

Experimental Data

		Total pressure, P		Composition of liquid phase		Composition of gas phase		
t/°C	T/K	/atm	/kPa	x_2	x_1	y_2	y_1	p_1 /kPa*
0	273	0.1	9	1	0	1	0	0
		1	101	0.914	0.0860	0.0360	0.9640	98
		2	203	0.855	0.1450	0.0220	0.9780	198
		3	304	0.770	0.2300	0.0170	0.9830	299
		5	507	0.692	0.3080	0.0120	0.9880	501
		10	1013	0.462	0.5380	0.0080	0.9920	1005
		15	1520	0.342	0.6580	0.0060	0.9940	1511
		20	2026	0.162	0.8380	0.0050	0.9950	2016
		25	2533	0.042	0.9580	0.0030	0.9970	2526
20	293	0.24	2	1	0	1	0	0
		1	101	0.950	0.0500	0.0770	0.9230	94
		2	203	0.905	0.0950	0.0610	0.9390	190
		3	304	0.851	0.1490	0.0550	0.9450	287
		5	507	0.768	0.2320	0.0380	0.9620	487
		10	1013	0.606	0.3940	0.0250	0.9750	988
		15	1520	0.495	0.5050	0.0150	0.9850	1497
		20	2026	0.380	0.6200	0.0130	0.9870	2000
		25	2533	0.280	0.7200	0.0110	0.9890	2505
		30	3040	0.202	0.7980	0.0100	0.9900	3009
		35	3546	0.127	0.8730	0.0090	0.9910	3514
		40	4053	0.052	0.9480	0.0070	0.9930	4025
30	303	0	37	1	0	1	0	0
		1	101	0.973	0.0270	0.0120	0.9880	100
		3	304	0.892	0.1080	0.0950	0.9050	275
		5	507	0.817	0.1830	0.0670	0.9330	473
		10	1013	0.680	0.3200	0.0340	0.9660	979
		15	1520	0.550	0.4500	0.0200	0.9800	1489
		20	2026	0.470	0.5300	0.0170	0.9830	1992
		30	3040	0.278	0.7220	0.0150	0.9850	2994
		40	4053	0.163	0.8370	0.0110	0.9890	4008
		50	5066	0.055	0.9450	0.0090	0.9910	5021
40	313	1	58	1	0	1	0	0
		2	203	0.945	0.0550	0.0950	0.9050	183
		3	304	0.917	0.0830	0.0890	0.9110	277
		5	507	0.875	0.1250	0.0720	0.9280	470
		10	1013	0.760	0.2400	0.0460	0.9540	967
		15	1520	0.640	0.3600	0.0360	0.9640	1465
		20	2026	0.535	0.4650	0.0300	0.9700	1966
		30	3040	0.395	0.6050	0.0210	0.9790	2976
		40	4053	0.278	0.7220	0.0180	0.9820	3980
		50	5066	0.158	0.8420	0.0140	0.9860	4995

		60	6080	0.052	0.9480	0.0110	0.9890	6013
		64.5	6535	0.015	0.9850	0.0150	0.9850	6437
60	333	1.14	116	1	0	1	0	0
		3	304	0.965	0.0350	0.1730	0.8270	251
		5	507	0.922	0.0780	0.1220	0.8780	445
		10	1013	0.808	0.1920	0.0970	0.9030	915
		15	1520	0.722	0.2780	0.0890	0.9110	1385
		20	2026	0.643	0.3570	0.0840	0.9160	1856
		30	3040	0.527	0.4730	0.0780	0.9220	2803
		40	4053	0.417	0.5830	0.0750	0.9250	3749
		50	5066	0.310	0.6900	0.0730	0.9270	4696
		60	6080	0.225	0.7750	0.0720	0.9280	5642
		70	7093	0.167	0.8330	0.0710	0.9290	6589
		77	7802	0.060	0.9400	0.0600	0.9400	7334

*Calculated by the compiler.

Auxiliary Information

Method/Apparatus/Procedure:

Pressure–volume–temperature–compositions relations were studied using a steel autoclave fitted with a membrane cutoff valve and manometer.

Source and Purity of Materials:

(1) Purified ethyne was used. Critical constants agreed with published values.
(2) Acetone said to be '*pure*' was used. Critical constants agreed with published values.

Estimated Error:

δP/atm = ±0.2; δT/K = ±0.2; δx = 0.002 (authors).

Components:

(1) Ethyne; C_2H_2; [74-86-2]
(2) 2-Propanone, (acetone); C_3H_6O; [67-64-1]

Original Measurements:

G. P. Chukelkova, A. P. Rybkin, and T. N. Kozhichkina, Optimiz. Gazopinaniya Protsessov Gazoplam. Obrab. Met., M. 30–34 (1984).

Variables:

T/K = 203–273;
P/kPa = 101.3

Prepared By:

Yu. P. Yampolskii

Experimental Data

P/kPa	t/°C	T/K	S/mg g^{-1}*	x_1
101.3	−70	203.2	919	0.672
	−50	223.2	440	0.495
	−30	243.2	201	0.310
	0	273.2	55.5	0.110

*Solubility/milligrams of gas per gram of solvent.

Auxiliary Information

Method/Apparatus/Procedure:

A colorimetric method was used to determine the solubility of ethyne in acetone. This method was based on the formation of a colored solution of cuprous acetylide C_2Cu_2 by reaction of ethyne with an ammoniacal solution of cuprous nitrate.

Source and Purity of Materials:

No information.

Estimated Error:

Sensitivity of determination stated to be 5 mg of C_2H_2 per cm^3 of acetone.

Components:
(1) Ethyne; C_2H_2; [74-86-2]
(2) 2-Propanone (*acetone*); C_3H_6O; [67-64-1]
(3) Sodium iodide; NaI; [7681-82-5]

Original Measurements:
A. Maillard and W. Rosenthal, Compt. Rend. **234**, 2546–2548 (1952).

Variables:
$T/K = 293.15–303.15$;
p_1 /kPa = 101.3;
m_3 /mol kg^{-1} = 0–2.86

Prepared By:
P. G. T. Fogg

Experimental Data

t/°C	T/K	Mass % of NaI[a]	Ostwald coefficient, L[b]	Molal concentration of NaI[c] (m_3 /mol kg^{-1})	Sechenov constant[c] (k_{smc} /kg mol^{-1})
20	293.15	0	23.57	0	—
		13.27	19.74	1.021	0.075
		18.02	18.71	1.466	0.068
		21.35	17.48	1.811	0.072
		27.97	15.93	2.591	0.066
		29.98	15.21	2.856	0.067
20	293.15	12.9	19.73	0.988	0.089
22	295.15		19.13		0.080
24	297.15		18.19		0.079
26	299.15		17.46		0.070
28	301.15		16.37		0.076
30	303.15		15.78		0.058

[a]Weight of NaI/g in 100 g of solution.
[b]Defined as concentration of gas in the liquid phase/conc. in gas phase.
[c]Calculated by the compiler.

$$k_{smc} = ((1/m_3\ /\text{mol kg}^{-1}))\log_{10}(L^0/L).$$

Auxiliary Information

Method/Apparatus/Procedure:
The authors stated that equilibrium pressures were measured as a function of composition and that temperature was controlled by a thermostat. No other details were given. Data were presented in the form of small scale graphs (4.5×5.0 cm or less). The compiler obtained data from the graphs by use of a scanner and digitizing program.

Source and Purity of Materials:
No information.

Estimated Error:
$\delta L = \pm 0.1$ (estimated error in taking data from the graphs).

Components:
(1) Ethyne; C_2H_2; [74-86-2]
(2) *N,N*-Dimethylformamide; C_3H_7NO; [68-12-2]
(3) 2-Propanone; C_3H_6O; [67-64-1]

Original Measurements:
British Oxygen Co. Ltd., reported by S. A. Miller, *Acetylene–Its Properties, Manufacture and Uses* (Academic, New York, 1965), Vol. I.

Variables:
T/K = 273.15–333.15;
p_1 /kPa = 101.3; 709.3–3546.4

Prepared By:
P. G. T. Fogg

Experimental Data

T/K	p_1 /kPa	wt % of 2-propanone	g(C_2H_2)/kg solvent	Mole fractions* x_1	x_2	x_3
293.15	101.3	10	43.3	0.1059	0.7844	0.1097
		20	43.2	0.1034	0.682	0.2146
		30	42.7	0.1001	0.5846	0.3153
		50	41.3	0.0931	0.4015	0.5053
		70	39.2	0.0852	0.2324	0.6824
		90	36.8	0.0773	0.0749	0.8478

T/K	p_1 /atm	p_1 /kPa	Solubility of ethyne: g kg^{-1} of solvent	Solubility of ethyne: g dm^{-3} of solution	Mole fractions x_1	x_2	x_3
Solvent 24.4 wt % dimethylformamide 76.4 wt % 2-propanone							
273.15	5	506.6	250		0.3694	0.1232	0.5074
	10	1013.2	511		0.5449	0.0889	0.3662
	15	1519.9	782		0.6469	0.0690	0.2841
288.15	15	1519.9		238			
293.15	5	506.6	144		0.2523	0.1460	0.6017
	10	1013.2	286		0.4013	0.1169	0.4818
	15	1519.9	446		0.5110	0.0955	0.3935
	20	2026.5	625		0.5942	0.0793	0.3265
	25	2533.1	824		0.6588	0.0666	0.2746
	30	3039.7	1036		0.7083	0.0570	0.2348
313.15	5	506.6	79		0.1562	0.1648	0.679
	10	1013.2	180		0.2967	0.1374	0.566
	15	1519.9	275		0.3919	0.1188	0.4893
	20	2026.5	383		0.4730	0.1029	0.4241
	25	2533.1	504		0.5415	0.0896	0.369
	30	3039.7	647		0.6026	0.0776	0.3198
Solvent 37.4 wt % dimethylformamide 62.6 wt % 2-propanone							
273.15	5	506.6	226		0.3532	0.2082	0.4386
	10	1013.2	479		0.5365	0.1492	0.3143
	15	1519.9	791		0.6565	0.1106	0.2329
288.15	15	1519.9		241			
293.15	5	506.6	142		0.2555	0.2397	0.5049
	10	1013.2	284		0.4070	0.1909	0.4021
	15	1519.9	446		0.5187	0.1549	0.3264
	20	2026.5	633		0.6047	0.1273	0.2681
	25	2533.1	848		0.6720	0.1056	0.2224
	30	3039.7	1084		0.7237	0.0889	0.1874
313.15	5	506.6	98		0.1915	0.2603	0.5483
	10	1013.2	190		0.3146	0.2206	0.4647
	15	1519.9	291		0.4128	0.1890	0.3981
	20	2026.5	428		0.5084	0.1583	0.3334
	25	2533.1	530		0.5615	0.1411	0.2973
	30	3039.7	676		0.6203	0.1222	0.2575

*Calculated by the compiler.

Solubilities of ethyne in mixture of dimethylformamide and 2-propanone in the temperature range 0–60 °C and pressure range 7–35 atm (709.3–3546.4 kPa) are stated by the author to fit equations of the form:

$$x_1 = (p_1/\text{atm})(a - b\ \log_{10}(p_1/\text{atm})).$$

For 23.4 wt % dimethylformamide 76.4 wt % 2-propanone

$$\log_{10} a = 807/(T/K) - 3.879; \quad \log_{10} b = 1079/(T/K) - 5.141.$$

For 37.4 wt % dimethylformamide 62.6 wt % 2-propanone

$$\log_{10} a = 657/(T/K) - 3.364;$$
$$\log_{10} b = 843/(T/K) - 4.336.$$

Dilation, V/V_o was stated to fit the equations:

23.4 wt % dimethylformamide

$$V/V_o = 0.939 + 1.64s; \quad V/V_o = 1 + 0.0382p_1/\text{atm} + 0.000\,91(p_1/\text{atm})^2$$

37.4 wt % dimethylformamide

$$V/V_o = 1.042 + 1.39s; \quad V/V_o = 0.971 + 0.0544p_1/\text{atm},$$

where s = wt of ethyne/wt of solvent.

Auxiliary Information

Method/Apparatus/Procedure:
No information.

Source and Purity of Materials:
No information.

Components:
(1) Ethyne; C_2H_2; [74-86-2]
(2) 2-Propanone, (*acetone*); C_3H_6O; [67-64-1]
(3) 4-Methyl-1,3-dioxolane-2-one, (*propylene carbonate*); $C_4H_6O_3$; [108-32-7]

Original Measurements:
M. A. Nikitin, D. D. Zykov, and V. M. Shleinikov, Izv. Vyssh. Ucheb Zaved., Khim. Khim. Tekhnol. **18**, 571–575 (1975).

Variables:
T/K = 253–393;
P/kPa = 98–1961

Prepared By:
A. Skrzecz and P. G. T. Fogg

Experimental Data

Solubility of acetylene (1) in the solvent containing 85% of acetone (2) and 15% of propylene carbonate (by weight).

t/°C	T/K	p/atm	p/kPa*	Solubility [1]** /m_3/kg of solvent	x_1*
−20	253.1	1	98	0.0560	0.135
		2	196	0.0900	0.201
		4	392	0.1700	0.322
		6	588	0.2400	0.402
		8	785	0.3100	0.465
		10	981	0.4000	0.528
		12	1177	0.5500	0.606
		14	1373	0.7000	0.662
		16	1569	0.8600	0.708
		18	1765	1.0500	0.746
		20	1961	1.2500	0.778
0	273.1	1	98	0.0370	0.094
		2	196	0.0720	0.168
		4	392	0.1370	0.277
		6	588	0.1900	0.347
		8	785	0.2434	0.405
		10	981	0.3094	0.464
		12	1177	0.4145	0.537
		14	1373	0.5228	0.594
		16	1569	0.6347	0.640
		18	1765	0.7580	0.680
		20	1961	0.8625	0.707
20	293.1	1	98	0.0224	0.059
		2	196	0.0560	0.136
		4	392	0.1070	0.231
		6	588	0.1500	0.296
		8	785	0.1900	0.347
		10	981	0.2300	0.392
		12	1177	0.3070	0.462
		14	1373	0.3800	0.515
		16	1569	0.4400	0.552
		18	1765	0.5100	0.588
		20	1961	0.6000	0.627
40	313.1	1	98	0.0100	0.027
		2	196	0.0440	0.110
		4	392	0.0850	0.192
		6	588	0.1170	0.247
		8	785	0.1450	0.289
		10	981	0.1800	0.392

Solubility of acetylene (1) in the solvent containing 38.8% of acetone (2) and 61.2 mass % of propylene carbonate.

t/°C	T/K	p/atm	p/kPa*	Solubility [1]** /m^3/kg of solvent	x_1*
−20	253.1	1	98	0.025	0.080
		2	196	0.060	0.174
		4	392	0.125	0.304
		6	588	0.198	0.410
		8	785	0.245	0.466
		10	981	0.310	0.528
		12	1177	0.410	0.586
		14	1373	0.490	0.636
		16	1569	0.600	0.677
		18	1765	0.760	0.727
		20	1961	0.940	0.767
0	273.1	1	98	0.018	0.059
		2	196	0.042	0.125
		4	392	0.090	0.240
		6	588	0.130	0.317
		8	785	0.165	0.366
		10	981	0.210	0.425
		12	1177	0.270	0.483
		14	1373	0.315	0.526
		16	1569	0.390	0.577
		18	1765	0.485	0.631
20	293.1	1	98	0.009	0.032
		2	196	0.032	0.110
		4	392	0.063	0.181
		6	588	0.088	0.231
		8	785	0.110	0.272
		10	981	0.140	0.329
		12	1177	0.180	0.386
		14	1373	0.205	0.418
		16	1569	0.245	0.462
		18	1765	0.305	0.516
		20	1961	0.365	0.561
40	313.1	4	392	0.045	0.136
		6	588	0.057	0.164
		8	785	0.074	0.197
		10	981	0.094	0.240
		12	1177	0.117	0.287
		14	1373	0.132	0.317
		16	1569	0.155	0.352
		18	1765	0.192	0.402
		20	1961	0.230	0.446
60	333.1	4	392	0.031	0.098
		6	588	0.038	0.123
		8	785	0.049	0.149
		10	981	0.062	0.178
		12	1177	0.076	0.210
		14	1373	0.086	0.231
		16	1569	0.100	0.259
		18	1765	0.122	0.296
		20	1961	0.144	0.337
80	353.1	6	588	0.026	0.083
		8	785	0.033	0.104
		12	1177	0.2300	0.392
		14	1373	0.2700	0.431
		16	1569	0.3150	0.469
		18	1765	0.3600	0.502
		20	1961	0.4070	0.533
60	333.1	2	196	0.0320	0.087
		4	392	0.0570	0.138
		6	588	0.0800	0.184
		8	785	0.1050	0.227
		10	981	0.1360	0.276
		12	1177	0.1650	0.316
		14	1373	0.1900	0.352
		16	1569	0.2200	0.381
		18	1765	0.2500	0.412
		20	1961	0.2800	0.439
80	353.1	4	392	0.0430	0.107
		6	588	0.0600	0.144
		8	785	0.0780	0.179
		10	981	0.1030	0.224
		12	1177	0.1200	0.251
		14	1373	0.1380	0.279
		16	1569	0.1550	0.303
		18	1765	0.1750	0.329
		20	1961	0.1900	0.347
100	373.1	4	392	0.0320	0.082
		6	588	0.0460	0.114
		8	785	0.0600	0.144
		10	981	0.0780	0.179
		12	1177	0.0900	0.201
		14	1373	0.1000	0.219
		16	1569	0.1100	0.235
		18	1765	0.1200	0.251
		20	1961	0.1300	0.267
120	393.1	4	392	0.0290	0.070
		6	588	0.0350	0.090
		8	785	0.0440	0.110
		10	981	0.0600	0.144
		12	1177	0.0660	0.161
		14	1373	0.0700	0.164
		16	1569	0.0780	0.179
		18	1765	0.0840	0.190
		20	1961	0.0900	0.204

*Calculated by compiler.
**Volume of gas measured at 273.15 K and 101.3 kPa dissolved per kilogram of solvent.

Parameters of correlation equation evaluated by compiler.

p/atm	p/kPa	C	D	Dispersion
1	98	4.736	0.0117	4.508
2	196	3.030	0.0053	5.403
4	392	3.822	0.0062	6.710
6	588	3.954	0.0061	6.710
8	785	4.058	0.0061	6.710
10	981	4.099	0.0059	6.710
12	1177	4.424	0.0066	6.710
14	1373	4.674	0.0072	6.710

		10	981	0.044	0.128
		12	1177	0.050	0.149
		14	1373	0.056	0.161
		16	1569	0.064	0.181
		18	1765	0.079	0.210
		20	1961	0.090	0.240
100	373.1	8	785	0.022	0.820
		10	981	0.028	0.960
		12	1177	0.033	0.104
		14	1373	0.036	0.112
		16	1569	0.040	0.120
		18	1765	0.049	0.140
		20	1961	0.056	0.160
120	393.1	10	981	0.017	0.070
		12	1177	0.022	0.072
		14	1373	0.023	0.075
		16	1569	0.026	0.083
		18	1765	0.031	0.098
		20	1961	0.035	0.100
		20	1961	0.585	0.676

Parameters of correlation equation evaluated by compiler.

p/atm	p/kPa	C	D	Dispersion
1	98	3.700	0.0105	3.761
2	196	3.506	0.0068	3.748
4	392	4.019	0.0076	5.851
6	588	4.535	0.0089	5.851

*Calculated by compiler.
**Volume of gas measured at 273.15 K and 101.3 kPa dissolved per kilogram of solvent.

Auxiliary Information

Method/Apparatus/Procedure:

The method of measurements was described in Ref. 1. No other experimental details were reported in the paper.
The following equation was fitted to the experimental data: $\log_{10} \alpha = C - DT/\mathrm{K}$, where: α—solubility of acetylene/(m^3/1000 kg); C, D—adjustable coefficients.

Source and Purity of Materials:

(1) Source not specified.
(2) Source not specified; chemically pure grade.
(3) Stated to have been obtained from Russian industry after vacuum distillation.

Estimated Error:

No information.

References:

[1]I. P. Usyukin and V. M. Shleinikov, Neftepererab. Neftekhim. **(11)**, 35 (1963).

3.7. Acetic Acid and Esters of Carboxylic Acids

Components:
(1) Ethyne; C_2H_2; [74-86-2]
(2) Acetic Acid and Esters of Carboxylic Acids

Evaluator:
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London, United Kingdom.

Critical Evaluation

Acetic Acid

The solubility of ethyne in acetic acid was measured by Skubla and Waradzin[1] (293 K; 38–101 kPa) and by Barton[2] (291, 298 K; 101 kPa). The mole fraction solubilities given by Skubla and Waradzin vary linearly with pressure. The value for 101 kPa differs by about 2% from the value for 293 K and 101 kPa estimated from Barton's data.

Vinyl acetate

The solubility of ethyne in vinyl acetate has been reported by Skubla and Waradzin (293 K; 41–101 kPa), Kaszonyi *et al.*[3] (258–293 K; 22–101 kPa) and by Haspra and Paulech[4] (273–313 K; 101 kPa). There is satisfactory agreement between the data from Kaszonyl *et al.* and those from Haspra and Paulech. Solubility at a partial pressure of 101.3 kPa from these two sources fit the equation:

$$\ln x_1 = -50{,}9263 + 3578.56/(T/K) + 6.26154 \ln(T/K)$$

standard deviation in values of $x_1 = 2.52 \times 10^{-3}$.
This equation is valid for 258–313 K and may be accepted on a tentative basis. The values of the solubility given by Skubla and Waradzin fall below values from the other two sources.

Solubilities in mixtures of acetic acid and vinyl acetate were reported at 283 K by Skubla and Waradzin and at 258–273 K by Kaszonyl *et al.* There is some scatter of data in each case. However extrapoled values of the Kaszonyl data to 293 K are consistent with the Skubla data. This indicates that general trends are correct but that details need to be confirmed.

Methyl acetate

The solubility in methyl acetate was measured by Usyukin and Shleinikov[5] (203.2–293.2 K; 101 kPa), James[6] (263 K; 98 kPa), Horiuti[7] (273–313 K; 101 kPa). The data from Usyukin and Shleinikov are consistent with those from Horiuti. Solubility at a partial pressure of gas of 101.3 kPa from these two sources fit the equation:

$$\ln x_1 = 99.6219 - 2769.36/(T/K) - 16.3377 \ln(T/K)$$

standard deviation in values of $x_1 = 4.88 \times 10^{-3}$.
This equation is recommended, on a tentative basis, for use in the temperature range 203–313 K.

The solubility at 263 K calculated from data given by James lies above that from this equation. Data from this source are probably less reliable than data from the other two sources.

Ethyl acetate

The solubility in ethyl acetate was measured by Hölemann and Hasselmann[8] (298 K; 40–1082 kPa), Makitra *et al.*[9] (293 K; 99 kPa), James (263 K; 99 kPa), Bodor *et al.*[10] (198–318 K; 10–108 kPa). The evaluator considers the measurements by Hölemann and Hasselmann to be the most reliable. The solubility at 298 K from this source is consistent with the data given by Bodor *et al.* at lower temperatures. The variation in solubility at a partial pressure of 101.3 kPa from these two sources fit the equations:

$$\ln x_1 = 110.430 - 2912.22/(T/\mathrm{K}) - 18.1635 \ln(T/\mathrm{K})$$

standard deviation in values of $x_1 = 1.45 \times 10^{-2}$.
This equation is based on data from 198 to 298 K and is based on five data points. It should be taken as a guide to the behavior of the solvent until further data for the system are available.

Other esters of monobasic carboxylic acids

James also measured solubility in methyl formate, ethyl formate, 3-methylbutyl formate and 3-butylmethyl acetate at 263 K; 99 kPa. The solubility in the formates was found to be lower than the solubility in the corresponding acetates. No estimate of the reliability of the data can be made.

Isham[17] reported the solubility in furfuryl acetate. No comparable data are available. Isham also reported solubility in tetrahydrofurfuryl acetate at 298 K and about 101.3 kPa. Lagarde and Cambon[18] made measurements at 288 K; 1504 kPa but direct comparison of the measurements from the two sources is not possible.

Kodachenko measured a solubility in ethylene diacetate at 298 K; 101.3 kPa which corresponds to a mole fraction of 0.063. The only comparable value is that of the solubility in methylene diacetate of 0.044 at 298 K; 101.3 from a measurement by McKinnis.[15] McKinnis also reported solubility in trimethyl borate and in ethyl perfluorobutyrate.

Esters of dibasic carboxylic acids

Freidlin and Bushinskii[11] reported solubilities in the eight monoesters of hexanedioic acid (adipic acid) from methyl to octyl and also in the eight diesters from dimethyl to dioctyl. These were measured at a partial pressure of ethyne of 53.3 kPa in the temperature range 293–323 K. In addition, solubility in monomethyl adipate was measured over the pressure range of 7–59 kPa at 293 K and that in dimethyl adipate in the range 5–60 kPa also at 293 K. Freidlin *et al.*[12] measured solubilities in eight dimethyl esters of straight chain

dicarboxylic acids from propanedioic acid, dimethyl ester to decanedioic acid, dimethyl ester. These were measured at 298.2 K and pressures to 53.3 kPa but results were reported as Bunsen coefficients. In the case of both the monoalkyl and the dialkyl esters of hexanedioic acid, the mole fraction solubility at a fixed temperature and pressure decreases with increase in size of the alkyl group. In the case of the dialkyl esters, variations of mole fraction solubilities, as a function of the number of carbon atoms in the ester group, approximate to a sigmoid curve (Figs. 7 and 8). Solubility in a dialkyl ester is greater than that in the corresponding monoalkyl ester of hexanedioic acid.

When solubilities are compared for the series of dimethyl esters of dicarboxylic acids it is found that mole fraction solubility at 298 K and a partial pressure of 101.3 kPa also decreases with increase in the number of carbon atoms in the parent acid. These variations also approximate to a sigmoid curve (Fig. 9).

The data from the two papers are roughly consistent but need confirmation by other workers. Data from Freidlin and Bushinskii for the dimethyl ester of hexanedioic acid can be extrapolated to give a mole fraction solubility at 293 K and 101.3 kPa of 0.0759. This is compatible with the value of 0.0749 at 298 K and 101.3 kPa calculated from data given in the paper by Freidlin *et al*. No measurements on these systems by other workers are available for comparison.

Hölemann and Hasselmann[8] measured the solubility of ethyne in oxalic acid, diethyl ester. The value of the mole fraction solubility at 298 K and 101.3 kPa is 0.0577. This value may be compared with a mole fraction solubility in propanedioic acid, dimethyl ester of 0.0772. If the data are correct then the difference is size of the ester groups has greater influence on the relative solubilities in this pair of esters than the lengths of carbon chains in the parent acids.

Bushinskii and Freidlin[13] published the solubility of ethyne in various vinyl alkyl esters of dibasic acids. In the case of vinyl alkyl esters of adipic acid the data indicate a decrease in solubility from the methyl to the propyl ester but changes from propyl to hexyl ester do not show a definite trend. The solubility in vinyl methyl succinate is greater than the solubility in vinyl methyl glutarate, the ester of the next higher acid, but no definite trends are apparent as the length of the carboxylic acid chain is increased. There is no reason to doubt the reliability of the measurements by Bushinskii and Freidlin but further work is need for confirmation of the pattern.

Data for methyl orthoformate and methyl orthoacetate are given in details of a patent filed by Walker.[14] Mole fraction solubilities at 298.2 K and 101.3 kPa from these data are:

methyl orthoformate 0.070

methyl orthoacetate 0.073

The corresponding mole fraction solubility for methyl orthoacetate from measurements by McKinnis[15] is 0.068 and for ethyl orthoformate is 0.054.[16]

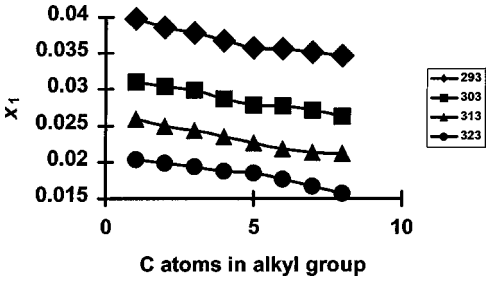

FIG. 7. Variation of solubility of ethyne in monoesters of hexanedioic at 53.3 kPa from data published by Freidlin and Bushinskii.

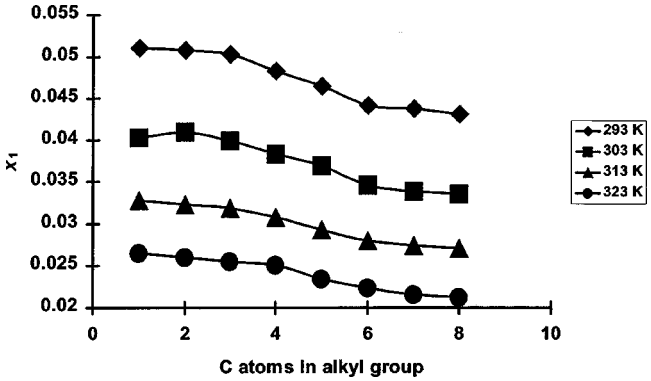

FIG. 8. Variation of solubility of ethene in diesters of hexanedioic acid at 53.3 kPa from data published by Freidlin and Bushinskii.

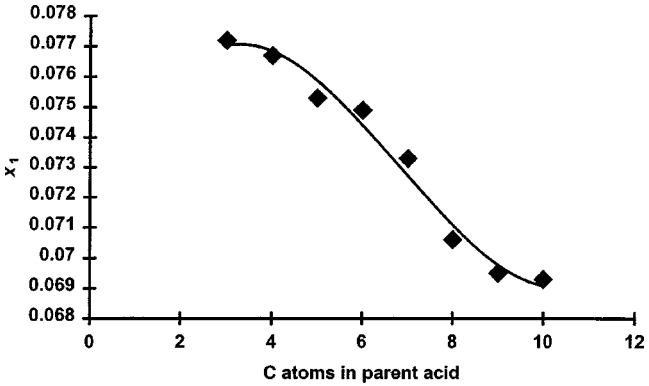

FIG. 9. Variation in the solubility of ethyne in methyl esters of dicarboxylic acids at 298 K and 101.3 kPa from data published by Freidlin and Bushinskii.

References:

[1]P. Skubla and W. Waradzin, Chem. Prum. **24**(10), 506–512 (1974).

[2]J. S. Barton, Ph.D thesis, Chem. Engng. Dept., Queen's University, Kingston, Ontario, Canada, 1970; Quoted in J. R. Barton and C. C. Hsu, Chem. Eng. Sci. **27**, 1313–1323 (1972).

[3]A. Kaszonyi, M. Harustiak, and J. Kizlink, J. Chem. Eng. Data **37**, 37–38 (1992).

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[8]P. Hölemann and R. Hasselmann. *Forschungsberichte des Wirtschafts- und Verkehrsministeriums Nord-Westfalen*, No. 109, Forschungsstelle für Acetylen (Westdeutscher Verlag, Köln-Opladen, Germany, 1954).

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[13]V. I. Bushinskii and G. N. Freidlin, Zh. Prikl. Khim. **45**, 408–411 (1972); J. Appl. Chem. USSR **45**, 402–405 (1972).

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[16]G. F. Kodachenko, Khim. Prom. (Moscow) **49**, (2), 106–108 (1973); Sovi. Chem. Ind. **49**, (2), 92–95 (1973).

[17] R. M. Isham, Report US2424987, 1947.

[18]H. Lagarde and J. Cambon, J. Soud. Tech. Conn. **9**, 7–11 (1955).

Components:
(1) Ethyne; C_2H_2; [74-86-2]
(2) Acetic acid; $C_2H_4O_2$; [64-19-7]

Original Measurements:
J. R. Barton, Ph.D Thesis, Chem. Eng. Dept., Queen's University, Kingston, Ontario, Canada, 1970; Quoted in Barton, J. R. Barton and C. C. Hsu, Chem. Eng. Sci. **27**, 1313–1323 (1972).

Variables:
T/K = 291.2–298.2; p_1 /kPa = 101.3

Prepared By:
P. G. T. Fogg

Experimental Data

t/°C	T/K	p_1 /kPa	x_1
18	291.2	101.3	0.015
25	298.2	101.3	0.01482

Auxiliary Information

No information.

Components:
(1) Ethyne; C_2H_2; [74-86-2]
(2) Acetic acid; $C_2H_4O_2$; [64-19-7]

Original Measurements:
P. Skubla and W. Waradzin, Chem. Prum. **24**(10), 506–512 (1974).

Variables:
T/K = 293.15; p_1 /kPa = 38.3–101.3

Prepared By:
P. G. T. Fogg

Experimental Data
T/K = 293.15

p_1 /Torr	p_1 /kPa	x_1	p_1 /Torr	p_1 /kPa	x_1
287.5	38.33	0.005674	536.6	71.54	0.010511
332.2	44.29	0.006673	582.0	77.59	0.011921
343.1	45.74	0.006951	609.8	81.30	0.012598
370.6	49.41	0.007770	668.3	89.10	0.013720
408.0	54.40	0.008217	726.6	96.87	0.014752
450.2	60.02	0.009205	760.0	101.33	0.015379
500.1	66.67	0.010043			

Auxiliary Information

Method/Apparatus/Procedure:
A modified Ostwald apparatus was used as described in Ref. 1.

Source and Purity of Materials:
(1) Bubbled through conc. H_2SO_4, over solid KOH and then active carbon. Absorbed in dimethylformamide at −10 to −15 °C and liberated at +5 to +10 °C and then further dried over active carbon. Chromatographic analysis indicated a purity of 99.9%.
(2) From *Lachema*, Brno. Frozen out three times and then fractionated in the presence of 2.5 mass % of CrO_3 and 2 mass % of acetic anhydride. Boiling point 118.1–118.2 °C; n_D^{20} = 1.3719, Chromatographic analysis indicated a purity of 100%.

Estimated Error:
No information.

References:
[1]J. Haspra, and J. Paulech, Chem. Prum. **7**, 569 (1957).

Components:
(1) Ethyne; C_2H_2; [74-86-2]
(2) Vinyl acetate (*acetic acid ethenyl ester*); $C_4H_6O_2$; [108-05-4]

Original Measurements:
J. Haspra and J. Paulech, Chem. Prum. **7**, 569–570 (1957).

Variables:
T/K=273–313;
p_1 /kPa=101

Prepared By:
A. Skrzecz and P. G. T. Fogg

Experimental Data

p_1 /mm Hg	p_1 /kPa*	t/°C	T/K*	Bunsen coefficient α	x_1*
760	101.3	0	273.1	18.31	0.0693
		10	283.1	14.16	0.0551
		20	293.1	10.98	0.0438
		30	303.1	8.83	0.0360
		40	313.1	7.11	0.0296

*Calculated by a compiler.

Auxiliary Information

Method/Apparatus/Procedure:
The method was based on a classical Ostwald absorber. The absorber, thermostated by water, was joined by a capillary to a thermostated burette filled with acetylene, a tank containing boiling solvent, a manometer and a vacuum line. The results were reported only as Bunsen coefficients; details of the procedure were not described.[1]

Source and Purity of Materials:
(1) Source not specified; technical grade dissolved in acetone or obtained from CaC_2; washed with H_2SO_4, KOH and then absorbed in dimethylformamide at −10 °C, desorbed at 5–10 °C and purified over active carbon.
(2) Source not specified: technical grade; distilled and stabilized with hydroquinone.

Estimated Error:
No information.

References:
[1]P. Skubla and W. Waradzin, Chem. Prum. **24**, 506–512 (1974).

Components:
(1) Ethyne; C_2H_2; [74-86-2]
(2) Vinyl acetate, (*acetic acid ethenyl ester*); $C_4H_6O_2$; [108-05-4]

Original Measurements:
P. Skubla and W. Waradzin, Chem. Prum. **24**(10), 506–512 (1974).

Variables:
T/K=293.15; p_1 /kPa=41.4–101.3

Prepared By:
P. G. T. Fogg

Experimental Data
T/K=293.15

p_1 /Torr	p_1 /kPa	x_1	p_1 /Torr	p_1 /kPa	x_1
310.2	41.36	0.01524	536.3	71.50	0.02648
384.5	51.26	0.01881	596.5	79.53	0.02949
430.9	57.45	0.02106	659.5	87.93	0.03277
471.6	62.87	0.02329	760	101.33	0.03779

Auxiliary Information

Method/Apparatus/Procedure:
A modified Ostwald apparatus was used as described in Ref. 1.

Source and Purity of Materials:
(1) Bubbled through conc. H_2SO_4, over solid KOH and then active carbon. Absorbed in dimethylformamide at −10 to −15 °C and liberated at +5 to +10 °C and then further dried over active carbon. Chromatographic analysis indicated a purity of 99.9%.
(2) From *Duslo* factory. Distilled, washed with water and dried with $CaCl_2$. Fractionated at barometric pressure. Sample boiling 72.5–72.7 °C collected. n_D^{20}=1.3956. Chromatographic analysis indicated a purity of 99.91 mass %. Impurities were acetaldehyde, acetone, and divinyl acetylene. The product was stabilized by addition of 0.3 mass % of diphenylamine and a small amount of hydroquinone.

Estimated Error:
No information.

References:
[1]J. Haspra and J. Paulech, Chem. Prum **7**, 569 (1957).

Components:
(1) Ethyne; C_2H_2; [74-86-2]
(2) Vinyl acetate, (*acetic acid ethenyl ester*); $C_4H_6O_2$; [108-05-4]

Original Measurements:
A. Kaszonyi, M. Harustiak, and J. Kizlink, J. Chem. Eng. Data **37**, 37–38 (1992).

Variables:
T/K=258.2–293.2; P/kPa=22.2–101.0

Prepared By:
P. G. T. Fogg

Experimental Data

t/°C	T/K	P_{total}/kPa	p_1*	$x_1 \pm$ SD[a]	Henry's constant, H/kPa[b]
20	293.15	101.0	89.4	0.0345±0.0002	2492±190
		80.6	68.9	0.0286±0.0004	
		53.9	42.1	0.0170±0.0003	
		40.6	28.7	0.0098±0.0008	
0	273.15	101.4	97.5	0.0580±0.0001	1632±47
		81.4	77.4	0.0482±0.0009	
		68.1	64.1	0.0404±0.0005	
		54.7	50.7	0.0312±0.0002	
		41.4	37.3	0.0229±0.0004	
		28.1	24.0	0.0137±0.0004	
−5	268.15	94.2	91.3	0.0727±0.0007	1261±18
		74.5	71.6	0.0565±0.0008	
		61.2	58.2	0.0451±0.0009	
		47.8	44.8	0.0358±0.0002	
		34.5	31.5	0.0253±0.0002	
−10	263.15	99.7	97.6	0.0824±0.0003	1172±24
		79.6	77.5	0.0658±0.0005	
		66.3	64.2	0.0549±0.0004	
		53.0	50.8	0.0450±0.0003	
		39.6	37.4	0.0313±0.0005	
−15	258.15	96.2	94.7	0.0950±0.0003	1001±10
		75.5	74.0	0.0738±0.0005	
		62.2	60.7	0.0602±0.0004	
		48.8	47.2	0.0466±0.0005	
		35.5	33.9	0.0332±0.0007	
		22.2	20.6	0.0212±0.0008	

*Calculated by the compiler from the equation for the vapor pressure of vinyl acetate given by the authors, i.e., $\log_{10}(p_2/\text{kPa}) = 6.379 - 1320.27/((t/°C) + 229.19)$.
[a]SD=standard deviation from five measurements.
[b]$H = p_1/x_1$.
[c]95% confidence interval at all temperatures.

Auxiliary Information

Method/Apparatus/Procedure:
A differential method was used. A volume of solvent in a glass cell fitted with a magnetic stirrer was allowed to come to equilibrium with gas at the same temperature. A measured volume of additional solvent was then introduced at constant pressure of gas. The system was agitated and the final reduction of volume of gas was noted. The temperature of the liquid was maintained to within ±1 °C by circulation of cooling liquid in the double walled absorption vessel.

Source and Purity of Materials:
(1) Commercial grade acetylene (99%) was passed through concentration H_2SO_4, solid NaOH and then activated charcoal. Chromatographic analysis indicated only traces of methane, acetone and nitrogen.
(2) Vinyl acetate was dried with $CaCl_2$ and the fraction boiling at 72.5–72.7 °C separated by fractional distillation under nitrogen and then stabilised by hydroquinone (4 ppm). Chromatographic analysis indicated a purity of 99.9 mass % with traces of acetaldehyde, acetic acid, and divinylacetylene.

Estimated Error:
δT/K=0.1 (authors).

Components:
(1) Ethyne; C_2H_2; [74-86-2]
(2) Acetic acid; $C_2H_4O_2$; [64-19-7]
(3) Vinyl acetate, (*acetic acid ethenyl ester*); $C_4H_6O_2$; [108-05-4]

Original Measurements:
P. Skubla and W. Waradzin, Chem. Prum. **24**(10), 506–512 (1974).

Variables:
T/K=293.15;
p_1/kPa=101.3

Prepared By:
P. G. T. Fogg

Experimental Data
T/K=293.15, p_1/kPa=101.3

Composition of solvent*	x_1	Composition of solvent*	x_1	Composition of solvent*	x_1
0	0.015 38	0.3073	0.028 64	0.6203	0.033 82
0.1381	0.022 26	0.371	0.030 04	0.8194	0.038 70
0.262	0.025 73	0.4087	0.030 00	1	0.037 79

*Mole fraction of vinyl acetate, x_3, in the solvent before dissolution of ethyne.

Auxiliary Information

Method/Apparatus/Procedure:
A modified Ostwald apparatus was used as described in Ref. 1.

Source and Purity of Materials:
(1) Bubbled through conc. H_2SO_4, over solid KOH and then active carbon. Absorbed in dimethylformamide at −10 to −15 °C, desorbed at +5 to +10 °C and then further dried over active carbon. Chromatographic analysis indicated a purity of 99.9%
(2) From *Lachema*, Brno. Frozen out three times and then fractionated in the presence of 2.5 mass % of CrO_3 and 2 mass % of acetic anhydride. Boiling point 118.1–118.2 °C; n_D^{20} =1.3719. Chromatographic analysis indicated a purity of 100%.
(3) From *Duslo* factory. Distilled, washed with water and dried with $CaCl_2$. Fractionated at barometric pressure. Sample boiling 72.5–72.7 °C collected. n_D^{20}=1.3956. Chromatographic analysis indicated a purity of 99.91 mass %. Impurities were acetaldehyde, acetone, and divinyl acetylene. The product was stabilized by addition of 0.3 mass % of diphenylamine and a small amount of hydroquinone.

Estimated Error:
No information.

References:
[1]J. Haspra and J. Paulech, Chem. Prum. **7**, 569 (1957).

Components:
(1) Ethyne; C_2H_2; [74-86-2]
(2) Vinyl acetate; $C_4H_6O_2$, (*acetic acid ethenyl ester*); [108-05-4]
(3) Acetic acid; $C_2H_4O_2$; [64-19-7]

Original Measurements:
A. Kaszonyi, M. Harustiak, and J. Kizlink, J. Chem. Eng. Data **37**, 37–38 (1992).

Variables:
T/K = 258.15–273.15; Mole fraction of vinyl acetate = 0.5.

Prepared By:
P. G. T. Fogg

Experimental Data
Mole fraction of vinyl acetate before dissolution of ethyne = 0.5.

t/°C	T/K	P_{total}/kPa	$x_1 \pm$ SD*
0	273.2	100.3	0.05±0.0004
		80	0.04±0.0005
		66.7	0.03±0.0005
		53.4	0.03±0.0004
		40	0.02±0.0003
		26.7	0.01±0.0002
−5	268.2	97.2	0.06±0.0009
		76.9	0.05±0.0005
		63.6	0.04±0.0008
		50.3	0.03±0.0004
		36.9	0.02±0.0002
		23.6	0.01±0.0003
−10	263.2	96.6	0.06±0.0008
		76.4	0.05±0.0009
		63	0.04±0.0009
		49.7	0.03±0.0008
		36.4	0.02±0.0006
		23	0.01±0.0006

T/K	H/kPa*	x_1 at p_1 = 101.3 kPa**
263.15	1470±27[a]	0.0689±0.0013
268.15	1562±27	0.0649±0.0011
273.15	1950±64	0.0520±0.0017

[a]95% confidence interval at all temperatures.
*Henry's constants, H, were calculated from the linear variation of x_1 with P_{total} and correspond to the equation $p_1 = x_1 H$.
**Estimated by the compiler.

Auxiliary Information

Method/Apparatus/Procedure:
The authors used a differential method similar to that described by Halmour and Sandall.[1] Measured additional volumes of solvent were brought into contact with gas in equilibrium with an initial volume of gas. The additional volumes of gas absorbed were measured. Liquid was agitated with a magnetic stirrer and maintained at constant temperature by circulation of cooling liquid between the double walls of the absorption vessel.

Source and Purity of Materials:
(1) A commercial 99% sample was purified by passing through concentrated sulfuric acid, solid sodium hydroxide and then activated carbon. Analysis by gas chromatography indicated trace quantities of 2-propanone, nitrogen and methane.
(2) Dried with $CaCl_2$ and the fraction boiling between 72.5 and 72.7 °C was separated by fractional distillation under nitrogen. The material was then stabilised by traces of hydroquinone (4 ppm) and degassed by boiling under reduced pressure before use. Purity 99.9% with traces of acetaldehyde, acetic acid and divinylacetylene.
(3) Heated for 1 h with acetic anhydride and CrO_3 slightly below boiling point. Fraction boiling between 118.1 and 118.2 °C separated by fractional distillation. Traces of acetic anhydride detected by gas chromatography.

Estimated Error:
$\delta T = \pm 0.1$; δx, δH see above (estimated by the authors).

References:
[1]N. Halmour and O. C. Sandall, Chem. Eng. Sci. **39**, 1791 (1984).

Components:
(1) Ethyne; C_2H_2; [74-86-2]
(2) Organic solvents

Original Measurements:
J. H. James, J. Ind. Eng. Chem. **5**, 115–120 (1913).

Variables:
T/K=263;
P/kPa=98.0–99.2

Prepared By:
P. G. T. Fogg

Experimental Data

P/mm Hg	P/kPa*	Absorption coefficient**	x_1†	x_1(1 atm)‡
Ethanal, (*acetaldehyde*); C_2H_4O; [75-07-0]				
744	99.2	60.2	0.1325	0.1756
Dimethoxymethane, (*methylal*); $C_3H_8O_2$; [109-87-5]				
735	98	54.3	0.1783	0.2019
1,1-Diethoxyethane, (*acetal*); $C_6H_{14}O_2$; [105-57-7]				
742	98.9	28.8	0.1559	0.1602
Formic acid, methyl ester, (*methyl formate*); $C_2H_4O_2$; [107-31-3]				
740	98.7	48.4	0.1186	0.1415
Formic acid, ethyl ester, (*ethyl formate*); $C_3H_6O_2$; [109-94-4]				
738	98.4	42.2	0.1333	0.1447
Formic acid, 3-methylbutyl ester, (*amyl formate*); $C_6H_{12}O_2$; [110-45-2]				
739	98.5	17.5	0.0938	0.0967
Acetic acid, methyl ester, (*methyl acetate*); $C_3H_6O_2$; [79-20-9]				
736	98.1	52.3	0.1578	0.1698
Acetic acid, ethyl ester, (*ethyl acetate*); $C_4H_8O_2$; [141-78-6]				
742	98.9	44.5	0.1642	0.1706
Acetic acid, 3-methylbutyl ester, (*amyl acetate*); $C_7H_{14}O_2$; [123-92-2]				
738	98.4	29.3	0.1094	0.1128

*Calculated by the compiler.
**Ratio of volume of gas absorbed, at stated temperature and pressure, to volume of solvent. The volume of gas was corrected to 273.15 K and 101.3 kPa.
†Calculated by the compiler using literature values of densities of solvents.
‡Calculated by the compiler using literature values of vapor pressures of solvents and assuming that the variation with partial pressure of the mole fraction of the gas approximates to Henry's law and the variation of vapor pressure of the solvent with composition approximates to Raoult's law.

Auxiliary Information

Method/Apparatus/Procedure:
The absorption apparatus consisted of a 5 in. test tube fitted with an inlet tube which cooled to between −18 and −19 °C in an ice and salt cooling mixture. Acetylene was bubbled through a measured quantity of solvent (about 1.5 cm^3) for about 12 min. Entrained and vaporized solvent was trapped and appropriate corrections made. The system was allowed to warm up to room temperature and then the liquid was boiled. The volume of acetylene evolved from −10 °C to boiling point was measured in a gas burette and assumed to correspond to gas in solution at −10 °C.

Source and Purity of Materials:
(1) Acetylene from calcium carbide was purified by passing through the following in succession: 10% H_2SO_4; 15% HCl solution saturated with mercuric chloride; bleaching powder+slaked lime; calcium chloride.
(2) No information.

Estimated Error:
Errors in excess of 10% may have occurred and results can only be considered as semiquantitative (compiler).

Components:
(1) Ethyne; C_2H_2; [74-86-2]
(2) Acetic acid, methyl ester, (*methyl acetate*); $C_3H_6O_2$; [79-20-9]

Original Measurements:
J. Horiuti, Sci. Pap. Inst. Phys. Chem. Res. (Jpn.) **17**, 125–256 (1931/1932).

Variables:
T/K=273.15–313.15;
p_1 /kPa: 101.325 (1 atm)

Prepared By:
M. E. Derrick and H. L. Clever

Experimental Data

T/K	Mol fraction x_1	Bunsen coefficient α/cm^3 (STP)cm^{-3} atm^{-1}	Ostwald coefficient L/cm^3 cm^{-3}
273.15	0.1159	38.04	38.04
278.15	0.1035	33.29	33.90
283.15	0.092 16	29.07	30.13
288.15	0.081 97	25.40	26.80
293.15	0.072 80	22.19	23.82
298.15	0.064 87	19.47	21.25
303.15	0.057 76	17.09	18.97
308.15	0.051 23	14.95	16.87
313.15	0.045 51	13.11	15.03

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.

$$\ln x_1 = 22.3540 - 24.8369/(T/100\ \mathrm{K}) - 15.3412 \ln(T/100\ \mathrm{K}).$$

The standard error about the regression line is 9.24×10^{-5}.

T/K	Mol. fraction x_1
273.15	0.1160
283.15	0.0921
288.15	0.0820
293.15	0.0729
298.15	0.0649
303.15	0.0577
313.15	0.0455

Auxiliary Information

Method/Apparatus/Procedure:
The apparatus consisted of a gas buret, a solvent reservoir, and an absorption pipet. The volume of the pipet was determined at various meniscus heights by weighing a quantity of water. The meniscus height was read with a cathetometer. The dry gas was introduced into the degassed solvent. The gas and solvent were mixed with a magnetic stirrer until saturation was achieved. Care was taken to prevent solvent vapor from mixing with the solute gas in the gas buret The volume of gas was determined from the gas buret readings. The volume of solvent was determined from the height of the meniscus in the absorption pipet.

Source and Purity of Materials:
(1) Ethyne. Prepared by the reaction of calcium carbide and water. The gas was passed through several wash solutions, dried, condensed by liquid air, and fractionated from liquid air several times.
(2) Methyl acetate. Merck. *Extra pure* grade. Dried with P_2O_5. Distilled several times. Boiling point (760 mm Hg) 57.12 °C.

Estimated Error:
$\delta T/K = 0.05$;
$\delta x_1/x_1 = 0.01$.

Components:

(1) Ethyne; C_2H_2; [74-86-2]
(2) γ-Butyrolactone; $C_4H_6O_2$; [96-48-0]
Ethyl acetoacetate; $C_6H_{10}O_3$; [141-97-9]
Diethyl oxalate; $C_6H_{10}O_4$; [95-92-1]
Ethyl acetate; $C_4H_8O_2$; [141-78-6]
4-Methyl-3-pentene-2-one, (*mesityl oxide*); $C_6H_{10}O$; [141-79-7]
1,4-Dioxane; $C_4H_8O_2$; [123-91-1]
Tetrahydrofuran; C_4H_8O; [109-99-9]
4-Methyl-2-pentanone-4-ol, (*diacetonealcohol*); $C_6H_{12}O_2$; [123-42-2]

Original Measurements:

P. Hölemann and R. Hasselmann, *Forschungsberichte des Wirtschafts- und Verkehrsministeriums Nord-Westfalen*, No. 109, Forschungsstelle für Acetylen (Westdeutscher Verlag, Köln-Opladen, Germany, 1954).

Variables:

T/K = 298;
p_1 /kPa = 0 – 2553

Prepared By:

P. G. T. Fogg

Experimental Data

Solvent	t/°C	T/K	p_1 /Torr*	p_1 /atm	p_1 /kPa**	Sol. coefficient***	x_1
Butyrolactone	25	298.15	730	0.96	97.3	14.9	0.0470
	25	298.15		7.8	788.1	13.7	0.2606
	25	298.15		15.5	1572.2	14.5	0.4266
	25	298.15		15.5	1572.2	14.6	0.4283
	25	298.15		20.3	2058.4	15.2	0.5052
	25	298.15		25.2	2552.8	16.0	0.5714
Ethyl acetoacetate	25	298.15	734	0.97	97.8	12.2	0.0575†
	25	298.15		5.8	591.6	12.3	0.2642
	25	298.15		5.8	591.6	12.3	0.2642
	25	298.15		10.7	1081.9	12.9	0.4078
	25	298.15		10.7	1081.9	13.0	0.4097
	25	298.15		15.5	1572.2	13.3	0.5078
	25	298.15		20.3	2058.4	13.7	0.5818
	25	298.15		25.2	2552.8	14.4	0.6446
Ethyl acetate	25	298.15	594	0.78	79.2	19.3	0.0613†
	25	298.15		5.8	591.6	19.2	0.2751
	25	298.15		10.7	1081.9	20	0.4196
Mesityloxide	25	298.15		1.0	0.0	15.4	0.0549
	25	298.15		5.8	591.6	15.3	0.2519
	25	298.15		10.7	1081.9	15.3	0.3811
Diacetonealcohol	25	298.15		1.0	101.3	10.6	0.0452
	25	298.15		5.8	591.6	9.6	0.2001
	25	298.15		10.7	1081.9	8.5	0.2882
1,4-Dioxane	25	298.15	609	0.80	81.2	16.6	0.0532†
Tetrahydrofuran	25	298.15	583	0.77	77.7	25.3	0.0655†
Diethyloxalate	25	298.15	602	0.79	80.2	10.9	0.0577†

*Maximum pressure of measurements in the case of measurements represented graphically.
**Calculated by compiler.
†Value for a partial pressure of 1 atm.
***The solubility coefficient was defined as mg(gas)/(g (solvent)× p_1 /atm)

In the case of butyrolactone the volume the liquid phase increased by 1.7 cm^3 per dm^3 of dissolved ethyne (reduced to 273.15 K and 101.3 kPa).

Auxiliary Information

Method/Apparatus/Procedure:

Ostwald type apparatus was used for measurements below 1 atm. The increase in volume of the liquid phase on dissolution of the gas could be measured. The apparatus is fully described in Ref. 1. Measurements were made from low pressures to the maximum values given above. Individual data points were published as plots of mg(gas)/g (solvent) against partial pressure. The points fell very close to straight lines through the origin. Values of the solubility coefficient equal to the slopes of the lines were tabulated by the authors. Mole fraction solubilities for a pressure of 1 atm are given above. A different apparatus was used for measurements at 1 atm and above. Ethyne at elevated pressure passed from a cylinder through a vessel containing a measured quantity of solvent. The passage of gas was controlled by inlet and outlet valves. The pressure over the solution was measured when the system had reached equilibrium with both valves closed. The dissolved ethyne was subsequently measured by allowing it to escape at lower pressure into standardised bulbs connected to a mercury manometer. The authors made allowance for the partial pressure of the solvent when the solubility coefficient was calculated. Full details of the apparatus were given by the authors.

Source and Purity of Materials:

Butyrolactone, and tetrahydrofuran were supplied by BASF. Other solvents were the purest obtainable. Solvents were purified by fractional distillation under reduced pressure. Density and vapor pressures were measured at 25 °C.

Solvent	Density/g cm^{-3} Measured	Density/g cm^{-3} Literature*	p_2^0/mm Hg
Ethyl acetate	0.8958	0.8943 (Ref. 2)	93.4
Ethyl acetoacetate	1.0248	1.0230 (Ref. 3)	10.5
Diethyl oxalate	1.0758	1.0725 (Ref. 3)	3.8
Butyrolactone	1.1261		3.2
Dioxane	1.0285		32.8
Tetrahydrofuran	0.885		167.2

*Quoted by authors.

Estimated Error:

Low pressure apparatus: δT/K = ± 0.05; δp_1 = ± 0.5 mm Hg high pressure apparatus: δT/K = ± 0.05; δp_1 = 0.05 kg cm^{-2} = 4.9 kPa (authors).

References:

[1]P. Hölemann and R. Hasselmann, *Forschungsberichte des Wirtschafts- und Verkehrsministeriums Nord-Westfalen*, No. 14, Forschungsstelle für Acetylen (Westdeutscher Verlag, Köln-Opladen, Germany, 1952).
[2]C. Smith and W. Walls, J. Am. Chem Soc. **53**, 529 (1931).
[3]P. Karrer, Lehrbuch der Organischen Chemie, Stuttgart, 1950, p. 305.

Components:
(1) Ethyne; C_2H_2; [74-86-2]
(2) 2-Methoxyethanol, (*ethylene glycol monmethyl ether*); $C_3H_8O_2$; [109-86-4]

Original Measurements:
E. Bodor, Gy. Bor, M. Maleczkine, G. Mesko, B. Mohai, and G. Siposs, Veszppremi Vegyip. Egyet. Kozlemen. **1**, 99–108 (1957).

Variables:
T/K = 198–318;
p_1 /kPa = 20.0–98.9

Prepared By:
C. L. Young

Experimental Data

T/K	p_1 /mm Hg	p_1 /kPa	α**	Mole fraction of acetylene in liquid, x_1*
318.2	150	20	1.42	0.00480
	397	52.9	3.93	0.0132
	533	71.1	5.25	0.0175
	649	86.5	6.43	0.0214
	−760	101.3	−7.5	0.0248
295.2	467	62.3	8.25	0.0272
	531	70.8	9.3	0.0306
	601	80.1	10.6	0.0347
	666	88.8	11.7	0.0382
	−760	101.3	−13	0.042
273.2	432	57.6	14.8	0.0478
	489	65.2	16.5	0.0531
	542	72.3	18.2	0.0582
	602	80.3	20	0.0636
	667	88.9	22.1	0.0698
	−760	101.3	−25	0.078
245.2	112	14.9	10.2	0.0335
	142	18.9	14.6	0.0472
	245	32.7	22.4	0.0707
	293	39.1	25.2	0.0788
	422	56.3	33.8	0.1029
	443	59.1	35.7	0.1081
	595	79.3	46.5	0.1364
	742	98.9	53.8	0.1544
245.2	−760	101.3	−60	0.169
223.2	208	27.7	65.8	0.1826
	339	45.2	84.5	0.2229
	350	46.7	76.6	0.2063
	488	65.1	105.8	0.2643
	507	67.6	99.8	0.2531
	611	81.5	119.1	0.2879
	634	84.5	122.8	0.2942
	742	98.9	134.7	0.3188
	742	98.9	135	0.3143
1982	−760	101.3	−140	0.322
	183	24.4	139	0.3206
	213	28.4	167.8	0.3629
	228	30.4	161.3	0.3539
	295	39.3	201.5	0.4062
	299	39.9	202	0.4068
	381	50.8	242	0.4510
	434	57.9	281	0.4882
	593	79.1	314.2	0.5162
	638	85.1	375	0.5601
	676	90.1	387	0.5678
	742	98.9	425	0.5907
	742	98.9	430	0.5935
	760	101.3	440	0.599

*Calculated by the compiler.
**(Vol. of gas, reduced to 101.3 kPa and 273.2 K)/cm^3 dissolved by 1 g of solvent.

Values in parentheses are extrapolated to 1 atm.

Auxiliary Information

Method/Apparatus/Procedure:
Volumetric method. Pressure measured when known amounts of gas were added, in increments, to a known amount of liquid in a vessel of known dimensions. Corrections were made for the partial pressure of solvent. Details in Ref. 1.

Source and Purity of Materials:
No information.

Estimated Error:
δT/K = ±0.1;
$\delta\alpha$ = ±4% or less.

References:
[1]E. Bodor, G. J. Bor, B. Mohai, and G. Siposs, Veszpremi, Vegyip. Egyet. Kozlemen. **1**, 55 (1957).

Components:
(1) Ethyne; C_2H_2; [74-86-2]
(2) Water; H_2O; [7732-18-5]
(3) Acetic acid, ethyl ester, (*ethyl acetate*); $C_4H_8O_2$; [141-78-6]

Original Measurements:
E. Bodor, Gy. Bor, M. Maleczkine, G. Mesko, B. Mohai, and G. Siposs, Veszppremi Vegyip. Egyet. Kozlemen. **1**, 77–87 (1959).

Variables:
T/K = 223–273;
p_1 /kPa = 20.3–101.3

Prepared By:
C. L. Young

Experimental Data

T/K	Mass % H_2O	p_1 /mm Hg	p_1 /kPa	α**	Mole fraction of C_2H_2 in liquid, x_1*
273	10	172	22.9	6.7	0.0186
		322	42.9	12.3	0.0336
		420	56.0	16.2	0.0438
		522	69.6	20.4	0.0546
		631	84.1	24.5	0.0648
		723	96.4	28.0	0.0734
		(760)	(101.3)	(30)	0.0780
223	5	152	20.3	46.4	0.1325
		246	32.8	70.6	0.1885
		406	54.1	105.0	0.2568
		516	68.8	133.7	0.3056
		624	83.2	156.1	0.3394
		729	97.2	173.0	0.3628
		(760)	(101.3)	(180)	0.3720
223	10	167	22.3	55.9	0.1366
		283	37.7	80.0	0.1846
		450	60.0	113.8	0.2436
		562	74.9	141.7	0.2862
		655	87.3	159.9	0.3116
		742	98.9	176.4	0.3330
		(760)	(101.3)	(180)	0.3380

*Calculated by compiler.
**(Vol. of gas, reduced to 101.3 kPa and 273.2 K)/cm^3 dissolved by 1 g of solvent.

Values in parentheses are extrapolated to 1 atm.

Auxiliary Information

Method/Apparatus/Procedure:
Volumetric method. Pressure measured when known amounts of gas were added, in increments, to a known amount of liquid in a vessel of known dimensions. Corrections were made for the partial pressure of solvent. Details in Ref. 1.

Source and Purity of Materials:
No information.

Estimated Error:
δT/K = ±0.1;
$\delta\alpha$ = ±4% or less.

References:
[1]E. Bodor, G. J. Bor, B. Mohai, and G. Siposs, Veszpremi, Vegyip. Egyet. Kozlemen. **1**, 55 (1957).

Components:
(1) Ethyne; C_2H_2; [74-86-2]
(2) Esters of hexanedioic acid (*adipic acid*)

Original Measurements:
G. N. Freidlin and V. I. Bushinskii, Zhur. Prikl. Khim. **40**, 2078–2082 (1967); J. Appl. Chem. U.S.S.R. **40**, 2006–2009 (1967).

Variables:
T/K = 293–2-323.2;
p/kPa = 6.7–53.3

Prepared By:
P. G. T. Fogg

Experimental Data

Solvent	T/K	p/mm Hg	p/kPa	x_1 Mole ratio	x_1 Mole fraction*
Hexanedioic acid, methyl ester, (*monomethyl adipate*); $C_7H_{12}O_4$	293.2	50.13	6.68	0.0059	0.0059
		93.07	12.41	0.0107	0.0106
		179	23.86	0.0201	0.0197
		265.03	35.33	0.0289	0.0281
		333.32	44.43	0.0349	0.0337
		389.15	51.88	0.0391	0.0376
		439.16	58.54	0.0452	0.0432
Hexanedioic acid, dimethyl ester (*dimethyl adipate*); $C_8H_{14}O_4$	293	37.35	4.98	0.0059	0.0059
		96.31	12.84	0.0130	0.0128
		203.24	27.09	0.0273	0.0266
		305.04	40.66	0.0397	0.0382
		387.7	51.68	0.0470	0.0449
		453.68	60.47	0.0556	0.0527

The above data were published in graphical form. The compiler obtained numerical values from the graphs by computer aided digitization. Other solubility data at a pressure of 400 mm Hg are given below. These were published in tabular form by the authors.

p_1 /mm Hg = 400 p_1 /kPa = 53.3

Solvent	t/°C	T/K	Mole ratio	Mole fraction, x_1
Hexanedioic acid, methyl ester (*monomethyl adipate*); $C_7H_{12}O_4$; [627-91-8]	20	293.15	0.0415	0.0398
	30	303.15	0.0320	0.0310
	40	313.15	0.0266	0.0259
	50	323.15	0.0207	0.0203
Hexanedioic acid, ethyl ester (*monoethyl adipate*); $C_8H_{14}O_4$; [626-86-8]	20	293.15	0.0402	0.0386
	30	303.15	0.0313	0.0304
	40	313.15	0.0256	0.0250
	50	323.15	0.0202	0.0198
Hexanedioic acid, propyl ester (*monopropyl adipate*); $C_9H_{16}O_4$	20	293.15	0.0393	0.0378
	30	303.15	0.0308	0.0299
	40	313.15	0.0250	0.0244
	50	323.15	0.0198	0.0194
Hexanedioic acid, butyl ester (*monobutyl adipate*); $C_{10}H_{18}O_4$; [7529-33-1]	20	293.15	0.0381	0.0367
	30	303.15	0.0296	0.0287
	40	313.15	0.0241	0.0235
	50	323.15	0.0192	0.0188
Hexanedioic acid, pentyl ester (*monoamyl adipate*); $C_{11}H_{20}O_4$	20	293.15	0.0370	0.0357
	30	303.15	0.0287	0.0279
	40	313.15	0.0232	0.0227
	50	323.15	0.0189	0.0185
Hexanedioic acid, hexyl ester (*monohexyl adipate*); $C_{12}H_{22}O_4$	20	293.15	0.0369	0.0356
	30	303.15	0.0285	0.0277
	40	313.15	0.0223	0.0218
	50	323.15	0.0180	0.0177
Hexanedioic acid, heptyl ester (*monoheptyl adipate*); $C_{13}H_{24}O_4$	20	293.15	0.0364	0.0351
	30	303.15	0.0279	0.0271
	40	313.15	0.0218	0.0213

	50	323.15	0.0170	0.0167
Hexanedioic acid, octyl ester	20	293.15	0.0358	0.0346
(*monooctyl adipate*); $C_{14}H_{26}O_4$	30	303.15	0.0270	0.0263
	40	313.15	0.0217	0.0212
	50	323.15	0.0159	0.0157
Hexanedioic acid, dimethyl ester	20	293.15	0.0537	0.0510
(*dimethyl adipate*); $C_8H_{14}O_4$;	30	303.15	0.0420	0.0403
[627-93-0]	40	313.15	0.0339	0.0328
	50	323.15	0.0272	0.0265
Hexanedioic acid, diethyl ester	20	293.15	0.0535	0.0508
(*diethyl adipate*); $C_{10}H_{18}O_4$;	30	303.15	0.0418	0.0401
[141-28-6]	40	313.15	0.0334	0.0323
	50	323.15	0.0267	0.0260
Hexanedioic acid, dipropyl ester	20	293.15	0.0530	0.0503
(*dipropyl adipate*); $C_{12}H_{22}O_4$;	30	303.15	0.0416	0.0399
[106-19-4]	40	313.15	0.0329	0.0319
	50	323.15	0.0262	0.0255
Hexanedioic acid, dibutyl ester	20	293.15	0.0508	0.0483
(*dibutyl adipate*); $C_{14}H_{26}O_4$;	30	303.15	0.0398	0.0383
[105-99-7]	40	313.15	0.0318	0.0308
	50	323.15	0.0257	0.0251
Hexanedioic acid, dipentyl	20	293.15	0.0488	0.0465
(*dimethyl adipate*); $C_{16}H_{30}O_4$;	30	303.15	0.0383	0.0369
[14027-78-2]	40	313.15	0.0302	0.0293
	50	323.15	0.0241	0.0235
Hexanedioic acid, dihexyl ester	20	293.15	0.0462	0.0442
(*dihexyl adipate*); $C_{18}H_{34}O_4$;	30	303.15	0.0358	0.0346
[110-33-8]	40	313.15	0.0288	0.0280
	50	323.15	0.0229	0.0224
Hexanedioic acid, diheptyl ester	20	293.15	0.0458	0.0438
(*diheptyl adipate*); $C_{20}H_{38}O_4$	30	303.15	0.0351	0.0339
	40	313.15	0.0282	0.0274
	50	323.15	0.0221	0.0216
Hexanedioic acid, dioctyl ester	20	293.15	0.0450	0.0431
(*dioctyl adipate*); $C_{22}H_{42}O_4$;	30	303.15	0.0347	0.0335
[123-79-5]	40	313.15	0.0279	0.0271
	50	323.15	0.0217	0.0212

Ester	d_4^{20}	n_D^{20}	Acid number		Ester number	
			Found	Calculated	Found	Calculated
Monomethyl adip.	1.1169*	1.4418	349.8	350.0	351.1	350.0
Monoethyl adip.	1.0669*		317.4	321.8	326.0	321.8
Monopropyl adip.	1.0465*	1.4415	299.3	297.8	285.6	297.8
Monobutyl adip.	1.0366	1.443	276.7	277.8	278.5	277.8
Monoamyl adip.	1.0216	1.445	260.0	259.2	258.0	259.2
Monohexyl adip.	1.0082	1.446	242.8	243.4	245.5	243.4
Monoheptyl adip.	0.9982	1.448	229.4	229.2	231.4	229.2
Monooctyl adip.	0.9847	1.450	216.9	217.0	218.2	217.0
Dimethyl adip.	1.0620	1.429	0	0	643.0	643.6
Diethyl adip.	1.0066	1.428	0	0	554.1	554.4
Dipropyl adip.	0.9810	1.432	0	0	486.2	486.9
Dibutyl adip.	0.9622	1.436	0	0	434.0	434.1
Diamyl adip.	0.9466	1.439	0	0	391.2	391.6
Dihexyl adip.	0.9350	1.440	0	0	356.0	356.6
Diheptyl adip.	0.9080	1.443	0	0	327.6	327.5
Dioctyl adip.	0.8950	1.445	0	0	302.8	302.7

*Density measured at 30 °C

The acid number is the number of milligrams of potassium hydroxide needed to neutralize 1 g of acid. The ester number is the number of milligrams of potassium hydroxide needed to saponify 1 g of ester.

Auxiliary Information

Method/Apparatus/Procedure:

A static method described in Ref. 1 was used. The absorption vessel was magnetically stirred and held in a thermostat bath.

Source and Purity of Materials:

(2) Carboxyl and ester groups estimated by titration (see below).

Estimated Error:

No information.

References:

[1]G. E. Braude, I. L. Leites, and I. V. Dedova, Khim. Prom. (**4**), 232 (1961).

Components:
(1) Ethyne; C_2H_2; [74-86-2]
(2) Dimethyl esters of dicarboxylic acids

Original Measurements:
G. N. Freidlin, V. E. Azen, and V. I. Bushinskii, Zh. Prikl. Khim. **40**, 1597–1601 (1967); J. Appl. Chem. USSR **40**, 1532–1535 (1967).

Variables:
T/K = 298.2;
p_1 /kPa = 101.3

Prepared By:
P. G. T. Fogg

Experimental Data

Bunsen coefficient α	x_1*	d_4^{20}	n_D^{20}	Boiling point/°C	Ester number[c] Found	Ester number[c] Calculated
Propanedioic acid, dimethyl ester, (*dimethyl malonate*); $C_5H_8O_4$; [108-59-8]						
16.21	0.0772	1.1544	1.4149[a]	181	848.4	848.4
Butanedioic acid, dimethyl ester, (*dimethyl succinate*); $C_6H_{10}O_4$; [106-65-0]						
14.12	0.0767	1.121[b]	1.4197[b]	195.2	768.1	767.1
Pentanedioic acid, dimethyl ester, (*dimethyl glutarate*); $C_7H_{12}O_4$; [1119-40-0]						
12.25	0.0753	1.0876	1.4246	95–96 (12 mm Hg)	700	700
Hexanedioic acid, dimethyl ester, (*dimethyl adipate*); $C_8H_{14}O_4$; [627-93-0]						
10.95	0.0749	1.063	1.4286	112 (10 mm Hg)	643	643.6
Heptanedioic acid, dimethyl ester, (*dimethyl pimelate*); $C_9H_{16}O_4$; [1732-08-7]						
9.71	0.0733	(1.0423)[c]	-	130–135 (17 mm Hg)	595.7	595.7
Octanedioic acid, dimethyl ester, (*dimethyl suberate*); $C_{10}H_{18}O_4$; [1732-09-8]						
8.51	0.0706	1.0217	1.4341	174–175 (13 mm Hg)	554.4	554.4
Nonanedioic acid, dimethyl ester, (*dimethyl azelate*); $C_{11}H_{20}O_4$; [1732-10-1]						
7.72	0.0695	1.0082	1.1446	140–144 (9 mm Hg)	518.5	518.51
Decanedioic acid, dimethyl ester, (*dimethyl sebacate*); $C_{12}H_{22}O_4$; [106-79-6]						
7.08	0.0693	0.9881[b]	1.4354[b]	175 (20 mm Hg)	486.9	486.9

*Calculated by the compiler from values of α. Mole ratio values given by the authors do not appear to be consistent with values of α.
[a]At 17 °C.
[b]At 18 °C.
[c]Number of milligrams of KOH needed to convert 1g of ester to methanol and potassium salt of the acid.

Auxiliary Information

Method/Apparatus/Procedure:
A static method[1] was used to measure solubilities at pressures to 400 mm Hg. The variation with pressure of gas of the ratio of the volume of gas (reduced to 273.15 K and 101.3 kPa) absorbed to that of solvent was close to linear over the pressure range studied. Solubilities at a pressure of 760 mm Hg were obtained by extrapolation.

Source and Purity of Materials:
(1) The acetylene was purified to remove oxygen, phosphine, and arsine.
(2) See the table above.

Estimated Error:
No information.

References:
[1]G. E. Braude, I. L. Leites, and I. V. Dedova, Khim. Prom. **4**, 232 (1961)

Components:
(1) Ethyne; C_2H_2; [74-86-2]
(2) Vinyl alkyl esters of dicarboxylic acids

Original Measurements:
V. I. Bushinskii and G. N. Freidlin, Zh. Prikl. Khim. **45**, 408–411 (1972); J. Appl. Chem. USSR **45**, 402–405 (1972).

Variables:
T/K = 293.2–323.2;
p_1 /kPa = 13.3–80.0

Prepared By:
P. G. T. Fogg

Experimental Data

t/°C	T/K*	p_1 /mm Hg	p_1 /kPa*	Solubility†	x_1	$H^{\ddagger}$	$-\beta^{\ddagger}$
Butanedioic acid, ethynyl methyl ester, (*vinyl methyl succinate*); $C_7H_{10}O_4$; [13038-41-0]							
20	293.15	100	13.3	2.7	0.0171	3.740	1.000
		300	40	7.3	0.0449		
		600	80	13.1	0.0779		
		760	101.3		0.0922*		
30	303.15	100	13.3	1.9	0.0122	3.870	1.010
		300	40	5.3	0.0334		
		600	80	9.8	0.0600		
		760	101.3		0.0737*		
40	313.15	100	13.3	1.5	0.0098	3.980	1.011
		300	40	4.3	0.0275		
		600	80	8.0	0.0500		
		760	101.3		0.0605*		
50	323.15	100	13.3	1.2	0.0079	4.100	0.461
		300	40	3.5	0.0227		
		600	80	6.5	0.0420		
		760	101.3		0.0540*		
Pentanedioic acid, ethenyl methyl ester, (*vinyl methyl glutarate*); $C_8H_{12}O_4$; [13038-37-4]							
20	293.15	100	13.3	2.3	0.0162	3.758	1.075
		300	40	6.4	0.0438		
		600	80	11.0	0.0731		
		760	101.3		0.0876*		
30	303.15	100	13.3	1.7	0.0120	3.890	0.937
		300	40	4.8	0.0336		
		600	80	8.8	0.0600		
		760	101.3		0.0724*		
40	313.15	100	13.3	1.3	0.0094	4.000	0.833
		300	40	3.8	0.0266		
		600	80	7.0	0.0478		
		760	101.3		0.0606*		
50	323.15	100	13.3	1.0	0.0073	4.108	0.641
		300	40	3.0	0.0217		
		600	80	5.9	0.0418		
		760	101.3		0.0512*		
Hexanedioic acid, ethenyl methyl ester, (*vinyl methyl adipate*); $C_9H_{14}O_4$; [2969-87-1]							
20	293.15	100	13.3	1.9	0.0150	3.780	0.937
		300	40	4.5	0.0423		
		600	80	9.8	0.0730		
		760	101.3		0.0878*		
30	303.15	100	13.3	1.4	0.0112	3.890	0.889
		300	40	4.1	0.0322		
		600	80	7.6	0.0581		
		760	101.3		0.0733*		
40	313.15	100	13.3	1.1	0.0090	4.000	0.895

		300	40	3.2	0.0256		
		600	80	6.2	0.0480		
		760	101.3		0.0598*		
50	323.15	100	13.3	0.8	0.0066	4.110	0.571
		300	40	2.6	0.0212		
		600	80	5.2	0.0414		
		760	101.3		0.0517*		
Hexanedioic acid, ethenyl ethyl ester, (*vinyl ethyl adipate*); $C_{10}H_{16}O_4$; [17223-10-8]							
20	293.15	100	13.3	1.6	0.0138	3.840	0.833
		300	40	4.6	0.0488**		
		600	80	8.4	0.0686		
		760	101.3		0.0814*		
30	303.15	100	13.3	1.2	0.0105	3.960	0.706
		300	40	3.5	0.0296		
		600	80	6.5	0.0543		
		760	101.3		0.0674*		
40	313.15	100	13.3	0.9	0.0080	4.060	0.571
		300	40	2.8	0.0242		
		600	80	5.3	0.0455		
		760	101.3		0.0572*		
50	323.15	100	13.3	0.7	0.0059	4.170	0.500
		300	40	2.2	0.0190		
		600	80	4.2	0.0365		
		760	101.3		0.0463*		
Hexanedioic acid, ethenyl propyl ester, (*vinyl propyl adipate*); $C_{11}H_{18}O_4$; [5135-75-1]							
20	293.15	100	13.3	1.3	0.0123	3.880	0.600
		300	40	3.9	0.0359		
		600	80	7.3	0.0652		
		760	101.3		0.0809*		
30	303.15	100	13.3	1.1	0.0105	3.990	0.482
		300	40	3.1	0.0290		
		600	80	5.9	0.0538		
		760	101.3		0.0673*		
40	313.15	100	13.3	0.8	0.0077	4.090	0.416
		300	40	2.4	0.0228		
		600	80	4.8	0.0447		
		760	101.3		0.0557*		
50	323.15	100	13.3	0.6	0.0059	4.200	0.352
		300	40	1.9	0.0184		
		600	80	3.7	0.0347		
		760	101.3		0.0447*		
Hexanedioic acid, butyl ethenyl ester,(*vinyl butyl adipate*); $C_{12}H_{20}O_4$; [2969-86-0]							
20	293.15	100	13.3	1.2	0.0122	3.890	0.500
		300	40	3.5	0.0349		
		600	80	6.7	0.0646		
		760	101.3		0.0817*		
30	303.15	100	13.3	0.9	0.0093	4.000	0.487
		300	40	2.8	0.0278		
		600	80	5.3	0.0523		
		760	101.3		0.0659*		
40	313.15	100	13.3	0.7	0.0073	4.100	0.290
		300	40	2.2	0.0226		
		600	80	4.3	0.0423		
		760	101.3		0.0561*		
50	323.15	100	13.3	0.5	0.0053	4.200	0.600
		300	40	1.6	0.0167		
		600	80	3.1	0.0319		
		760	101.3		0.0427*		
Heptanedioic acid, ethenyl methyl ester, (*vinyl methyl pimelate*); $C_{10}H_{16}O_4$; [13038-38-5]							
20	293.15	100	13.3	1.9	0.0159	3.790	1.000
		300	40	5.0	0.0419		
		600	80	9.0	0.0729		
		760	101.3		0.0848*		
30	303.15	100	13.3	1.4	0.0124	3.905	0.930
		300	40	3.7	0.0316		
		600	80	6.9	0.0574		
		760	101.3		0.0706*		
40	313.15	100	13.3	1.1	0.0098	4.010	0.800
		300	40	3.1	0.0271		
		600	80	5.7	0.0488		
		760	101.3		0.0599*		
50	323.15	100	13.3	0.7	0.0063	4.120	0.658
		300	40	2.4	0.0211		
		600	80	4.6	0.0398		
		760	101.3		0.0498*		
Nonanedioic acid, ethenyl methyl ester, (*vinyl methyl azelate*); $C_{12}H_{20}O_4$; [4795-19-1]							
20	293.15	100	13.3	1.5	0.0152	3.840	0.636
		300	40	4.1	0.0404		
		600	80	7.5	0.0724		
		760	101.3		0.0863*		
30	303.15	100	13.3	1.2	0.0122	3.960	0.421
		300	40	3.2	0.0319		
		600	80	6.0	0.0582		
		760	101.3		0.0727*		
40	313.15	100	13.3	0.9	0.0092	4.060	0.380
		300	40	2.5	0.0253		
		600	80	4.8	0.0474		
		760	101.3		0.0598*		
50	323.15	100	13.3	0.7	0.0073	4.170	0.318
		300	40	2.0	0.0205		
		600	80	3.8	0.0383		
		760	101.3		0.0480*		
Decanedioic acid, ethenyl methyl ester, (*vinyl methyl sebacate*); $C_{13}H_{22}O_4$; [4753-37-1]							
20	293.15	100	13.3	1.3	0.0140	3.850	0.317
		300	40	3.7	0.0388		
		600	80	7.0	0.0709		
		760	101.3		0.0942		
30	303.15	100	13.3	1.1	0.0119	3.960	0.317
		300	40	3.0	0.0319		
		600	80	5.7	0.0603		
		760	101.3		0.0750*		
40	313.15	100	13.3	0.9	0.0093	4.075	0.253
		300	40	2.3	0.0249		
		600	80	4.4	0.0465		
		760	101.3		0.0598*		
50	323.15	100	13.3	0.6	0.0064	4.180	0.000
		300	40	1.8	0.0197		
		600	80	3.7	0.0397		
		760	101.3		0.0502*		
Hexanedioic acid, ethenyl pentyl ester, (*vinyl amyl adipate*); $C_{13}H_{22}O_4$; [23039-00-1]							
20	293.15	100		1.2	0.0131	3.920	0.200
		300		3.4	0.0362		
		600		6.4	0.0661		
		760			0.0914*		

30	303.15	100	0.9	0.0099	4.020	0.250
		300	2.5	0.0271		
		600	4.9	0.0518		
		760		0.0673*		
40	313.15	100	0.7	0.0078	4.120	0.461
		300	1.9	0.0209		
		600	3.7	0.0400		
		760		0.0518*		
Hexanedioic acid, ethenyl hexyl ester, (*vinyl hexyl adipate*); $C_{14}H_{24}O_4$; [23039-01-2]						
20	293.15	100	1.1	0.0128	3.925	0.200
		300	3.1	0.0352		
		600	6.6	0.0660		
		760		0.0839*		
30	303.15	100	0.8	0.0094	4.030	0.238
		300	2.4	0.0284		
		600	4.8	0.0529		
		760		0.0661*		
40	313.15	100	0.6	0.0071	4.130	0.615
		300	1.8	0.0211		
		600	3.5	0.0402		
		760		0.0492*		

*Calculated by the compiler.
†Volume of gas, reduced to 273.15 K and 101.3 kPa, dissolved by 1 vol. of solvent.
‡Coefficients in the Krichevskii–Il'inskaya equation in the form

$$\log_{10}(p_1/x_1)=\log_{10} H-\beta(1-x_2^2).$$

x_1, x_2 = mole fractions of ethyne and ester, respectively; H = limiting value of Henry's constant at zero concentration.
**Recalculated by the compiler using the Krichevskii–Il'inskaya equation.

Auxiliary Information

Method/Apparatus/Procedure:
The authors used a static method described earlier.[1]

Source and Purity of Materials:
(2) Vinyl esters were prepared by the vinyl exchange method described in Ref. 2. These were purified by vacuum distillation through a laboratory column.

Estimated Error:
$\delta x/x=\pm 10\%$ (compiler).

References:
[1]G. N. Freidlin and V. I. Bushinskii, Zh. Prikl. Khim. **42**, 944 (1971).
[2]G. N. Freidlin, S. M. Zhenodarova, A. P. Chukur, and N. V. Fomina, Zh. Obshch. Khim. **32**, 738 (1962); **33**, 904 (1963).

3.8. Ethers and Glycols

Components:
(1) Ethyne; C_2H_2; [74-86-2]
(2) Ethers and Glycols

Evaluator:
Peter G. T. Fogg, University of North London, London, United Kingdom.

Critical Evaluation

Diethyl ether

Solubility in diethyl ether was measured by Mohai and Maleczkine[1] (198–248 K; 9.3–103 kPa) and by Usyukin and Shleinikov[2] (203–293 K, 101.3 kPa). There is poor agreement between these two sources. At 223 K values of mole fraction solubility at a partial pressure of 101.3 kPa are 0.349 (Ref. 1) and 0.398 and (Ref. 2). At 248 K the values are 0.161 (Ref. 1) and 0.231 (Ref. 2). It is not clear what allowances have been made for the vapor pressure of the solvent.

Other alkyl ethers

Ryutani[3] measured the solubility in dihexyl ether at 253–273 K and 395–1479 kPa (total pressure). Extrapolated values of mole fraction solubilities to 101.3 kPa using the Krichevsky–Il'inskaya equation do not give consistent results. The extrapolated value at 263 K is inconsistent with the values found by extrapolation of the data at 273 K and 253 K.

Trofimov *et al.*[4] published solubilities in dibutyl ether and in butylvinyl ether. At 273.2 K the mole fraction solubility at 101.3 kPa in this solvent is 0.643 which is close to the extrapolated value of 0.0668 for solubility in dihexyl ether from Ryutani's data. At 253.2 K the corresponding values are 0.1037 (dihexyl ether) and 0.0984 (dibutyl ether).

Measurements of the solubility in butylvinyl ether by Trofimov *et al.* show that replacement of one of the butyl groups in dibutyl ether by a vinyl group lowers the mole fraction solubility of ethyne.

The solubility in 4-Propenylanisole, (*phenyl methyl ether, -4-Propenyl*) ether was measured by Hamill and Vogt[14] at 288 K; 101.3 kPa. No other measurements are available for comparison.

Ryutani[3] measured the solubility in tetrahydrofurfurylmethyl ether at 253–283 K and 395–1277 kPa total pressure. The evaluator has extrapolated values of the mole fraction solubilities at 273.15 and 283.15 K to a pressure of 101.3 kPa using the Krichevsky–Il'inskaya equation. The corresponding mole fraction solubilities are 0.217 (273.15 K) and 0.120 (283.15 K). No other measurements on this system are available for comparison and data can only be accepted on a tentative basis.

Cyclic ethers

Solubility in tetrahydrofuran has been measured by Makitra *et al.*[5] (293 K; 99.2 kPa), Christian[6] (298 K; 101.3 kPa), Kiyama and Hiraoka[7] (273–303 K; 101–2452 kPa); Bodor *et al.*[8] (198–318 K; 17.3–98.8 kPa), Hölemann and Hasselmann[9] (298 K; 32–78 kPa). Mole fraction solubilities at a partial pressure of 101.3 kPa calculated from these sources, with the exclusion of Makitra *et al.*, can be fitted to the equations

$$\ln x_1=101.247-2587.32/(T/\mathrm{K})-16.7408\ \ln(T/\mathrm{K})$$

standard deviation in values of $x_1=6.46\times10^{-3}$.
This is valid in the range 198–303 K.

$$\ln x_1=-529.815+24399.1/(T/\mathrm{K})+78.1393\ \ln(T/\mathrm{K})$$

standard deviation in values of $x_1=1.67\times10^{-3}$.
This is valid in the range 273–298 K.

Solubility in 1, 4-dioxane were measured by Maillard and Rosenthal[10] (293.15 K; 101.3 kPa), Makitra *et al.*[11] (293.15 K; 97 kPa), Eck (293 K; 101.3 kPa), Sirlibaev *et al.*[12] (288–313 K; 203–1520 kPa), Narkhodzhaev *et al.*[13] (285–303 kPa; 17.5–91.6 kPa), Hamill and Vogt[14] (278, 283 K; 101.3 kPa), Hölemann and Hasselmann[9] (298 K, 81 kPa).

Mole fraction solubilities at 101.3 K from these sources fitted the equation

$$\ln x_1-296.678+15086.3/(T/\mathrm{K})+42.6588\ \ln(T/\mathrm{K})$$

standard deviation in values of $x_1=3.9\times10^{-3}$.
Valid in the temperature range 285–313 K.

Maillard and Rosenthal presented their measurements in the form of a small scale graph which were not used in deriving the above equation. Measurements by Eck were not used because it was unclear whether data had been corrected for the partial pressure of the solvent.

There is no reason to question the measurements over pressure ranges carried out by Sirlibaev[12] and Narkhodzhaev *et al.*[13] but no measurements by an independent group are available for comparison.

McKinnis[17] measured the solubility in 1,4-dioxane saturated with trioxane at 298 K. The presence of trioxane appears to lower the solubility of ethyne.

Maillard and Rosenthal measured solubilities in mixtures of 1,4-dioxane and water. Data were presented as small scale graphs and can only give a qualitative indication of a general trend.

Solubility in 4-methyl-1,3-dioxolane-2-one was measured by Bova *et al.*[15] (253–353 K; 13.3–101.3 kPa) and by Kodachenko[16] (298 K, 101.3 kPa). The one data point from Kodachenko is consistent with the data from Bova *et al.* Data from the two sources for mole fraction solubility at a partial pressure of 101.3 kPa fit the equation:

$$\ln x_1 = -25.7950 + 2636.45/(T/\mathrm{K}) + 2.36224 \ln(T/\mathrm{K})$$

standard deviation in values of $x_1 = 1.06\times10^{-3}$.

Valid for 253–353 K.

This equation may be accepted on a tentative basis.

Various authors have measured solubilities in other cyclic ethers with one or more oxygen atoms in the ring but measurements have not been confirmed by other workers. (See Table 3) It is apparent from the table that there is no clear relationship between the number of oxygen atoms in the ring and the solubility of ethyne.

TABLE 3. Solubility of ethyne in cyclic ethers at a partial pressure of 101.3 kPa and 298 K (except where noted)

Solvent	Formula	Reg. No	x_1	First author
Methylnaphthodioxane	$C_7H_{12}O_4$		0.0746	McKinnis
Ethylene oxide	C_2H_4O	75-21-8	0.0876	McKinnis
2-Methyl-2-methoxy-1-3-dioxolane	$C_5H_{10}O_3$		0.0579	McKinnis
2,2-Dimethyl-4-methoxy-1,3-dioxolane	$C_6H_{12}O_3$		0.0574	Kodachenko
4-Methyl-1,3-dioxolane-2-one	$C_4H_6O_3$		0.0304	See above
Tetrahydrofuran	C_4H_8O	109-99-9	0.0624	See above
2-Methyltetrahydrofuran	$C_5H_{10}O$	96-47-9	0.0560	Christian
2,5-Dimethyltetrahydrofuran	$C_6H_{12}O$		0.0490	Christian
1,4-Dioxane	$C_4H_8O_2$	123-91-1	0.0485	See above
1,3-Dioxolane	$C_3H_6O_2$	864 49	0.1130*	Lagarde
2,4,6-Trimethyl-1,3,5-trioxane	$C_6H_{12}O_3$	123-63-7	0.064**	Hamill

*288.15 K.
**283.15 K.

Glycols and alkoxy ethers

Ryutani[3] measured solubilities in the following alkoxy ethers
tetrahydrofurfuryl methyl ether; $C_6H_{12}O_2$
1,2-dimethoxyethane; $C_4H_{10}O_2$
2,2′-di-*n*-butoxydiethylether; $C_6H_{14}O_3$
2,2′-di-*t*-butoxydiethylether; $C_6H_{14}O_3$
2,2′-dimethoxydiethylether; $C_6H_{14}O_3$
1,1,3,3-tetramethoxypropane; $C_7H_{16}O_4$
triethyleneglycol dimethylether; $C_8H_{18}O_4$
tetraethyleneglycol dimethylether; $C_{10}H_{22}O_5$

Solubility in 2,2′-dimethoxydiether was measured from 253 to 293 K. Other measurements were in the range 253–283 K. All measurements were in the range 395–1277 kPa.

Measurements are more consistent the higher the pressure with smoother variation of mole fraction solubility with change of temperature. There is a general tendency for mole fraction solubility, at fixed temperature and pressure, to increase in the order tetrahydrofurfuryl methyl ether<1,2-dimethoxyethane<2,2′-dimethoxydiethylether<triethyleneglycol dimethylether<tetraethyleneglycol dimethylether. Solubility in 2,2′-di-*t*-butoxydiethylether tends to be greater than in 2,2′-di-*n*-butoxydiethylether but both tend to be close to that in 2,2′-dimethoxydiether.

The solubility in 1,1,3,3-tetramethoxypropane is low compared with that in other methoxy compounds which were studied, despite the presence of four oxygen atoms.

The general pattern of measurements by Ryutani can be accepted on a tentative basis but should be confirmed by other workers.

Makitra[5] measured the solubility in 2,2′-dimethoxydiether at 293 K, 97 kPa. The corresponding mole fraction solubility at 101.3 kPa is 0.121 compared with a value of 0.153 by extrapolation of Ryutani's data.

Solubility in various alkoxy compounds at 298 K and 101.3 kPa have been reported by McKinnis,[17] by James[21] (Table 4), and by Walker.[21]

TABLE 4. Solubility of ethyne in alkoxy compounds at a partial pressure of 101.3 kPa and 298 K (except where noted)

Solvent	Formula	Reg. No.	x_1	First author
Diethyl oxalate dimethyl acetal	$C_8H_{16}O_5$		0.0971	McKinnis
Glyoxal tetramethyl acetal	$C_6H_{14}O_4$		0.0876	McKinnis
Dimethoxymethane (*methylal*)	$C_3H_8O_2$	109-87-5	0.0812	McKinnis
			0.2019*	James
1,1-Diethoxyethane (*acetal*)	$C_4H_{14}O_2$	105-57-7	0.0713	McKinnis
			0.1602*	James
Orthoacetic acid, trimethyl ester	$C_5H_{12}O_3$	1445-45-0	0.0680	McKinnis
Orthoformic acid; triethylester (*triethoxymethane*)	$C_7H_{16}O_3$	122-51-0	0.0545	McKinnis
Orthoformic acid; trimethylester (*trimethoxymethane*)	$C_4H_{10}O_3$		0.0700	Walker

*263 K.

Solubility in ethanediol was measured by Makitra *et al.*[5] (293 K; 97.3 kPa), Hayduk and Miyano[18] (273–323 K; 101.3 kPa), Hannaert *et al.*[19] (303 K), Hölemann and Hasselmann[20] (298 K; 33–83 kPa). The value from Hannaert should be rejected. The data from Hayduk and Miyano fit the equation:

$$\ln x_1 = -11.2757 + 1897.2/(T/\mathrm{K})$$

standard deviation in values of $x = 0.0001$.

Valid for 273–323 K.

This equation gives a value of x_1 at 283.15 of 0.0082 which is close to the value of 0.0085 from Makitra's data. At 298.15 the equation gives a value of x_1 of 0.0074. The value from Hölemann's data is 0.0083. The value of 0.0050 from Hannaert's data should be rejected. The evaluator considers that the data from Hayduk are likely to be the most reliable.

Hannaert *et al.*[19] measured the solubility in triethylene glycol at 303.13 K. The mole fraction solubility at a partial pressure of 101.3 kPa from these data is 0.0258.

Hannaert *et al.* also reported solubilities at 293.15 K in Carbowax 200, 350, and 400. Carbowaxes are mixtures of polyethylene glycols. In these cases the average relative molecular masses of the three samples are 200, 350, and 400. The corresponding average mole fraction solubilities of ethyne are 0.063 (200), 0.112 (350), 0.133 (400) showing a linear increase in solubility with increase in the average number of ether links in the molecules of solvent.

Bodor *et al.*[8] measured the solubility of ethyne in 2-methoxyethanol at 198–318 K; 14.9–98.9 kPa. The mole fraction solubility at 298.15 K and 101.3 kPa estimated from these data is 0.0405. Bodor's measurements should be accepted on a tentative basis until they are confirmed by other workers.[21]

References:

[1]B. Mohai and M. Maleczkine, Veszpremi. Vegyip. Egyet. Kozlemen. **3**, 211–220 (1959).
[2]I. P. Usyukin and V. M. Shleinikov, Novosti Nefti Gaz Techn. Neftepererabotka Neftekhim. (**12**), 33–39 (1961).
[3]B. Ryutani, Nippon Kagaku Zasshi **81**, 1192–1201 (1960).
[4]B. A. Trofimov, V. A. Granzhan, V. B. Modonov, V. V. Kryuchkov, S. V. Amosova, and M. G. Voronkov, Izv. Sib. Otd. Akad. Nauk. SSSR ser. Khim. Nauk. (**2**), 107–112 (1979).
[5]R. G. Makitra, F. B. Moin, Ya. N. Pirig, and T. I. Politanskaya, Zh. Prikl. Khim. **53**, 1529–1531 (1980); J. Appl. Chem. USSR **53**, 1179–1181 (1980).
[6]J. D. Christian, Patent No. US2715100, 1955.
[7]R. Kiyama and H. Hiraoka, Rev. Phys. Chem. Jpn. **26**, 1–8 (1956).
[8]E. Bodor, Gy. Bor, M. Maleczkine, G. Mesko, B. Mohai, and G. Siposs, Veszppremi Vegyip. Egyet. Kozlemen. **1**, 89–98 (1957).
[9]P. Hölemann and R. Hasselmann, *Forschungsberichte des Wirtschafts- und Verkehrsministeriums Nord-Westfalen*, No. 14, Forschungsstelle für Acetylen (Westdeutscher Verlag, Köln-Opladen, Germany, 1952).
[10]A. Maillard and W. Rosenthal, Compt. Rend. **234**, 2546–2548 (1952).
[11]J. C. Eck, Report No. US2664997.
[12]T. S. Sirlibaev, E. F. Narkhodzhaev, and A. A. Yul'chibaev, Dokl. Akad. Nauk. Uzb. SSR **31** (7), 41–42 (1974).
[13]E. F. Narkhodzhaev, T. S. Sirlibaev, A. A. Yulchibaev, and Kh. U. Usmanov, Uzbek. Khim. Zh. **19(3)**, 19–20 (1975).
[14]W. H. Hamill and R. R. Vogt, U.S. Pat. 2405693, 1946.
[15]V. G. Bova, D. A. Kuznetsov, I. E. Furmer, and V. I. Sasov, Zh. Prikl. Khim. (Leningrad), **45** (2), 408–411 (1974).
[16]G. F. Kodachenko, Khim. Prom. (Moscow) **49** (2), 106–108 (1973); Sov. Chem. Ind. **49** (2), 92–95 (1973).
[17]A. C. McKinnis, Ind. Eng. Chem. **47** (4), 850–853 (1955).
[18]Y. Miyano and W. Hayduk, Can. J. Chem. Eng. **59**, 746–751 (1981).
[19]H. Hannaert, M. Haccuria, and M. P. Mathieu, Ind. Chim. Belge **32**, 156–164 (1967).
[20]J. H. James, J. Ind. Eng. Chem. **5**, 115–120 (1913).
[21]H. M. Walker, Patent No. US2666742, 1954.

Components:
(1) Ethyne; C_2H_2; [74-86-2]
(2) 1,1-Oxybisethane, (*diethyl ether*); $C_4H_{10}O$; [60-29-7]

Original Measurements:
B. Mohai and M. Maleczkine, Veszpremi. Vegyip. Egyet. Kozlemen **3**, 211–220 (1959).

Variables:
T/K = 198–248;
p_1 /kPa = 21–103

Prepared By:
C. L. Young

Experimental Data

T/K	p_1 /mm Hg	p_1 /kPa	α**	Mole fraction of C_2H_2 in liquid, x_1*
248.2	161	21.5	12.1	0.0385
	174	23.2	12.5	0.0397
	183	24.4	13.3	0.0421
	315	42.0	23.8	0.0730
	318	42.4	23.9	0.0732
	439	58.5	33.1	0.0987
	542	72.3	40.7	0.1189
	648	86.4	49.3	0.1402
	772	102.9	56.3	0.1570
	−760	101.3	−58	0.1609
223.2	129	17.2	38.4	0.1128
	172	22.9	45.7	0.1312
	298	39.7	69.5	0.1869
	441	58.8	101.2	0.2507
	574	76.5	123	0.2891
	611	81.5	135.3	0.3091
	687	91.6	144	0.3225
	765	102.0	162	0.3488
	−760	101.3	−162	0.3490
198±2	70	9.3	46.8	0.1340
	237	31.6	134.8	0.3083
	337	44.9	195	0.3920
	414	55.2	234	0.4362
	446	59.5	248	0.4506
	501	66.8	288	0.4878
	537	71.6	305	0.5021
	760	101.3	450	0.5980

*Calculated by the compiler.
**(Vol. of gas, reduced to 101.3 kPa and 273.2 K)/cm^3 dissolved by 1 g of solvent.

Values in parentheses are extrapolated to 1 atm.

Auxiliary Information

Method/Apparatus/Procedure:
Volumetric method. Pressure measured when known amounts of gas were added, in increments, to a known amount of liquid in a vessel of known dimensions. Corrections were made for the partial pressure of solvent. Details in Ref. 1.

Source and Purity of Materials:
No information.

Estimated Error:
δT/K = ±0.1;
$\delta\alpha$ = ±4% or less.

References:
E. Bodor, G. J. Bor, B. Mohai, and G. Siposs, Veszpremi, Vegyip. Egyet. Kozlemen. **1**, 55 (1957).

Components:
(1) Ethyne; C_2H_2; [74-86-2]
(2) Hexane, 1,1-oxybis (*dihexyl ether*); $C_{12}H_{26}O$; [112-58-3]

Original Measurements:
B. Ryutani, Nippon Kagaku Zasshi **81**, 1192–1201 (1960)

Variables:
T/K = 253.15–273.15;
P/kPa = 395–1479

Prepared By:
Sim-wan Annie Bligh and P. G. T. Fogg

Experimental Data

t/°C	T/K	P/atm	P/kPa*	S^a (cm^3 g^{-1})	x_1*	Density/g cm^{-3} Solvent	Density/g cm^{-3} Solution	ΔV^b /cm^3 g^{-1}
0	273.15	3.9	395	32.3	0.2135	0.8091	0.8016	0.059
		6.8	689	51.8	0.3034		0.7872	0.112
		9.7	983	84.6	0.4156		0.7822	0.17
		12.6	1277	111.7	0.4843		0.7659	0.241
		14.6	1479	138.7	0.5383		0.7585	0.297
−10	263.15	6.8	689	63.7	0.3487	0.817	0.7868	0.142
		9.7	983	103.3	0.4648		0.7726	0.227
		12.6	1277	163.6	0.579		0.757	0.351
−20	253.15	3.9	395	54.3	0.3134	0.8251	0.8125	0.097
		6.8	689	100.3	0.4575		0.7956	0.193
		9.7	983	175.2	0.5956		0.7804	0.333
		12.6	1277	325.2	0.7322		0.7457	0.641

*Calculated by the compiler.
[a]S is the volume/cm^3 of gas, corrected to 273.15 K and 101.3 kPa, dissolved by the weight/g of solvent.
[b]ΔV is the change in volume of the liquid due to dissolution of gas.

Auxiliary Information

Method/Apparatus/Procedure:
Absorption was measured by a static method. Densities of saturated solutions were measured by the balancing column method[1] in which saturated solution and mercury in one side of a U-tube were balanced against mercury in the other side of the U-tube with both sides of the tube subject to the same pressure of gas. Heights of liquid columns were measured by a traveling microscope

Source and Purity of Materials:
(1) Dried with silica gel; purity 99.5%–99.6%.
(2) Boiling point 99.2 °C (10 mm Hg) n_D^{20} 1.4217.

Estimated Error:
δT/K = ±0.1 (author).

References:
[1]Weissberger, *Technique of Organic Chemistry*, Vol. I, Physical Methods, Part I (Interscience, New York, 1949), p. 285.

Components:
(1) Ethyne; C_2H_2; [74-86-2]
(2) Compounds containing oxygen

Original Measurements:
G. F. Kodachenko, Khim. Prom. (Moscow) **49** (2), 106–108 (1973); Sov. Chem. Ind. **49** (2), 92–95 (1973).

Variables:
T/K = 298.15;
P/kPa = 101.3

Prepared By:
P. G. T. Fogg

Experimental Data

Solvent	Vol/Vol	x_1*
4-Methyl-1,3-dioxolane-2-one, (*propylene carbonate*); $C_4H_6O_3$; [108-32-7]	9.5	0.0324
2,2-Dimethyl-4-methoxy-1,3-dioxalane; $C_6H_{12}O_3$	11.9	0.0508
Ethylene diacetate; $C_6H_{10}O_4$	12	0.0634

*Calculated by the compiler. The compiler has assumed that vol/vol data are Ostwald coefficients not Bunsen coefficients.

Auxiliary Information

Method/Apparatus/Procedure:
Measurements were conducted at 298.15 K and 760 mm Hg using a chromatographic technique described earlier.[1]

Source and Purity of Materials:
(1) No information.
(2) 2,2-Dimethyl-4-oxymethyl-1,3-dioxal was prepared from glycerine and acetone.[2]

Estimated Error:
No information.

References:
[1]G. A. Kurkchi and A. V. Iogansen, *Gas Chromatography* (papers from The Second All-Union Conference). (Nauka, Moscow, 1964), p. 50.
[2]*Beilstein's Handbuch der Organischen Chemie* (Berlin, 1952), Vol. 19, p. 72.

Components:
(1) Ethyne; C_2H_2 ; [74-86-2]
(2) Butane, 1,1-oxybis (*dibutyl ether*); $C_8H_{18}O$; [142-96-1]
Butane, 1-(ethenyloxy)-, (*butylvinyl ether*) $C_6H_{12}O$; [111-34-2]

Original Measurements:
B. A. Trofimov, V. A. Granzhan, V. B. Modonov, V. V. Kryuchkov, S. V. Amosova, and M. G. Voronkov, Izv. Sib. Otd. Akad. Nauk. SSSR ser. Khim. Nauk. (**2**), 107–112 (1979).

Variables:
T/K = 273.2;
p_1 /kPa = 23–103

Prepared By:
P. G. T. Fogg

Experimental Data

Solvent	T/K	p_1 /mm Hg	p_1 /kPa	x_1
Dibutyl ether	273.2	225	30	0.013
		330	44	0.0207
		374	49.8	0.0242
		480	64.1	0.0335
		499	66.6	0.0354
		581	77.5	0.0444
		623	83	0.0491
		685	91.4	0.056
Butylvinylether	273.2	175	23.3	0.0098
		252	33.5	0.0145
		357	47.6	0.0213
		466	62.2	0.0282
		491	65.5	0.0298
		558	74.4	0.0342
		637	84.9	0.04
		704	93.9	0.0452
		774	103.1	0.0508

The authors published constants, H and A, for the equation:

$$\log_{10}\left\{\frac{p_1\ /\text{mm Hg}}{x_1}\right\} = \log_{10}(\text{H/mm Hg}) - Ax_1\ .$$

The constant, H, is the limiting value of Henry's constant. The compiler calculated values of x_1 at $p_1 = 101.3$ kPa from this equation. These are given below:

Solvent	t/°C	T/K	$\log_{10} H$	A	x_1 at $p_1 = 101.3$ kPa
Dibutylether	−30	243.15	3.798	0.252	0.1305
	−15	258.15	4.021	0.6519	0.0819
	0	273.15	4.228	2.4153	0.0643
Butylvinylether	−30	243.15	3.9471	0.7279	0.1018
	−15	258.15	4.127	0.9788	0.0658
	0	273.15	4.2538	1.4137	0.0498

Auxiliary Information

Method/Apparatus/Procedure:
The apparatus and method were similar to those described in previous publications.[1,2]

Source and Purity of Materials:
Solvents were tested by standard methods and were at least 99% pure.

Estimated Error:
No information.

References:
[1]G. E. Braude and S. F. Shakhova, Khim. Prom. (**3**), 177 (1961).
[2]V. A. Granzhan, O. G. Kirillova, and N. Z. Pin'kovskaya, Zh. Phys. Khim. **42**, 2381 (1969).

Components:
(1) Ethyne; C_2H_2; [74-86-2]
(2) Butane, 1-(ethenyloxy)-, (*butylvinyl ether, butoxyethene*); $C_6H_{12}O$; [111-34-2]

Original Measurements:
M. G. Voronkov, Zhur. Fiz,. Khim. **21**, 969–973 (1947).

Variables:
T/K = 273–353; Barometric pressure

Prepared By:
P. G. T. Fogg

Experimental Data

t/°C	T/K	Bunsen coefficient α	x_1
0	273.15	6.97	0.0393
10	283.15	6.49	0.0357
20	293.15	5.81	0.0325
30	303.15	4.94	0.0281
40	313.15	4.18	0.0242
60	333.15	3.42	0.0204
80	353.15	2.51	0.0154

Auxiliary Information

Method/Apparatus/Procedure:
Ethyne bubbled through the solvent at barometric pressure for 4 h. Samples of the solution were analyzed for dissolved ethyne. The method of analysis depended on conversion of the dissolved ethyne to copper acetylide, CuC_2, by reaction with ammoniacal copper sulphate solution containing hydroxylamine hydrochloride. The precipitated copper acetylide was washed and dissolved in nitric acid. The cupric nitrate was then reacted with plumbous nitrate and urea followed by potassium thiocyanate and potassium iodide. The liberated iodine was titrated with standard sodium thiosulphate solution. Full details are given in the paper.

Source and Purity of Materials:
(1) From a cylinder; purified by passing through solutions of KOH, $CuSO_4$,H_2CrO_4; dried with $CaCl_2$ and then P_2O_5.
(2) Washed with water, dried with $CaCl_2$, distilled, dried with sodium, and then double distilled. Boiling point 92.9–93.2 °C (744 mm Hg); n_D^{20} = 1.4028.

Estimated Error:
Titration 0.2%–0.3% (author).

Components:
(1) Ethyne; C_2H_2; [74-86-2]
(2) Tetrahydrofurfurylmethyl ether; $C_6H_{12}O_2$

Original Measurements:
B. Ryutani, Nippon Kagaku Zasshi **81**, 1192–1201 (1960)

Variables:
T/K = 253.15–283.15;
P/kPa = 395–1277

Prepared By:
Sim-wan Annie Bligh and P. G. T. Fogg

Experimental Data

t/°C	T/K	P/atm	P/kPa*	S^a (cm^3 g^{-1})	x_1*	Density/g cm^{-3} Solvent	Density/g cm^{-3} Solution	ΔV^b (cm^3 g^{-1})
10	283.15	3.9	395	84.8	0.3077	0.9751	0.9225	0.167
		6.8	689	138.9	0.4213		0.8937	0.276
		9.7	983	223.3	0.5392		0.8897	0.393
		12.6	1277	291.5	0.6044		0.8666	0.523
0	273.15	3.9	395	129.6	0.4045	0.9853	0.9368	0.215
		6.8	689	221.8	0.5375		0.9156	0.362
		9.7	983	299.4	0.6107		0.8827	0.516
		12.6	1277	376.1	0.6634		0.8477	0.685
−10	263.15	3.9	395	162.5	0.4599	0.9953	0.9253	0.282
		6.8	689	256.5	0.5734		0.8746	0.483
		9.7	983	361.2	0.6543		0.826	0.719
		12.6	1277	521.9	0.7323		0.766	1.101
−20	253.15	3.9	395	211.8	0.5261	1.0055	0.9222	0.36
		6.8	689	335.6	0.6375		0.8527	0.64
		9.7	983	560.6	0.7461		0.7953	1.09
		12.6	1277	1013.9	0.8416		0.7039	2.117

*Calculated by the compiler.
[a]S is the volume/cm^3 of gas, corrected to 273.15 K and 101.3 kPa, dissolved by the weight/g of solvent.
[b]ΔV is the change in volume of the liquid due to dissolution of gas.

Auxiliary Information

Method/Apparatus/Procedure:
Absorption was measured by a static method. Densities of saturated solutions were measured by the balancing column method[1] in which saturated solution and mercury in one side of a U-tube were balanced against mercury in the other side of the U-tube with both sides of the tube subject to the same pressure of gas. Heights of liquid columns were measured by a traveling microscope. Details are given in Ref. 2.

Source and Purity of Materials:
(1) Dried with silica gel; purity 99.5%–99.6%.
(2) Boiling point 140 °C (760 mm Hg) n_D^{20} 1.4296.

Estimated Error:
δT/K = ±0.1 (author).

References:
[1]Weissberger, *Technique of Organic Chemistry*, Vol. I, Physical Methods, Part I (Interscience, New York, 1949), p. 285.
[2]B. Ryutani, Nippon Kagaku Zasshi **80**, 1407 (1959).

Components:
(1) Ethyne; C_2H_2 ; [74-86-2]
(2) Organic compounds containing oxygen

Original Measurements:
US patents

Variables:
T/K = 298.15

Prepared By:
P. G. T. Fogg

Experimental Data

t/°C	T/K*	Bunsen coefficient	Ostwald coefficient	x_1*
Walker, H. M. US2666742, 1954				
Trimethylorthoformate; $C_4H_{10}O_3$				
25	298.15	15.12	16.50	0.070
Trimethylorthoacetate; $C_5H_{12}O_3$; [1445-45-0]				
25	298.15	13.78	15.04	0.073
Christian, J.D. US2715100, 1955				
2-Methyltetrahydrofuran; $C_5H_{10}O$; [96-47-9]				
25	298.15	12.96	14.15	0.056
2,5-Dimethyltetrahydrofuran; $C_6H_{12}O$				
25	298.15	9.52	10.39	0.049
Tetrahydrofuran; C_4H_8O; [109-99-9]				
25	298.15	17.98	19.63	0.062

*Calculated by the compiler.

Auxiliary Information

No information.

Components:
(1) Ethyne; C_2H_2 ; [74-86]
(2) Tetrahydrofuran; C_4H_8O; [109-99-9]

Original Measurements:
R. Kiyama and H. Hiraoka, Rev. Phys. Chem. Jpn **26**, 1–8 (1956).

Variables:
T/K = 273.15–303.15;
P/kPa = 101–2452

Prepared By:
P.G.T. Fogg

Experimental Data

	Total pressure		Solubility	
T/K	P/kg cm^{-2}	P/kPa	Vol/Vol*	x_1
273.15	5	490.3	145	0.341
	10	980.7	296	0.514
283.15	5	490.3	112	0.287
	10	980.7	217	0.439
	20	1961.3	617	0.691
293.15	5	490.3	82.1	0.231
	10	980.7	160	0.369
	15	1471	264	0.491
	20	1961.3	402	0.595
	25	2451.7	649	0.704
303.15	5	490.3	64.2	0.192
	10	980.7	129	0.323
	15	1471	207	0.433
	20	1961.3	307	0.532
	25	2451.7	429	0.613

*The solubility was recorded as the volume of gas, corrected to a partial pressure of 101.3 kPa and a temperature of 273.15 K, which was absorbed by 1 vol of solvent at the temperature and pressure of the experiment. The value at a pressure of 101.3 kPa was given as the Bunsen coefficient α.

T/K	p_1 /kPa	Bunsen coefficient α	Mole fraction solubility, x_1
278.15	101.3	30.1	0.0978
283.15	101.3	26	0.0861
288.15	101.3	22	0.0742
293.15	101.3	19.5	0.0667
298.15	101.3	17.3	0.06

The authors also gave the following equation for the mole fraction solubility of ethyne at a partial pressure of 1.013 kPa:

$$\log_{10} x_1 = -4.155 + 885.7/(T/\mathrm{k}).$$

The density, d, and the vapor pressure, p_2, of the tetrahydrofuran measured by an isoteniscope in the range 5–30 °C could be represented by the following equations:

$$d/g\ \mathrm{cm}^{-3} = 0.9079 - 9.93\times 10^{-4}(t/°\mathrm{C}) - 1.6\times 10^{-6}(t/°\mathrm{C})^2,$$

$$\log_{10}(p_2\ /\mathrm{mm\ Hg}) = \frac{-1.022\times 10^{-3}}{(t/°\mathrm{C})} + 5.635.$$

Components:
(1) Ethyne; C_2H_2 ; [74-86-2]
(2) Tetrahydrofuran; C_4H_8O; [109-99-9]

Original Measurements:
E. Bodor, Gy. Bor, M. Maleczkine, G. Mesko, B. Mohai, and G. Siposs, Veszppremi Vegyip. Egyet. Kozlemen. **1**, 89–98 (1957).

Variables:
T/K = 198–318;
p_1 /kPa = 17.3–98.8

Prepared By:
C. L. Young

Experimental Data

T/K	p_1 /mm Hg	p_1 /kPa	α**	Mole fraction of C_2H_2 in liquid, x_1*
318.2	130	17.3	2.32	0.00741
	161	21.5	3.16	0.0101
	222	29.6	4.53	0.0144
	223	29.7	4.02	0.0128
	297	39.6	5.38	0.0170
	300	40.0	6.75	0.0213
	330	44.0	6.08	0.0192
295.2	216	28.8	7.54	0.0237
	222	29.6	6.78	0.0216
	295	39.3	10.3	0.0321
	306	40.8	9.7	0.0303
	368	49.1	12.7	0.0393
	392	52.3	12.3	0.0381
	447	59.6	15.2	0.0466
	495	66.0	15.5	0.0475
	532	70.9	18	0.0547
	598	79.7	18.4	0.0559
273.2	329	43.9	20.2	0.0610
	341	45.5	20.4	0.0616
	383	51.1	23.3	0.0697
	404	53.9	24	0.0717
	454	60.5	26.7	0.0791
	471	62.8	28	0.0826
	531	70.8	30.6	0.0896
	575	76.7	33	0.0960
	610	81.3	34.6	0.1001
	652	86.9	36.6	0.1053
	697	92.9	38.8	0.1110
	701	93.5	38.8	0.1110
	−760	−101.3	−42	0.1190
248.2	174	23.2	30.1	0.0883
	260	34.7	39.4	0.1125
	348	46.4	51.5	0.1422
	480	64.0	65.8	0.1747
	528	70.4	69.6	0.1830
	617	82.3	80.1	0.2049
	724	96.5	86.9	0.2185
	730	97.3	89.6	0.2238
	−760	−101.3	−95	0.2340
223.2	139	18.5	75.1	0.1946
	170	22.7	83.2	0.2112
	305	40.7	121.2	0.2806
	368	49.1	127.7	0.2912
	431	57.5	152.2	0.3287

Auxiliary Information

Method/Apparatus/Procedure:
An Ostwald type apparatus was used for measurement at atmospheric pressure. Measurements at higher pressures were conducted by bubbling the gas into the solvent contained in a pressure vessel. The equilibrium total pressure was measured with a Bourbon type gauge. A sample was then transferred into an analyzer consisting of two connected burettes. The ratio of volume of gas to volume of solvent was measured at prevailing barometric pressure and temperature. The volume of gas was then adjusted to a partial pressure of 101.3 kPa and temperature of 273.15 K with appropriate allowance for the partial pressure of solvent (see Ref. 1).

Source and Purity of Materials:
(1) Ethyne prepared from calcium carbide and water had purity of 99.5%–99.6%.
(2) Tetrahydrofuran refluxed with metallic sodium for several hours and then fractionated. Boiling point 66.1–66.3 °C (760 mm Hg). Vapor pressure and density given above.

Estimated Error:
No information.

References:
[1]H. Hiraoka, Rev. Phys. Chem. Jpn. **24**, 13 (1954).

	527	70.3	171.2	0.3552
	535	71.3	174.1	0.3591
	633	84.4	196.8	0.3877
	732	97.6	219.7	0.4142
	739	98.5	216.5	0.4106
	−760	101.3	−230	0.4253
198±2	183	24.4	223.6	0.4184
	262	34.9	240.2	0.4359
	263	35.1	265.2	0.4604
	331	44.1	296.2	0.4880
	417	55.6	354.3	0.5327
	427	56.9	367	0.5415
	505	67.3	425	0.5776
	531	70.8	449	0.5910
	587	78.3	523	0.6373
	616	82.1	529	0.6299
	741	98.8	673	0.6841
	−760	101.3	−700	0.6925

*Calculated by the compiler.
**(Vol. of gas, reduced to 101.3 kPa and 273.2 K)/cm^3 dissolved by 1 g of solvent.
Values in parentheses are extrapolated to 1 atm.

Auxiliary Information

Method/Apparatus/Procedure:
Volumetric method. Pressure measured when known amounts of gas were added, in increments, to a known amount of liquid in a vessel of known dimensions. Corrections were made for the partial pressure of solvent. Details in Ref. 1.

Source and Purity of Materials:
No information.

Estimated Error:
δT/K = ±0.1;
$\delta\alpha$ = ±4% or less.

References:
[1]E. Bodor, G. J. Bor, B. Mohai, and G. Siposs, Veszpremi, Vegyip. Egyet. Kozlemen. **1**, 55 (1957).

Components:
(1) Ethyne; C_2H_2 ; [74-86-2]
(2) Organic solvents containing oxygen

Original Measurements:
W. H. Hamill and R. R. Vogt, U.S. Patent 2405693, 1946.

Variables:
T/K = 273–293

Prepared By:
P. G. T. Fogg

Experimental Data

Number of vols of gas per 100 vols. of solvent	t/°C	T/K*	Bunsen coefficient*	Ostwald coefficient*	x_1*
2,5-Pyrrolidinedione, 1-ethyl, (*ethyl succinimide*); $C_6H_9NO_2$; [2314-78-5]					
1500	15	288.15	14.2	15	
1,3-Dioxolane-2-one, (*1,2-ethanediol carbonate*); $C_3H_4O_3$; [96-49-1]					
800	20	293.15	7.45	8	
1,4-Dioxane; $C_4H_8O_2$; [123-91-1]					
3000	5	278.15	29.46	30	0.1
2400	10	283.15	23.15	24	0.081
2,5-Hexanedione, (*acetonylacetone*); $C_6H_{10}O_2$; [110-13-4]					
2400	5	278.15	23.57	24	0.109
4-Propenylanisole, (*anethole; phenyl methyl ether,-4-Propenyl*); $C_{10}H_{12}O$					
1200	15	288.15	11.38	12	0.071
4-Morpholine carboxaldehyde (*carbomethoxymorpholine, 4-formylmorpholine*); [4394-85-8]					
2400	0	273.15	24	24	
1,3,5-Trioxane, 2,4,6-trimethyl-, (*paraldehyde*); $C_6H_{12}O_3$; [123-63-7]					
1200	10	283.15	11.58	12	0.064

*Calculated by the compiler.

Auxiliary Information

No information.

Components:
(1) Ethyne; C_2H_2 ; [74-86-2]
(2) *N,N*-Dimethylformamide; C_3H_7NO; [68-12-2]
(2) Propanone (*acetone*); C_3H_6O; [67-64-1]; 1,4-Dioxane; $C_4H_8O_2$; [123-91-1]
(3) (Dioxane); Water; H_2O; [7732-18-5]

Original Measurements:
A. Maillard and W. Rosenthal, Compt. Rend. **234**, 2546–2548 (1952).

Variables:
T/K=293.15;
p_1 /kPa=1.0134

Prepared By:
P. G. T. Fogg

Experimental Data

Solvents	Mass % component 3	Ostwald	Density/g cm^{-3}	x_1[a]
DMF–dioxane	0.0	35.88	0.952	0.1038
	25.4	32.05	0.971	0.0959
	50.2	27.29	0.992	0.0846
	75.3	23.68	1.012	0.0762
	100.0	19.04	1.032	0.0640
DMF–water	0.0	35.88	0.952	0.1038
	10.2	18.63	0.968	0.0432
	25.2	9.78	0.979	0.0171
	50.4	2.82	0.990	0.0034
	75.3	0.84	0.996	0.0008
	100.0	0.69	1.000	0.0005
Acetone–water	0.0	24.00	0.786	0.0694
	9.9	16.67	0.807	0.0397
	25.6	11.04	0.840	0.0200
	50.4	5.02	0.894	0.0064
	75.3	1.76	0.947	0.0017
	100.0	0.69	0.998	0.0005
Dioxane–water	0.0	18.46	1.032	0.0622
	9.9	14.83	1.028	0.0371
	25.4	8.97	1.024	0.0161
	50.4	2.82	1.016	0.0035
	75.3	0.84	1.008	0.0008
	100.0	0.69	1.000	0.0005

[a]Calculated by the compiler.

Auxiliary Information

Method/Apparatus/Procedure:
The authors stated that equilibrium pressures were measured as a function of composition and that temperature was controlled by a thermostat. No other details were given. Data were presented in the form of small scale graphs (4.5×5.0 cm or less). The compiler obtained data from the graphs by use of a scanner and digitizing program.

Source and Purity of Materials:
No information.

Estimated Error:
No information.

Components:
(1) Ethyne; C_2H_2 ; [74-86-2]
(2) Various solvents

Original Measurements:
H. Lagarde and J. Cambon, Soud. Tech. Conn. **9**, 7–11 (1955).

Variables:
T/K=288.15 K;
p_1 /kPa=1363–1513

Prepared By:
P. G. T. Fogg

Experimental Data
T=288.15 K

p_1 /kg cm^{-2}	p_1 /kPa*	Solubility○ V_{gas}/V_{solv}	Mole fraction* x_1	$\Delta_{mass}/\Delta_{vol}$‡
Dimethyldioxane; $C_6H_{12}O_2$				
15.38	1508	16.75	0.599	0.551
1,4-Dioxane; $C_4H_8O_2$; [123-91-1]				
13.9	1363	21.9	0.545	0.57
Methyloxazolidone				
14.6	1432	16.3		
Ethyldiglycol				
15.34	1504	10.75	0.423	0.591
Tetrahydrofurfuryl acetate; $C_7H_{12}O_2$				
15.43	1513	16.3	0.592	0.57
Ethyleneglycol sulfite; $C_2H_4O_3S$				
15.29	1499	11.8	0.388	0.248
γ-Butyrolactone; $C_4H_6O_2$; [96-48-0]				
14.84	1455	17.25	0.481	0.612

*Calculated by the compiler.
○Volume of gas, measured at 101.3 kPa and 288.15 K, dissolved by 1 vol of pure solvent at 288.15 K and the partial pressure of acetylene specified.
‡Mass of dissolved gas divided by the increase in volume of the liquid.

Auxiliary Information

Method/Apparatus/Procedure:
The apparatus consisted of a light alloy cylinder fitted with a narrow bore glass gauge to measure the height of liquid and also a pressure gauge. A measured quantity of solvent was introduced followed by ethyne. The weight of gas introduced was found from the increase in weight of the cylinder and contents. The cylinder and contents were held in a thermostat bath. When equilibrium was attained the final pressure was recorded. The height of liquid in the glass gauge was measured with a cathetometer to determine the increase in volume of the liquid phase.

Source and Purity of Materials:
(1) Purified by distillation; less than 0.05% of impurities.
(2) Pure industrial solvent; gaseous impurities removed under vacuum.

Estimated Error:
δT/K=±0.002 (authors).

Components:
(1) Ethyne; C_2H_2; [74-86-2]
(2) 1,4-Dioxane; $C_4H_8O_2$; [123-91-1]

Original Measurements:
T. S. Sirlibaev, E. F. Narkhodzhaev, and A. A. Yul'chibaev, Dokl. Akad. Nauk. Uzb. SSR **31** (7), 41–42 (1974).

Variables:
T/K = 288.15–313.15;
P/kPa = 202.6–1519.6

Prepared By:
P. G. T. Fogg

Experimental Data

t/°C	T/K	P/atm	P/kPa	S*	x_1
15	288.15	2	202.6	32.3	0.112
		5	506.6	90.7	0.263
		8	810.6	146.1	0.365
		10	1013.2	176.2	0.412
		12	1215.9	225.2	0.47
		15	1519.9	312.4	0.553
20	293.15	2	202.6	29.1	0.105
		5	506.6	84.6	0.242
		8	810.6	135.3	0.343
		10	1013.2	163.3	0.389
		12	1215.9	215.2	0.458
		15	1519.9	283.4	0.525
30	303.15	2	202.6	22	0.079
		5	506.6	61.1	0.194
		8	810.6	109.2	0.301
		10	1013.2	140.1	0.352
		12	1215.9	182	0.417
		15	1519.9	243.7	0.498
40	313.15	2	202.6	17.7	0.065
		5	506.6	47.1	0.158
		8	810.6	88.7	0.26
		10	1013.2	118.2	0.318
		12	1215.9	140.1	0.394
		15	1519.9	207	0.447

*S = vol. of C_2H_2 (STP)/cm^3 dissolved by 1 g of solvent (Kuenen coefficient).

Auxiliary Information

Method/Apparatus/Procedure:
The authors measured solubilities by methods described in Ref. 1.

Source and Purity of Materials:
No information.

Estimated Error:
No information.

References:
[1]E. R. Shenderei and F. P. Ivanovskii, Gazovaya Promishlennost 33 (1962).

Components:
(1) Ethyne; C_2H_2; [74-86-2]
(2) 1,4-Dioxane (*p-dioxane*); $C_4H_8O_2$; [123-91-1]

Original Measurements:
E. F. Narkhodzhaev, T.S. Sirlibaev, A. A. Yulchibaev, and Kh. U. Usmanov, Uzbek. Khim. Zh. **19**(3), 19–20 (1975).

Variables:
T/K = 285–303;
p_1 /kPa = 17.5–91.6

Prepared By:
A. Skrzecz and P. G. T. Fogg

Experimental Data

t/°C	T/K	p_1 /Torr	p_1 /kPa*	x_1	Solubility† α
12	285.1	131	17.5	0.010	2.78
		255	34	0.023	6.08
		400	53.3	0.035	9.29
		510	68	0.044	11.92
		604	80.5	0.052	14.14
		664	88.5	0.057	15.56
20	293.1	171	22.8	0.012	2.85
		277	36.9	0.019	5.07
		440	58.7	0.030	8.05
		575	76.7	0.039	10.5
		661	88.1	0.045	12.2
30	303.1	163	21.7	0.006	1.79
		297	39.6	0.016	4.16
		457	60.9	0.026	6.94
		594	79.2	0.034	8.99
		687	91.6	0.038	10.27

*Calculated by the compiler
†Volume of gas, corrected to 273.15 K and 101.3 kPa, dissolved by unit volume of solvent.

Auxiliary Information

Method/Apparatus/Procedure:
A static method was used. Apparatus was connected to a vacuum line. The absorption coefficient, α, was obtained from experimental data. The method and calculation procedures, were described in Ref. 1. No more details were reported in the paper.

Source and Purity of Materials:
No information.

Estimated Error:
No information.

References:
[1]G. E. Braude and S. F. Shakhova, Khim. Prom-st (**3**), 177 (1961).

Components:
(1) Ethyne; C_2H_2; [74-86-2]
(2) Various solvents

Original Measurements:
A. C. McKinnis, Ind. Eng. Chem. **47**(4), 850–853 (1955).

Variables:
p_1 /kPa=101.3;
T/K=298

Prepared By:
P. G. T. Fogg

Experimental Data

Solvent	V_1/V_2	m_1/m_2	x_1
Phosphoric triamide, hexamethyl; (*hexamethylphosphoramide*); $C_6H_{12}N_3OP$; [680-31-9]			
	43	8.8	0.253
Sulfinylbismethane, (*dimethylsulfoxide*); C_2H_6OS; [67-68-5]			
	32.0*	3.1	0.106
Tetramethylenesulfoxide; C_4H_8OS			
	30.7*	3	0.103
Acetylpyrrolidine; $C_6H_{11}NO$			
	24.2*	2.9	0.1
Tritetramethylenephosphoramide $C_{12}H_{24}N_3O$			
	22.3	6.4	0.197
Methylnaphthodixane; $C_7H_{12}O_4$	22	2.1	0.075
Phosphorous acid, trimethyl ester, (*trimethyl phosphite*); $C_3H_9O_3P$; [121-45-9]			
	19	2.6	0.091
Phosphorodiamidic fluoride, tetramethyl-, (*tetramethyldiamidophosphonyl fluoride*); $C_4H_{12}FN_2O$; [115-26-4]			
	19	2.7	0.094
Formylpyrrolidine; C_5H_9NO	16.8*	1.83	0.066
Ethylene oxide; C_2H_4O; [75-21-8]	14.2	0.8	0.03
Glyoxal tetramethyl acetal; $C_6H_{14}O_4$	14.2	2.5	0.088
Diethyl oxalate dimethyl acetal; $C_8H_{16}O_5$	14	2.8	0.097
Orthoacetic acid, trimethyl ester, (*methyl orthoacetate*); $C_5H_{12}O_3$; [1445-45-0]			
	13.6	1.9	0.068
Phosphorotrithionic acid, *S,S,S*-trimethyl ester, (*trimethylmercaptophosphate*); $C_3H_9OPS_3$; [681-71-0]			
	13	2.1	0.075
2-Methyl-2-methoxy-1,3-dioxolane; $C_5H_{10}O_3$; [1004-17-8]			
	13	1.6	0.058
Boric acid, trimethyl ester, (*trimethyl borate*); $C_3H_9BO_3$; [121-43-7]			
	12	1.6	0.058
1-Nitrosopyrrolidine, (*N*-nitrosopyrrolidine); $C_4H_8N_2O$; [930-55-2]			
	11	1.16	0.043
Acetic acid, methylene diester, (*methanediol diacetate*); $C_5H_8O_4$			
	8.8	1.2	0.044
Ethyl perfluorobutyrate; $C_6H_5F_7O_2$	8.5	1.2	0.044
Dioxane saturated with trioxane $C_4H_8O_2$	8.1	0.8	0.03
Orthoformic acid, triethyl ester, (*ethyl orthoformate, triethoxy methane*); $C_7H_{16}O_3$; [122-51-0]			
	7.7	1.5	0.054
Dimethyldisulfide; $C_2H_6S_2$	3.8	0.44	0.017

*Stated by the author to have been measured by Don Anderson.

Auxiliary Information

Method/Apparatus/Procedure:
When solvents had low vapor pressures at 298.15 K, solubilities were measured by bubbling ethyne through a weighed amount of solvent until either the weight of solution was constant or the weight loss per volume of ethyne passed through was constant. When solvents were volatile measured volumes were put in contact with a measured volume of gas at barometric pressure in a gas buret cooled in an ice bath. The solvent was stirred with a magnetic stirrer until no further gas dissolved. The apparatus was then allowed to warm to room temperature with constant stirring. The new volume of gas in contact with the solution was then recorded and the quantity of gas in solution calculated. In each case the weight of gas which was dissolved was corrected to 101.3 kPa on the assumption that this weight was proportional to the partial pressure of the gas. There is no mention of temperature control and it is likely that solubilities were corrected to 25 °C by the following formula:
$\log_{10} V' = \log_{10} V + 0.0113(T/\mathrm{K} - 298)$, where V' is the volume of gas absorbed at 298 K and V' is the volume absorbed at T. The author used this formula to correct measurements which had been reported by other workers.

Source and Purity of Materials:
(1) Washed with water, dried over calcium chloride, and passed through a bed of activated charcoal.
(2) No information.

Estimated Error:
No information.

Components:
(1) Ethyne; C_2H_2; [74-86-2]
(2) 4-Methyl-1,3-dioxolane-2-one, (*propylene carbonate*); $C_4H_6O_3$; [108-32-7]

Original Measurements:
V. G. Bova, D. A. Kuznetsov, I. E. Furmer, and V. I. Sasov, Zh. Prikl. Khim. (Leningrad), **45** (2), 408–411 (1974).

Variables:
T/K = 253.1–353.1;
p_1 /kPa = 13.3–101.3

Prepared By:
P. G. T. Fogg

Experimental Data

					Henry's constant, H			
				Mole fraction	Authors' values		Recalculated*	
t/°C	T/K	p_1 /mm Hg	p_1 /kPa	x_1	/mm Hg	/kPa	/mm Hg	/kPa
−20	253.1	100	13.3	0.0150	6300	839.9	6542	872.2
		200	26.7	0.0293				
		300	40	0.0423				
		400	53.3	0.0564				
		500	66.7	0.0690				
		600	80	0.0812				
		760	101.3	0.1001**				
0	273.1	100	13.3	0.0080	12670	1689.2	12253	1633.6
		200	26.7	0.0154				
		300	40	0.0227				
		400	53.3	0.0297				
		500	66.7	0.0363				
		600	80	0.0427				
		760	101.3	0.0799**				
20	293.1	100	13.3	0.0044	22200	2959.8	22727	3030
		200	26.7	0.0088				
		300	40	0.0132				
		400	53.3	0.0176				
		500	66.7	0.0220				
		600	80	0.0264				
		760	101.3	0.0334**				
40	313.1	100	13.3	0.0029	34600	4613	34533	4604
		200	26.7	0.0058				
		300	40	0.0087				
		400	53.3	0.0115				
		500	66.7	0.0145				
		600	80	0.0174				
		760	101.3	0.0220**				
60	333.1	100	13.3	0.0020	50100	6679.5	50000	6666.1
		200	26.7	0.0040				
		300	40	0.0060				
		400	53.3	0.0080				
		500	66.7	0.0100				
		600	80	0.0120				
		760	101.3	0.0152				
80	353.1	100	13.3	0.0015	64200	8559.3	65354	8713.2
		200	26.7	0.0031				
		300	40	0.0046				
		400	53.3	0.0061				
		500	66.7	0.0077				
		600	80	0.0092				
		760	101.3	0.0116**				

*The authors stated that they had analyzed experimental data by use of an equation given in Ref. 1 and that they had published interpolated values of solubilities. The evaluator assumes that authors used the equation $\log_{10} p_1/x_1 = \log_{10} H - \beta(1-x_2^2)$, where H is Henry's constant defined as the limiting value of p_1/x_1 at $x_1 = 0$. The authors gave values of H and of β. The evaluator found that these values are not entirely consistent with the solubilities presented in the paper and tabulated above and has recalculated values of H from the above equation.
**Extrapolated by the compiler.

Auxiliary Information

Method/Apparatus/Procedure:
The authors used a static method described in Ref. 2. The absorption vessel was magnetically stirred and held in a thermostat bath.

Source and Purity of Materials:
(1) Chromatographic analysis indicated a purity of 99.9%;
(2) Chromatographic analysis indicated a purity of 99.9%.

Estimated Error:
No information.

References:
[1]I. R. Krichevskii, *Phase Equilibria in Solutions under High Pressures* Goskhimizdat, Moscow, 1952.
[2]G. E. Braude, I. L. Leites, and I. V. Dedova, Khim Prom. (**4**), 232 (1961).

Components:
(1) Ethyne; C_2H_2; [74-86-2]
(2) 1,3-Dioxolane; $C_3H_6O_2$; [646-06-0]

Original Measurements:
H. Lagarde and J. Cambon, Soud. Tech. Conn. **9**, 7–11 (1955).

Variables:
T/K = 288.15 K;
p_1 /kPa = 95–3162

Prepared By:
P. G. T. Fogg

Experimental Data
T = 288.15 K.

p_1 /kg cm^{-2}	p_1 /kPa*	Solubility** V_{gas}/V_{solv}	x_1*
0.97	95	41.24	0.108
1.84	180	31.71	0.150
2.67	262	28.15	0.187
5.94	583	20.54	0.277
9.75	956	21.19	0.402
14.40	1412	23.94	0.540
14.73	1445	24.13	0.548
17.12	1679	25.21	0.602
20.09	1970	27.44	0.667
26.96	2644	38.8	0.807
29.05	2849	47.09	0.850
32.24	3162	65.93	0.903

*Calculated by the compiler.
**Volume of gas, measured at 101.3 kPa and 288.15 K, dissolved by 1 vol of pure solvent at 288.15 K and the partial pressure of acetylene specified.
‡Mass of dissolved gas divided by the increase in volume of the liquid.

Auxiliary Information

Method/Apparatus/Procedure:
The apparatus consisted of a light alloy cylinder fitted with a narrow bore glass gauge to measure the height of liquid and also a pressure gauge. A measured quantity of solvent was introduced followed by ethyne. The weight of gas introduced was found from the increase in weight of the cylinder and contents. The cylinder and contents were held in a thermostat bath. When equilibrium was attained the final pressure was recorded. The height of liquid in the glass gauge was measured with a cathetometer to determine the increase in volume of the liquid phase.

Source and Purity of Materials:
(1) Purified by distillation; less than 0.05% of impurities.
(2) Pure industrial solvent; gaseous impurities removed under vacuum.

Estimated Error:
δT/K = ±0.002 (authors).

Components:
(1) Ethyne; C_2H_2; [74-86-2]
(2) 1,2-Dimethoxyethane; $C_4H_{10}O_2$; [110-71-4]

Original Measurements:
B. Ryutani, Nippon Kagaku Zasshi **81**, 1192–1201 (1960).

Variables:
T/K = 253.15–283.15;
P/kPa = 395–1277

Prepared By:
Sim-wan Annie Blight and P. G. T. Fogg

Experimental Data

t/°C	T/K	P/atm	P/kPa*	S[a] (cm^3 g^{-1})	x_1*	Density/g cm^{-3} Solvent	Density/g cm^{-3} Solution	ΔV[b] (cm^3 g^{-1})
10	283.15	3.9	395	170.2	0.4090	0.8777	0.8724	0.236
		6.8	689	238.4	0.4922		0.8278	0.407
		9.7	983	323.1	0.5678		0.8009	0.583
		12.6	1277	416.3	0.6286		0.7720	0.789
0	273.15	3.9	395	184.2	0.4282	0.8891	0.8461	0.313
		6.8	689	289.6	0.5407		0.8056	0.539
		9.7	983	406.6	0.6231		0.7725	0.788
		12.6	1277	536.6	0.6857		0.7637	1.010
−10	263.15	3.9	395	241.2	0.4951	0.9004	0.8423	0.413
		6.8	689	408.0	0.6239		0.8146	0.705
		9.7	983	565.5	0.6969		0.7610	1.076
		12.6	1277	713.9	0.7438		0.7313	1.403
−20	253.15	3.9	395	293.1	0.5437	0.9119	0.8249	0.532
		6.8	689	474.4	0.6586		0.7624	0.944
		9.7	983	848.7	0.7753		0.7340	1.622
		12.1	1226	1257.2	0.8364		0.6833	2.526

*Calculated by the compiler.
[a]S is the volume/cm^3 of gas, corrected to 273.15 K and 101.3 kPa, dissolved by the weight/g of solvent.
[b]ΔV is the change in volume of the liquid due to dissolution of gas.

Auxiliary Information

Method/Apparatus/Procedure:
Absorption was measured by a static method. Densities of saturated solutions were measured by the balancing column method[1] in which saturated solution and mercury in one side of a U-tube were balanced against mercury in the other side of the U-tube with both sides of the tube subject to the same pressure of gas. Heights of liquid columns were measured by a traveling microscope

Source and Purity of Materials:
(1) Dried with silica gel; purity 99.5%–99.6%.
(2) Boiling point 83.7 °C (760 mm Hg) n_D^{20} 1.3804.

Estimated Error:
No information.

References:
[1]Weissberger, *Technique of Organic Chemistry*, Vol. I, Physical Methods, Part I (Interscience, New York, 1949), p. 285.

Components:
(1) Ethyne: C_2H_2 ; [74-86-2]
(2) 2,2′-Di-*t*-butoxydiethyl ether; $C_6H_{14}O_3$; [112-73-2]

Original Measurements:
B. Ryutani, Nippon Kagaku Zasshi **81**, 1192–1201 (1960).

Variables:
T/K = 253.15–283.15;
P/kPa = 395–1277

Prepared By:
Sim-wan Annie Bligh and P. G. T. Fogg

Experimental Data

t/°C	T/K	P/atm	P/kPa*	S^a (cm^3 g^{-1})	x_1*	Density/g cm^{-3} Solvent	Density/g cm^{-3} Solution	ΔV^b (cm^3 g^{-1})
10	283.15	3.9	395	83.3	0.4507	0.8853	0.8743	0.126
		6.8	689	119.8	0.5413		0.8509	0.211
		9.7	983	158.5	0.6096		0.8325	0.295
		12.6	1277	197.9	0.6609		0.8131	0.386
0	273.15	3.9	395	96.3	0.4868	0.8943	0.8689	0.163
		6.8	689	137.8	0.5758		0.8378	0.269
		9.7	983	198.8	0.662		0.8227	0.381
		12.6	1277	264.4	0.7226		0.8148	0.49
−10	263.15	3.9	395	122.9	0.5476	0.9033	0.8669	0.213
		6.8	689	212.2	0.6764		0.8511	0.361
		9.7	983	284.1	0.7367		0.8169	0.525
		12.6	1277	397.1	0.7964		0.7981	0.73
−20	253.15	3.9	395	178	0.6368	0.9124	0.8777	0.281
		6.8	689	267	0.7245		0.8296	0.487
		9.7	983	408	0.8008		0.789	0.778
		12.6	1277	668.9	0.8682		0.7368	1.327

*Calculated by the compiler.
[a]S is the volume/cm^3 of gas, corrected to 273.15 K and 101.3 kPa, dissolved by the weight/g of solvent.
[b]ΔV is the change in volume of the liquid due to dissolution of gas.

Auxiliary Information

Method/Apparatus/Procedure:
Absorption was measured by a static method. Densities of saturated solutions were measured by the balancing column method[1] in which saturated solution and mercury in one side of a U-tube were balanced against mercury in the other side of the U-tube with both sides of the tube subject to the same pressure of gas. Heights of liquid columns were measured by a traveling microscope.

Source and Purity of Materials:
(1) Dried with silica gel; purity 99.5%–99.6%.
(2) Boiling point 87.2 °C (3 mm Hg) n_D^{20} 1.4188.

Estimated Error:
δT/K = ±0.1 (author).

References:
[1]Weissberger, *Technique of Organic Chemistry*, Vol. I, Physical Methods, Part I (Interscience, New York, 1949), p. 285.

Components:
(1) Ethyne; C_2H_2 ; [74-86-2]
(2) 2,2′-Di-*n*-butoxydiethyl ether; $C_{12}H_{26}O_3$; [112-73-2]

Original Measurements:
B. Ryutani, Nippon Kagaku Zasshi **81**, 1192–1201 (1960).

Variables:
T/K = 253.15–283.15;
P/kPa = 395–1277

Prepared By:
Sim-wan Annie Bligh and P. G. T. Fogg

Experimental Data

t/°C	T/K	P/atm	P/kPa*	S* (cm^3 g^{-1})	x_1*	Density/g cm^{-3} Solvent	Density/g cm^{-3} Solution	ΔV^b (cm^3 g^{-1})
10	283.15	3.9	395	67.4	0.399	0.8917	0.8811	0.103
		6.8	689	111.8	0.5241		0.8679	0.182
		9.7	983	156.7	0.6068		0.8572	0.26
		12.6	1277	185.9	0.6468		0.8347	0.338
0	273.15	3.9	395	70.4	0.4095	0.9007	0.8667	0.139
		6.8	689	133.5	0.568		0.8553	0.242
		9.7	983	190.5	0.6524		0.8371	0.351
		12.6	1277	256.7	0.7166		0.8241	0.469
−10	263.15	3.9	395	81.3	0.4447	0.9096	0.8569	0.179
		6.8	689	165	0.6191		0.8436	0.316
		9.7	983	245.7	0.7076		0.8192	0.474
		12.6	1277	354.5	0.7774		0.7976	0.676
−20	253.15	3.9	395	139.5	0.5788	0.9185	0.876	0.24
		6.8	689	234.6	0.698		0.8412	0.427
		9.7	983	357.2	0.7787		0.7928	0.702
		12.6	1277	571	0.849		0.7474	1.146

*Calculated by the compiler.
[a]S is the volume/cm^3 of gas, corrected to 273.15 K and 101.3 kPa, dissolved by the weight/g of solvent.
[b]ΔV is the change in volume of the liquid due to dissolution of gas.

Auxiliary Information

Method/Apparatus/Procedure:
Absorption was measured by a static method. Densities of saturated solutions were measured by the balancing column method[1] in which saturated solution and mercury in one side of a U-tube were balanced against mercury in the other side of the U-tube with both sides of the tube subject to the same pressure of gas. Heights of liquid columns were measured by a traveling microscope.

Source and Purity of Materials:
(1) Dried with silica gel; purity 99.5%–99.6%.
(2) Boiling point 108 °C (3 nm Hg) n_D^{20} 1.4231.

Estimated Error:
δT/K = ±0.1 (author).

References:
[1]Weissberger, *Technique of Organic Chemistry*, Vol. I, Physical Methods, Part I (Interscience, New York, 1949), p. 285.

Components:
(1) Ethyne; C_2H_2 ; [74-86-2]
(2) 2,2′-Dimethoxydiethylether; $C_6H_{14}O_3$

Original Measurements:
B. Ryutani, Nippon Kagaku Zasshi **80**, 1192–1201 (1960).

Variables:
T/K=253.15–293.15;
P/kPa=395–1277

Prepared By:
Sim-wan Annie Bligh and P. G. T. Fogg

Experimental Data

t/°C	T/K	P/atm	P/kPa*	S^a (cm^3 g^{-1})	x_1*	Density/g cm^{-3} Solvent	Density/g cm^{-3} Solution	ΔV^b (cm^3 g^{-1})
20	293.15	3.9	395	83.8	0.3366	0.9429	0.9023	0.157
		6.8	689	132.9	0.4458		0.8739	0.262
		9.7	983	196.8	0.5437		0.8636	0.365
		12.6	1277	244.6	0.5969		0.8391	0.473
10	283.15	3.9	395	106.6	0.3922	0.9534	0.8996	0.213
		6.8	689	177.8	0.5184		0.8740	0.346
		9.7	983	264.7	0.6157		0.8627	0.481
		12.6	1277	331.9	0.6677		0.8330	0.631
0	273.15	3.9	395	145.1	0.4676	0.9640	0.9018	0.260
		6.8	689	236.1	0.5883		0.8658	0.438
		9.7	983	331.4	0.6673		0.8385	0.619
		12.6	1277	449.2	0.7311		0.8107	0.847
−10	263.15	3.9	395	189.8	0.5347	0.9740	0.8901	0.347
		6.8	689	314.6	0.6557		0.8498	0.585
		9.7	983	447.3	0.7303		0.8053	0.867
		12.6	1277	584.3	0.7796		0.7684	1.167
−20	253.15	3.9	395	269.5	0.6200	0.9844	0.8940	0.457
		6.8	689	469.0	0.7395		0.8290	0.849
		9.7	983	638.4	0.7944		0.7612	1.282
		12.6	1277	1153.8	0.8748		0.6942	2.376

*Calculated by the compiler.
[a]S is the volume/cm^3 of gas, corrected to 273.15 K and 101.3 kPa, dissolved by the weight/g of solvent.
[b]ΔV is the change in volume of the liquid due to dissolution of gas.

Auxiliary Information

Method/Apparatus/Procedure:
Absorption was measured by a static method. Densities of saturated solutions were measured by the balancing column method[1] in which saturated solution and mercury in one side of a U-tube were balanced against mercury in the other side of the U-tube with both sides of the tube subject to the same pressure of gas. Heights of liquid columns were measured by a traveling microscope.

Source and Purity of Materials:
(1) Dried with silica gel; purity 99.5%–99.6%.
(2) Boiling point 161.2 °C (760 mm Hg); n_D^{20} 1.4080.

Estimated Error:
No information.

References:
[1]Weissberger, *Technique of Organic Chemistry*, Vol. I, Physical Methods, Part I (Interscience, New York, 1949), p. 285.

Components:
(1) Ethyne; C_2H_2 ; [74-86-2]
(2) 1,1,3,3-Tetramethoxypropane; $C_7H_{16}O_4$; [102-52-3]

Original Measurements:
B. Ryutani, Nippon Kagaku Zasshi **81**, 1192–1201 (1960).

Variables:
T/K=253.15–283.15;
P/kPa=395–1277

Prepared By:
Sim-wan Annie Bligh and P. G. T. Fogg

Experimental Data

t/°C	T/K	P/atm	P/kPa*	S^a (cm^3 g^{-1})	x_1*	Density/g cm^{-3} Solvent	Density/g cm^{-3} Solution	ΔV^b (cm^3 g^{-1})
10	283.15	3.9	395	33	0.1964	1.0029	0.921	0.131
		6.8	689	91.8	0.4048		0.9018	0.231
		9.7	983	122.1	0.4749		0.859	0.334
		12.6	1277	180.5	0.5721		0.8423	0.442
0	273.15	3.9	395	38.2	0.2206	1.0137	0.9021	0.172
		6.8	689	103.7	0.4345		0.871	0.301
		9.7	983	171.7	0.5598		0.8404	0.443
		12.6	1277	251.8	0.651		0.8116	0.61
−10	263.15	3.9	395	103.7	0.4345	1.0246	0.9298	0.23
		6.8	689	185.3	0.5785		0.8768	0.413
		9.7	983	284.1	0.6779		0.8214	0.647
		12.6	1277	425.4	0.7591		0.7923	0.916
−20	253.15	3.9	395	135.4	0.5008	1.0355	0.9466	0.259
		9.7	983	467.9	0.7761		0.798	0.974
		12.6	1277	719.5	0.842		0.7198	1.597

*Calculated by the compiler.
[a]S is the volume/cm^3 of gas, corrected to 273.15 K and 101.3 kPa, dissolved by the weight/g of solvent.
[b]ΔV is the change in volume of the liquid due to dissolution of gas.

Auxiliary Information

Method/Apparatus/Procedure:
Absorption was measured by a static method. Densities of saturated solutions were measured by the balancing column method[1] in which saturated solution and mercury in one side of a U-tube were balanced against mercury in the other side of the U-tube with both sides of the tube subject to the same pressure of gas. Heights of liquid columns were measured by a traveling microscope. Details are given in Ref. 2.

Source and Purity of Materials:
(1) Dried with silica gel; purity 99.5%–99.6%.
(2) Boiling point 78 °C (20 mm Hg) n_D^{20} 1.4070.

Estimated Error:
δT/K=±0.1 (author).

References:
[1]Weissberger, *Technique of Organic Chemistry*, Vol. I, Physical Methods, Part I (Interscience, New York, 1949), p. 285.
[2]B. Ryutani, Nippon Kagaku Zasshi **80**, 1407 (1959).

Components:
(1) Ethyne; C_2H_2 ; [74-86-2]
(2) Triethyleneglycol dimethylether; $C_8H_{18}O_4$; [112-49-2]

Original Measurements:
B. Ryutani, Nippon Kagaku Zasshi **81**, 1192–1201 (1960).

Variables:
T/K = 253.15–283.15;
P/kPa = 395–1277

Prepared By:
Sim-wan Annie Bligh and P. G. T. Fogg

Experimental Data

t/°C	T/K	P/atm	P/kPa*	S^a (cm^3 g^{-1})	x_1*	Density/g cm^{-3} Solvent	Density/g cm^{-3} Solution	ΔV^b (cm^3 g^{-1})
10	283.15	3.9	395	124	0.4993	0.9944	0.964	0.183
		6.8	689	184.8	0.5977		0.9272	0.307
		9.7	983	235.2	0.6541		0.9007	0.411
		12.6	1277	294.4	0.703		0.8759	0.531
0	273.15	3.9	395	165.4	0.5708	1.0045	0.9694	0.236
		6.8	689	218.5	0.6373		0.912	0.382
		9.7	983	292.1	0.7014		0.8771	0.536
		12.6	1277	382.1	0.7544		0.8532	0.702
−10	263.15	3.9	395	191	0.6056	1.0147	0.9469	0.307
		6.8	689	307.3	0.7119		0.9062	0.516
		9.7	983	412.3	0.7683		0.859	0.742
		12.6	1277	522.2	0.8077		0.8293	0.959
−20	253.15	3.9	395	253.1	0.6705	1.0248	0.9381	0.407
		6.8	689	398.2	0.762		0.8823	0.688
		9.7	983	609.1	0.8304		0.8298	1.091
		12.6	1277	876.6	0.8758		0.7728	1.65

*Calculated by the compiler.
[a]S is the volume/cm^3 of gas, corrected to 273.15 K and 101.3 kPa, dissolved by the weight/g of solvent.
[b]ΔV is the change in volume of the liquid due to dissolution of gas.

Auxiliary Information

Method/Apparatus/Procedure:
Absorption was measured by a static method. Densities of saturated solutions were measured by the balancing column method[1] in which saturated solution and mercury in one side of a U-tube were balanced against mercury in the other side of the U-tube with both sides of the tube subject to the same pressure of gas. Heights of liquid columns were measured by a traveling microscope. Details are given in Ref. 2.

Source and Purity of Materials:
(1) Dried with silica gel; purity 99.5%–99.6%.
(2) Boiling point 101.8 °C (9.5 mm Hg) n_D^{20} 1.4247.

Estimated Error:
δT/K = ±0.1 (author).

References:
[1]Weissberger, *Technique of Organic Chemistry*, Vol. I, Physical Methods. Part I (Interscience, New York, 1949), p. 285.
[2]B. Ryutani, Nippon Kagaku Zasshi **80**, 1407 (1959).

Components:
(1) Ethyne; C_2H_2 ; [74-86-2]
(2) Tetraethyleneglycol dimethylether; $C_{10}H_{22}O_5$; [143-24-8]

Original Measurements:
B. Ryutani, Nippon Kagaku Zasshi **81**, 1192–1201 (1960).

Variables:
T/K = 253.15–283.15;
P/kPa = 395–1277

Prepared By:
Sim-wan Annie Bligh and P. G. T. Fogg

Experimental Data

t/°C	T/K	P/atm	P/kPa*	S^a (cm^3 g^{-1})	x_1*	Density/g cm^{-3} Solvent	Density/g cm^{-3} Solution	ΔV^b (cm^3 g^{-1})
10	283.15	3.9	395	95.5	0.4892	1.0202	0.9643	0.173
		6.8	689	156	0.61		0.9403	0.278
		9.7	983	221.4	0.6895		0.926	0.68
		12.6	1277	276.1	0.7347		0.9008	0.49
0	273.15	3.9	395	140	0.584	1.0305	0.9712	0.229
		6.8	689	210	0.678		0.9266	0.362
		9.7	983	289.6	0.7439		0.9121	0.499
		12.6	1277	342.8	0.7747		0.8929	0.6
−10	263.15	3.9	395	162	0.619	1.0407	0.9871	0.282
		6.8	689	243.1	0.7091		0.9019	0.464
		9.7	983	347.2	0.7769		0.8661	0.664
		12.6	1277	449.3	0.8184		0.8256	0.889
−20	253.15	3.9	395	200.9	0.6683	1.0511	0.9327	0.374
		6.8	689	322.7	0.7639		0.8753	0.624
		9.7	983	510.7	0.8366		0.8328	0.969
		12.6	1277	791.1	0.8881		0.7483	1.626

*Calculated by the compiler.
[a]S is the volume/cm^3 of gas, corrected to 273.15 K and 101.3 kPa, dissolved by the weight/g of solvent.
[b]ΔV is the change in volume of the liquid due to dissolution of gas.

Auxiliary Information

Method/Apparatus/Procedure:
Absorption was measured by a static method. Densities of saturated solutions were measured by the balancing column method[1] in which saturated solution and mercury in one side of a U-tube were balanced against mercury in the other side of the U-tube with both sides of the tube subject to the same pressure of gas. Heights of liquid columns were measured by a traveling microscope.[2]

Source and Purity of Materials:
(1) Dried with silica gel; purity 99.5%–99.6%,
(2) Boiling point 116.3–116.4 °C (3.5 mm Hg) n_D^{20} 1.4319.

Estimated Error:
δT/K = ±0.1 (author).

References:
[1]Weissberger, *Technique of Organic Chemistry*, Vol. I, Physical Methods, Part I (Interscience, New York, 1949), p. 285.
[2] B. Ryutani, Nippon Kagaku Zasshi **80**, 1407 (1959).

Components:
(1) Ethyne; C_2H_2; [74-86-2]
(2) 2-Methoxyethanol, (*ethylene glycol monomethyl ether*); $C_3H_8O_2$; [109-86-4]

Original Measurements:
E. Bodor, Gy. Bor, M. Maleczkine, G. Mesko, B. Mohai, and G. Siposs, Veszppremi Vegyip. Egyet. Kozlemen. **1**, 99–108 (1957).

Variables:
T/K = 198–318;
p_1 /kPa = 20.0–98.9

Prepared By:
C. L. Young

Experimental Data

T/K	p_1 /mm Hg	p_1 /kPa	α**	x_1*
318.2	150	20	1.42	0.00480
	397	52.9	3.93	0.0132
	533	71.1	5.25	0.0175
	649	86.5	6.43	0.0214
	−760	101.3	−7.5	0.0248
295.2	467	62.3	8.25	0.0272
	531	70.8	9.3	0.0306
	601	80.1	10.6	0.0347
	666	88.8	11.7	0.0382
	−760	101.3	−13	0.042
273.2	432	57.6	14.8	0.0478
	489	65.2	16.5	0.0531
	542	72.3	18.2	0.0582
	602	80.3	20	0.0636
	667	88.9	22.1	0.0698
	−760	101.3	−25	0.078
245.2	112	14.9	10.2	0.0335
	142	18.9	14.6	0.0472
	245	32.7	22.4	0.0707
	293	39.1	25.2	0.0788
	422	56.3	33.8	0.1029
	443	59.1	35.7	0.1081
	595	79.3	46.5	0.1364
	742	98.9	53.8	0.1544
245.2	−760	101.3	−60	0.169
223.2	208	27.7	65.8	0.1826
	339	45.2	84.5	0.2229
	350	46.7	76.6	0.2063
	488	65.1	105.8	0.2643
	507	67.6	99.8	0.2531
	611	81.5	119.1	0.2879
	634	84.5	122.8	0.2942
	742	98.9	134.7	0.3188
	742	98.9	135	0.3143
1982	−760	101.3	−140	0.322
	183	24.4	139	0.3206
	213	28.4	167.8	0.3629
	228	30.4	161.3	0.3539
	295	39.3	201.5	0.4062
	299	39.9	202	0.4068
	381	50.8	242	0.4510
	434	57.9	281	0.4882
	593	79.1	314.2	0.5162
	638	85.1	375	0.5601
	676	90.1	387	0.5678
	742	98.9	425	0.5907
	742	98.9	430	0.5935
	760	101.3	440	0.599

*Calculated by the compiler.
**(Vol. of gas, reduced to 101.3 kPa and 273.2 K)/cm^3 dissolved by 1 g of solvent.
Values in parentheses are extrapolated to 1 atm.

Auxiliary Information

Method/Apparatus/Procedure:
Volumetric method. Pressure measured when known amounts of gas were added, in increments, to a known amount of liquid in a vessel of known dimensions. Corrections were made for the partial pressure of solvent. Details in Ref. 1.

Source and Purity of Materials:
No information.

Estimated Error:
δT/K = ±0.1;
$\delta\alpha$ = ±4% or less.

References:
[1]E. Bodor, G.J. Bor, B. Mohai, and G. Siposs, Veszpremi, Vegyip. Egyet. Kozlemen. **1**, 55 (1957).

Components:
(1) Ethyne; C_2H_2; [74-86-2]
(2) Organic oxygen compounds

Prepared By:
P. G. T. Fogg

Experimental Data

t/°C	T/K*	Bunsen coefficient	Ostwald coefficient	x_1*
R. M. Isham, Patent US2063680, 1936				
γ-Butyrolactone; $C_5H_6O_2$; [96-48-0]				
27	300.15	13.65	15	0.052
R. M. Isham, Patent US2424987, 1947				
Furfuryl acetate; $C_7H_8O_3$				
25	298.15	7.21	7.87	0.039
2-Furfuraldehyde, (*furfural*); $C_5H_4O_2$; [98-01-1]				
25	298.15	6.83	7.46	0.025
Tetrahydrofurfuryl alcohol, $C_5H_{10}O_2$ [97-99-4]				
25	298.15	9.22	10.06	0.039
Tetrahydrofurfuryl acetate; $C_7H_{12}O_3$				
25	298.15	11.96	13.05	0.068
R. M. Isham, Patent US2587689				
Acetic anhydride; $C_4H_6O_3$; [108-24-7]				
24	297.05	8.59	9.34	0.035
J. C. Eck, Patent US2664997				
2-Propanone, (*acetone*); C_3H_6O; [67-64-1]				
20	293.15	17.5	18.78	0.055
1,4-Dioxane; $C_4H_8O_2$; [123-91-1]				
20	293.15	19.5	20.93	0.07
γ-Butyrolactone; $C_5H_6O_2$; [96-48-0]				
20	293.15	17	18.24	0.063
Cyclohexanone; $C_6H_{10}O$; [108-94-1]				
20	293.15	14	15.03	0.061

*Calculated by the compiler.

Auxiliary Information

No information.

Components:
(1) Ethyne; C_2H_2 [74-86-2]
(2) Carbowax 200; Carbowax 350; Carbowax 400

Original Measurements:
H. Hannaert, M. Haccuria, and M. P. Mathieu, Ind. Chim. Belge **32**, 156–164 (1967).

Variables:
T/K = 273–353

Prepared By:
E. L. Boozer and H. L. Clever

Experimental Data

Temperature range	$KP\nu$/atm at 293.15	Enthalpy of dissolution, ΔH/kcal mol^{-1}	A
Carbowax 20			
273.15–353.15 T/K	13.2	5.4	5.16
Carbowax 35			
293.15–313.15 T/K	7.35	5.78	5.19
Carbowax 40			
273.15–353.15 T/K	6.6	4.25	4.6

$$\log_{10}(KP\nu/\text{atm}) = A - (\Delta H/\text{cal mol}^{-1})/(2.3R(T/\text{K})).$$

The author's definitions are:
$K = y_1/x_1$ = mole fraction gas in gas phase/mole fraction gas in liquid phase,
P/atm = total pressure; ν = coefficient of fugacity.

The function $KP\nu$/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

Source and Purity of Materials:
(1) Ethyne. Commercial product. Purified by passage over activated carbon and vacuum fusion. Purity 99.8%–99.9%.
(2) Carbowax. Union Carbide. Polyethylene glycols. Carbowax 200 mol wt. 200±10; Carbowax 350 mol wt. 350±15; Carbowax 400 mol wt. 400±20.

Method/Apparatus/Procedure:
A gas liquid chromatographic method was used.

Estimated Error:
2%–5% (authors).

Components:
(1) Ethyne; C_2H_2; [74-86-2];
(2) Mixed solvents.

Original Measurements:
B. Ryutani, Nippon Kagaku Zasshi **82**, 513–517 (1961).

Variables:
T/K=273.15–283.15;
P/kPa=395–1277

Prepared By:
Sim-wan Annie Bligh and P. G. T. Fogg

Experimental Data

t/°C	T/K	P/atm	P/kPa*	S^a cm^{3}g^{-1}	x_1*	Density/g cm^{-3} Solvent	Density/g cm^{-3} Solution	ΔV^b (cm^3 g^{-1})
Trichloromethane; $CHCl_3$; [67-66-3] (56.59 wt. %; 0.496 mole fraction)[c]								
Dimethoxyethane; $C_4H_{10}O_2$; [110-71-4] (43.41 wt. %; 0.504 mole fraction)[c]								
0	273.15	3.9	395	33.3	0.1358	1.17	1.0847	0.103
		6.8	689	88.1	0.2937		1.0466	0.2
		9.7	983	141.7	0.4008		0.9891	0.324
		12.6	1277	192.2	0.4757		0.9585	0.424
Sulfinylbismethane, (*dimethylsulfoxide*); C_2H_6OS; [67-68-5] (79.50 wt %; 0.472 mole fraction)[c] Water; H_2O; [7732-18-5] (20.50 wt %; 0.528 mole fraction)[c]								
10	283.15	3.9	395	17.5	0.035	1.1117	1.0508	0.072
		6.8	689	55.2	0.1036		1.0368	0.128
		9.7	983	105.2	0.1805		1.0331	0.188
		12.6	1277	134.9	0.2202		1.0141	0.243

*Calculated by the compiler.
[a]S is the volume/cm^3 of gas, corrected to 273.15 K and 101.3 kPa, dissolved by the weight/g of solvent.
[b]ΔV is the change in volume of the liquid due to dissolution of gas.
[c]Composition of liquid mixture before addition of ethyne.

Auxiliary Information

Method/Apparatus/Procedure:
Absorption was measured by a static method. Densities of saturated solutions were measured by the balancing column method[1] in which saturated solution and mercury in one side of a U-tube were balanced against mercury in the other side of the U-tube with both sides of the tube subject to the same pressure of gas. Heights of liquid columns were measured by a traveling microscope. Details are given in Ref. 2.

Source and Purity of Materials:
(1) Dried with silica gel; purity 99.5%–99.6%.

Estimated Error:
δT/K=±0.1 (author).

References:
[1]Weissberger, *Technique of Organic Chemistry*, Vol. I, Physical Methods, Part I (Interscience, New York, 1949), p. 285.
[2]B. Ryutani, Nippon Kagaku Zasshi **80**, 1407 (1959).

3.9. Other Oxygen Compounds Including Aldehydes and Ketones Except 2-Propanone

Components:
(1) Ethyne; C_2H_2; [74-86-2]
(2) Other Oxygen Compounds including Aldehydes and Ketones except 2-Propanone.

Evaluator:
Peter G. T. Fogg, University of North London, London, United Kingdom.

Critical Evaluation

Formaldehyde

Solubility in aqueous solutions of formaldehyde was measured by Jadkar and Chaudhari[10] at 280–328 K; 101.3 kPa and concentrations of formaldehyde of 0–12.8 mol dm^{-3}. Mole fraction solubility decreased with addition of 6.6 mol dm^{-3} but further additions of formaldehyde caused the solubility to increase to a value greater than that in pure water. The work is self-consistent but no measurements by other workers are available to confirm these measurements.

Acetaldehyde

Solubility in acetaldehyde was measured by Bodor *et al.*[1] at 198–273 K; 2.5–97.2 kPa. It was measured by James[2] at 263 K; 101.3 kPa. Mole fraction solubilities, extrapolated to a partial pressure of 101.3 kPa, from Bodor's data fit the equation:

$$\ln x_1 = 15.822 + 611.28/(T/\mathrm{K}) - 3.6727 \ln(T/\mathrm{K})$$

standard deviation in values *of* $x_1 = 3.99\times10^{-3}$

based on data for the temperature range 198–273 K.

The value of x_1 at 263.15 K and a partial pressure of 101.3 kPa based on the above equation is 0.098. This contrasts markedly with the value of 0.176 from James' data. The Bodor measurements are probably the more reliable but confirmation by other workers is desirable.

2-Furfuraldehyde

Solubility was reported by Isham. No other data are available for comparison.

Cyclohexanone

Solubility in cyclohexanone was reported by Eck[3] (293 K; 101.3 kPa), Makitra[4] (293 K; 97.3 kPa), Bushinskii and Matyushenskii[5] (293 K, 13.3–66.7 kPa). The mole fraction solubilities at a partial pressure of 101.3 kPa from the first two sources are in close agreement i.e., 0.061 (Eck); 0.059 (Makitra). These contrast sharply with the value of 0.110 obtained by extrapolation of Bushinskii's data. Further measurements on this system are required.

Butyrolactone

Hölemann and Hasselmann[6] measured solubility in γ-butyrolactone at 298.15 K and 97–2553 kPa. The data are self-consistent and may be accepted on a tentative basis. Lagarde and Cambon[7] measured solubility at 288.15 K and 1455 kPa. The values are not incompatible with measurements by Hölemann and Hasselmann at 298.15 K but precise comparison is not possible. Isham[8] published a value for 300.15 K and 101.3 kPa and Eck[3] a value for 293.15 K and 1013 kPa. Data from these two authors are probably less reliable than data published by Hölemann and Hasselmann.

Other ketones

Hölemann and Hasselmann[6] measured solubility in 4-methyl-3-pentene-2-one (*mesityl oxide*) at 298 K; 101–1082 kPa. The mole fraction solubility at a partial pressure of 101.3 kPa from these data is 0.0549. Measurements under the same conditions were also reported for solubility in 4-methyl-2-pentanone-4-ol (*diacetone alcohol*). The corresponding mole fraction solubility at 298 K; 101.3 kPa is 0.0451.[9,11]

These authors measured the solubility in ethylacetoacetate at 298 K to a pressure of 2553 kPa. The corresponding value of x_1 at a partial pressure of 101.3 kPa is 0.0570. Measurements by Hölemann and Hasselmann are likely to be reliable but no measurements by other workers on these three systems are available for comparison.

Hamil and Vogt[12] reported the solubility in 2,5-hexanedione at 278 K. No other data for this system are available for comparison.

References:
[1]E. Bodor, B. Mohai, and Gy Pfeifer, Veszpremi, Vegyip. Egyet. Kozlemen. **3**, 205–210 (1959).
[2]J. H. James, J. Ind. Eng. Chem. **5**, 115–120 (1913).
[3]J. C. Eck, US2664997.
[4]V. I. Bushinskii and B. V. Matyushenskii, Zh. Prikl. Khim. **41**, 1168–1170 (1968); J. Appl. Chem. USSR **41**, 1114–1115 (1968).
[5]R. G. Makitra, F. B. Moin, Ya. N. Pirig, and T. I. Politanskaya, Zh. Prikl. Khim. **53**, 1529–1531 (1980); J. Appl. Chem. USSR **53**, 1179–1181 (1980).
[6] P. Hölemann and R. Hasselmann, *Forschungsberichte des Wirtschafts- und Verkehrsministeriums Nord-Westfalen*, No. 109 Forschungsstelle für Acetylen (Westdeutscher Verlag, Köln-Opladen, Germany, 1954).
[7]
[8] H. Lagarde and J. Cambon, Soud. Tech. Conn. **9**, 7–11 (1955).
[9]R. M. Isham, US2063680, 1936.
[10]P. B. Jadkar and R. V. Chaudhari, J. Chem. Eng. Data **25**, 115–117 (1980).
[11]R. M. Isham, US2424987, 1947.
[12]W. H. Hamill, and R. R. Vogt, U.S. Patent 2405693, 1946.

Components:
(1) Ethyne: C_2H_2 ; [74-86-2]
(2) Acetaldehyde; C_2H_4O; [75-07-0]

Original Measurements:
E. Bodor, B. Mohai, and Gy Pfeifer, Veszpremi, Vegyip. Egyet. Kozlemen, **3**, 205–210 (1959).

Variables:
T/K = 198–273;
p_1 /kPa = 2.5–97.2

Prepared By:
C. L. Young

Experimental Data

T/K	p_1 /mm Hg	p_1 /k Pa	α**	Mole fraction of acetylene in liquid, x_1*
273.2	19	2.5	1.81	0.00354
	87	11.6	6.85	0.01328
	164	21.9	10.85	0.02088
	204	27.2	12.4	0.02379
	300	40	18	0.0342
	372	49.6	22.3	0.0420
	468	62.4	27.4	0.0511
248.2	140	18.7	9.1	0.0176
	221	29.5	25.4	0.0475
	435	58	48	0.0862
	518	69.1	56.2	0.0995
	632	84.3	65.3	0.1137
	760	101.3	85	0.1430
223.2	227	30.3	66.5	0.1156
	312	41.6	94.2	0.1562
	417	55.6	120.8	0.1919
	515	68.7	143.2	0.2196
	620	82.7	157.8	0.2367
	716	95.5	178	0.2592
	760	101.3	185	0.2670
198±2	185	24.7	190.5	0.2724
	208	27.7	233	0.3141
	403	53.7	408	0.4450
	729	97.2	746	0.5945
	760	101.3	770	0.6021

*Calculated by compiler.
**(Vol. of gas, reduced to 101.3 kPa and 273.2 K)/cm^3 dissolved by 1 g of solvent.

Solubilities at 101.3 kPa are extrapolated values.

Auxiliary Information

Method/Apparatus/Procedure:
Volumetric method. Pressure measured when known amounts of gas were added, in increments, to a known amount of liquid in a vessel of known dimensions. Corrections were made for the partial pressure of solvent. Details in Ref. 1.

Source and Purity of Materials:
No information.

Estimated Error:
δT/K = ±0.1;
$\delta\alpha$ = ±4% or less.

References:
E. Bodor, G. J. Bor, B. Mohai, and G. Siposs, Veszpremi, Vegyip. Egyet. Kozlemen. **1**, 55 (1957).

Components:
(1) Ethyne; C_2H_2 ; [74-86-2]
(2) α-Dimethylaminomethylacetylacetone; $C_8H_{15}NO_2$
Cyclohexanone; $C_6H_{10}O$; [108-94-1]

Original Measurements:
V. I. Bushinskii and B. V. Matyushenskii, Zh. Prikl. Khim. **41**, 1168–1170 (1968); J. Appl. Chem. USSR **41**, 1114–1115 (1968)

Variables:
T/K = 293.15;
P/kPa = 13.3–66.7

Prepared By:
P. G. T. Fogg

Experimental Data

Solvent	t/°C	T/K	P/mm Hg	P/kPa*	Mole ratio	x_1*
α-Dimethylaminomethylacetylacetone (DMAMAA)						
	20	293.15	100	13.3	0.0250	0.0244
			200	26.7	0.0650	0.0610
			300	40.0	0.0940	0.0859
			400	53.3	0.1210	0.1079
			500	66.7	0.1460	0.1274
Cyclohexanone						
	20	293.15	100	13.3	0.0160	0.0157
			200	26.7	0.0330	0.0319
			300	40.0	0.4900	0.3289
			400	53.3	0.0650	0.0610
			500	66.7	0.0800	0.0741

*Calculated by the compiler.

Auxiliary Information

Method/Apparatus/Procedure:
A static method was used as described in Ref. 1.

Source and Purity of Materials:
(1) Ethyne prepared from calcium carbide and stored in a cylinder was first dissolved in acetone at −78 °C and then purified by activated carbon.
(2) DMAMAA was prepared by the authors (details given). Distilled at 65–66 °C. (5 mm Hg). n_D^{20} = 1.4202; ρ^{20} = 1.1395 g cm^{-3}; C = 61.14%; H = 9.55%; N = 8.91%; O = 20.4%, Cyclohexanone was reagent grade.

Estimated Error:
No information.

References:
[1]G. E. Braude, I. L. Leites, and I. V. Dedova, Zh. Khim. Prom. (**2**) (1963).

3.10. Nitrogen Compounds

Components:
(1) Ethyne; C_2H_2; [74-86-2]
(2) Nitrogen compounds

Evaluator:
Peter G. T. Fogg, University of North London, London, United Kingdom.

Critical Evaluation

Ammonia

Solubility in this solvent was measured by Khodeeva[1] (197–231 K; 15.2–95.5 kPa), Bodor and Pfeifer[2] (199–223 K; 32.0–105.2 kPa), Hannaert *et al.*[3] (208–318 K). In the case of the third paper solubilities were given in the form of an equation. The evaluator used this equation to calculate mole fraction solubilities at a partial pressure of 101.3 kPa at intervals of 20 K. These values and values at specified temperatures from data in the other two papers, were used to derive the following smoothing equation:

$$\ln x_1 = 8.2168 + 1016.6/(T/\mathrm{K}) - 2.5932 \ln(T/\mathrm{K})$$

$$\text{standard deviation in values of } x_1 = 3.4\times10^{-2}$$

$$\text{temperature range} = 197–318\ \mathrm{K}.$$

This equation can be used as an approximate guide to the behavior of the system until further measurements are available.

Acetonitrile

Miller[17] reported the solubility of acetonitrile at 273–313 K and pressure 507–3040 kPa. The data are self-consistent. Extrapolation using the Krichevsky–Il'inskaya equation gives consistent values of solubility at 101.3 kPa. These values fit the equation:

$$\ln x = -8.3891 + 1533.0/(T/\mathrm{K})$$

standard deviation in values of $x_1 = 2.4\times10^{-4}$.

Aliphatic amines and imino compounds

Sada *et al.*[4] measured solubility in solutions of alkanolamines in water at 298 K. Bunsen coefficients for solubility in isopropanolamine, diethanolamine, diisopropanolamine, and triethanolamine peak at about 0.3 mol dm^{-3} of alkanolamine. The Bunsen coefficient for solubility in ethanolamine increases with concentration of alkanolamine over the whole concentration range (0–3.165 mol dm^{-3}).

Scott and Harris[5] reported solubility in dimethylacetonylamine and in trimethyl glycine at 296 K; 101.3 kPa. Nelson[6] reported solubility in ethylene diamine at 298 K; 101.3 kPa. No similar data are available for comparison.

Mole fraction solubilities in imino compounds studied by Kodachenko[7] at 298.15 K; 101.3 kPa are close to each other, i.e.,
N-formylhexamethyleneimine (0.1123); *N*-acetylhexamethyleneimine (0.1185);
N-propionylhexamethyleneimine (0.1190); *N*-carbethoxyhexamethyleneimine (0.1000).
No measurements by other workers are available for comparison.

N,N-Dimethylformamide

Numerous workers have measured solubility in *N,N*-dimethylformamide over the temperature range 213–423 K and pressures to 3171 kPa.[5,8–21] Data from Refs. 5, 8–14, 16, 17, 20, and 21 for solubility at a partial pressure of 101.3 kPa fit the equation:

$$\ln x_1 = 128.843 - 3924.70/(T/\mathrm{K}) - 20.7162 \ln(T/\mathrm{K})$$

standard deviation in values of $x_1 = 1.15\times10^{-2}$.

This equation is valid for the temperature range 213–323 K.

The boiling point of *N,N*-dimethylformamide is 149–156 °C.

The vapor pressure of the solvent at temperatures less that 323 K is less that 2 kPa. For practical purposes, the solubility at a partial pressure of gas of 101.3 kPa is within 2% of the solubility at a total pressure of 101.3 kPa. At higher temperatures the difference becomes increasingly more significant. Solubilities at temperatures from 273 to 423 K were measured by Howard *et al.* The evaluator assumes that these measurements correspond to a total pressure of 101.3 kPa because there is no indication that allowance was made for the partial pressure of the solvent. The available data for the mole fraction solubility for a total pressure of 101.3 kPa fit the equation:

$$\ln x_1 = 123.316 - 3717.08/(T/\mathrm{K}) - 19.8667 \ln(T/\mathrm{K})$$

standard deviation in values of $x_1 = 1.07\times10^{-2}$.

This equation is valid for the temperature range 213–423 K.
(At temperatures below 323 K the evaluator has assumed that measurements at a partial pressure of 101.3 kPa are identical with measurements at a total pressure of 101.3 kPa.)

The evaluator found that values for the range 81–1573 kPa at 298.15 K, published by Hölemann and Hasselmann, closely fit the equation:

$$\ln((p_1/\mathrm{kPa})/x_1) = 8.6501 + 1.6525(1 - x_2^2).$$

Measurements over pressure ranges were also published by the following authors: Ryutani[15] (253–273 K; 395–1277 kPa), Miller[17] (213–333 K; 10–3040 kPa), Shenderei and Ivanovskii[16] (218–298 K; 13–101 kPa), Heidegger and Szebenyi (278–313 K; 27–120 kPa), Hölemann and Hasselmann[10] (298 K; 81–2553 kPa), (298 K; 13–101 kPa); Bushinskii and Matyushenskii;[18] and Lagarde and Cambon[12] (288 K; 131–3171 kPa). In the opinion of the compiler data published by Heidegger and Szbenyi and those quoted by Bushinskii and Matyushenskii are inconsistent and less reliable than those published by other authors. In general sets of data published by other authors mentioned above are consistent with each other. However values for solubilities measured by Lagarde and Cambon at 288.15 K and pressures above 1619 kPa appear to be too high. They are inconsistent with data published by Miller and by Hölemann and Hasselmann and should be rejected.[22]

Maillard and Rosenthal[8] measured solubility in mixtures of *N,N*-dimethylformamide and water and of sodium iodide. Data were presented as small scale graphs and can only give a qualitative indication of a general trend.

Granzhan *et al.*[23] measured solubility in mixtures of *N,N*-dimethylformamide and 3-methyl-1*H* pyrazole at temperatures of 253, 303, and 313 K over a composition range. Data at the three temperatures fall on smooth curves of solubility against composition which are consistent with solubilities in the pure components.

Solubility in mixtures of water and *N,N*-dimethylformamide were reported by Howard *et al.*,[11] Haidegger *et al.*,[14] Braude *et al.*,[24] Shenderei and Ivanovskii,[16] and by Maillard and Rosenthal.[8] The data from Maillard and Rosenthal are in the form of small scale graphs. The measurements reported by the different authors cover a wide range of different concentration of water, temperature, and pressure. At 293 K the Haidegger data are within about 2% of the Maillard data, at 298 K within about 10% of the Braude data, and at 303 K within about 5% of the Howard data. The Haidegger data are also self consistent from 298 to 313 K and the Shenderei data self-consistent from 263 to 303 K.

N,N-Diethylformamide

A single measurement at 294.15 K was reported by Scott and Harris.[5] This corresponds to a mole fraction solubility at 101.3 kPa of 0.094. This may be compared with a value of 0.105 for dissolution in *N,N*-dimethyl formamide under the same conditions.

N,N-Dimethyl acetamide

Solubilities were published by Hölemann and Hasselmann[10] (298.15 K; 61–1573 kPa), by Scott and Harris[5] (293.15 K; 101.3 kPa), and by Granzhan *et al.*[25] (253–303; 14.1–99.3 kPa). Mole fraction solubilities at different pressures from Hölemann's data and from Granzhan's data fit smooth curves. The values from 61 to 1082 kPa from Hölemann can be represented by the equation:

$$\ln((p_1/\mathrm{kPa})/x_1) = 6.33594 + 1.87833(1 - x_2^2).$$

The interpolated value of x_1 at 101.3 kPa is 0.1182.
Mole fraction solubilities at a partial pressure of 101.3 kPa from all sources fit the equation:

$$\ln x_1 = -7.6572 + 1604.07/(T/\mathrm{K})$$

standard deviation in values of $x_1 = 1.1\times10^{-2}$.

This equation is based on data for the range 253–333 K and should be accepted on a tentative basis for this temperature range until more consistent data are available.

Tetraethylglutaramide

Freidlin and Bushinskii[26] measured solubilities in N,N,N',N'-tetraethylglutaramide at 293–323 K; 13–101 kPa. Data appear to be self-consistent and may be accepted on a tentative basis until confirmed by other workers. Mole fraction solubilities at a partial pressure of 101.3 kPa fit the equation:

$$\ln x_1 = -6.50135 + 1483.65/(T/\mathrm{K})$$

standard deviation in values of $x_1 = 2.0\times10^{-3}$.

These authors also reported solubilities in mixtures of water and tetraethylglutaramide. At constant water content their data indicate an approximately linear variation of solubility with partial pressure of ethyne. At constant partial pressure there is a sharp decline in solubility with addition of 4.75 mol % of water. From 9.36 to 100 mol % of water the decline is approximately linear. The data for the system are self consistent but need confirmation by other workers.

Tetramethylaminoacetamide

Scott and Harris[5] reported a solubility in N,N,N',N'-tetramethylaminoacetamide at 296 K; (101.3 kPa) but no other work on the system is available for comparison.

Dimethyloxamethane

Scott and Harris[5] reported a solubility in dimethyloxamethane (*N,N-dimethyl ethyloxamate*) at 297 K; 101.3 kPa but no other work on the system is available for comparison.

N-Methyl caprolactam

Solubility in *N*-methyl caprolactam was measured by Granzhan *et al.*[25] (273–313 K; 25.5–104.6 kPa). The evaluator found that the data fitted equations of the type:

$$\ln((p_1/\mathrm{kPa})/x_1) = \ln a + b(1 - x_2^2)$$

T/K	a	b
273.2	2964.6	0.911 01
293.2	5814.9	0.393 87
313.2	9435.9	0.2783

Values of x_1 at a partial pressure of 101.3 kPa fit the equation:

$$\ln x = -8.6149 + 1898.52/(T/\mathrm{K})$$

standard deviation in values of $x_1 = 1.6\times10^{-3}$.
This equation is valid for the temperature range 273–313 K.

Granzhan's data are self-consistent and probably reliable but the equations must be accepted on a tentative basis until confirmed by other workers.

Tetramethylurea

Hölemann and Hasselmann[10] measured solubilities at 288, 298, and 313 K and 70.7, 104.0, and 95.0 kPa, respectively. Solubilities have also been published by Scott and Harris[5] (293 K; 101.3 kPa) and Schay and Szekely[27] (298, 333 K; 101.3 kPa). Mole fraction solubilities from the three sources, corrected where necessary to 101.3 kPa, fit the equation:

$$\ln x_1 = -9.5521 + 2222.3/(T/\mathrm{K})$$

standard deviation in values of $x_1 = 6.4\times10^{-3}$.
This equation is valid for the temperature range 288–333 K.

Tetraethylurea

Mole fraction solubilities calculated from data reported by Scott and Harris[5] are 293.15 K; 0.111, 295.15 K; 0.096. No solubility data from other authors are available for this system. The mole fraction solubility in tetramethylurea at 295.15 K from the equation given above is 0.132.

Ethyl carbamic acid, ethyl ester

Azen *et al.*[28] reported Henry's constants measured in the range 273–333 K; 7–93 kPa. Mole fraction solubilities at 101.3 have been estimated by the evaluator on the assumption that x_1 varies linearly with pressure to 101.3 kPa. These values of x_1 fit the equation:

$$\ln x_1 = -10.095 + 19725.9/(T/\mathrm{K})$$

standard deviation in values of $x_1 = 3.0\times10^{-3}$.
This equation is valid for 273–333 K.

Diethylcarbamic acid, ethyl ester

Azen *et al.*[28] also reported Henry's constants at 273–313 K based on measurements in the range 7–93 kPa. Mole fraction solubilities at 101.3 have been estimated on the assumption that x_1 varies linearly with pressure to 101.3 kPa. These values of x_1 fit the equation:

$$\ln x_1 = -10.274 + 2317.4/(T/\mathrm{K})$$

standard deviation in values of $x_1 = 2.7\times10^{-3}$.
This equation is based on data for the range 273–333 K.
The data on this system can only be accepted on a tentative basis until they are substantiated by further measurements.

Dimethylammoniumdimethyl carbamate

Nelson[13] reported solubility at 298 K; 101.3 kPa. No other measurements are available for comparison.

Trimethylcarbamate (*dimethylcarbamic acid, methylester*)

Scott and Harris[5] reported solubility data at 296.15 K; 101.3 kPa corresponding to $x_1 = 0.079$. Nelson[13] reported data at 298.15; 101.3 kPa corresponding to $x_1 = 0.067$. These values can be taken as an approximate guide to the solubility at these temperatures.

Formic hexamethyleneamide

Granzhan *et al.*[29] measured solubility in solutions of formic hexamethyleneamideamide containing 0–9.95 mass % of water. The data are self-consistent and compatible with recommended solubility in pure water.

1-Methyl-2-pyrrolidinone

Solubility in this solvent was reported by Miller[17] (290, 293 K; 101.2, 709–2229 kPa), Makitra *et al.*[20] (293 K, 99.2 kPa), Shenderei and Ivanovskii[30] (273–298 K; 13.3–101.3 kPa), Lagarde and Cambon[12] (288 K; 202–3346 kPa), Granzhan and Kvasova[31] (273–313 K, 13.3–93.3 kPa), Usmanov *et al.*[32] (283–313 K, 202–1519 kPa), Hölemann and Hasselmann,[10] (288–313 K; 37–2062 kPa), Usyukin and Shleinikov[21] (253–293 K; 101.3 kPa) and Kodachenko[7] (298 K; 101.3 kPa), Eck,[9] Lorenz.[34] In addition Demidova and Shleinkov[33] reported solubility (253–293 K; 60–112 kPa partial pressure of C_2H_2) in the presence of carbon dioxide and nitrogen to a total pressure of 1521 kPa.

Solubility at a partial pressure of ethyne of 101.3 kPa from Refs. 7, 12, 17, 20, 30, and 31 fit the following equation:

$$\ln x_1 = 102.172 - 2838.88/(T/\mathrm{K}) - 16.6295\ \ln(T/\mathrm{K})$$

standard deviation in values of $x_1 = 5.2\times10^{-3}$.

Valid for 253–313 K

Sets of measurements over pressure ranges by Granzhan, Lagarde, and by Hölemann are consistent with each other and can all be accepted. Solubilities over a pressure range measured by Demidova in the presence of carbon dioxide and nitrogen at high total pressures are much higher then solubilities of pure ethyne. The data are self consistent but need to be confirmed by other workers.

Shenderei and Ivanovskii[30] measured solubility in mixtures of 1-methyl-2-pyrrolidinone and water at various temperatures, pressures and proportions of water. Data are self-consistent.

Granzhan and Kvasova[31] measured solubility at 213–313 K in 1-methyl-2-pyrrolidinone to which had been added naphthalene, water, and acetic acid in various proportions. The data give an indication of the depression of solubility caused by the additives but further measurements on the system are needed for confirmation.

1,5-Dimethyl-2-pyrrolidinone

Ryutani[15] made measurements of solubility at 253–293 K and 395–1429 kPa. He also measured densities of solutions which enabled calculation of change of volume on dissolution of ethyne. The measurements are self-consistent and there is no reason to doubt their reliability. There are no other measurements on this system available for comparison and they can only be accepted on a tentative basis.

Other *N*-Alkylpyrrolidinones

Eck[9] reported solubility data in a range of *N*-alkylpyrrolidinones. There is no consistent change in mole fraction with size of the alky group. However solubility on a volume/volume basis decreases with increase in size of the alkyl group. The mole fraction solubility in *N*-methylpyrrolidinone from Eck's data is 0.157 compared with the value of 0.139 from the above equation. In the opinion of the evaluator, Eck's data for the higher homologues should only be used as a guide to the behavior of the compounds.

Pyrrolidines

Data for *N*-formylpyrrolidine have been published by Dorsey[35] and by McKinnis.[36] Solubilities at 101.3 kPa calculated from these data are:

$$x_1 = 0.075 \ \text{at}\ 291.15\ \mathrm{K}\ \ (\text{Dorsey})$$
$$x_1 = 0.066 \ \text{at}\ 298.15\ \mathrm{K}\ \ (\text{McKinnis}).$$

These figures correspond to agreement between the measurements within about 5% but should be accepted on a tentative basis.

Data for *N*-acetylpyrrolidine have been published by Dorsey[35] and by McKinnis.[36] Solubilities at 101.3 kPa calculated from these data are:

$$x_1 = 0.107 \ \text{at}\ 297.15\ \mathrm{K}\ \ (\text{Dorsey})$$
$$x_1 = 0.100 \ \text{at}\ 298.15\ \mathrm{K}\ \ (\text{McKinnis}).$$

These figures correspond to agreement between the measurements within about 5% but should be accepted on a tentative basis.

Mole fraction solubility in 1-nitrosopyrrolidine at 298 K and 101.3 kPa from a measurement by McKinnis[36] is 0.043.

***N*-methylpyrrole**

Nelson[37] reported solubility in *N*-methylpyrrole at (298.15 K; 101.3 kPa). No other data are available for comparison.

Methyl and dimethyl pyrazoles

Granzhan *et al*. published values of Henry's constants for dissolution of ethyne in 3-methyl-1*H*-pyrazole at 293–313 K.

The corresponding mole fraction solubilities fit the equation:

$$\ln x_1 = -15.006 + 3118.3/(T/\mathrm{K})$$

standard deviation in values of $x_1 = 2.5\times10^{-4}$.

This equation is based on data for 293–313 K. No measurements by other workers are available for comparison and the equation should be accepted on a tentative basis.

Granzhan *et al.*[23] measured the solubility at 273, 283, and 303 K in mixtures of 3-methyl-1*H*-pyrazole and water in various proportions. Confirmation of the data by other workers is required. These workers also measured solubility in an equimolar mixture of 1,3- and 1,5-dimethylpyrazole. No other data on the system are available for comparison.

Piperidines

Data for *N*-formylpiperidine have been published by Dorsey[35] and by Kodachenko.[7] Solubilities at 101.3 kPa calculated from these data are:

$$x_1 = 0.061 \ \text{at}\ 297.15\ \mathrm{K}\ \ (\text{Dorsey})$$
$$x_1 = 0.1011 \ \text{at}\ 298.15\ \mathrm{K}\ \ (\text{Kodachenko}).$$

No further data on this system are available for comparison. Solubility in *N*-formylpiperidine is likely to be close to that in *N*-acetylpiperidine. These two authors agree on a mole fraction solubility in *N*-acetylpiperidine of about 0.100 at 297–298 K. On this basis Kodachenko's value is more likely to be closer to the solubility in *N*-formylpiperidine. Further measurements are needed for confirmation.

Data for *N*-acetylpiperidine have been published by Dorsey[35] and by Kodachenko.[7] Solubilities at 101.3 kPa calculated from these data are:

$$x_1 = 0.099 \ \text{at}\ 297.15\ \mathrm{K}\ \ (\text{Dorsey})$$
$$x_1 = 0.1001 \ \text{at}\ 298.15\ \mathrm{K}\ \ (\text{Kodachenko}).$$

These figures correspond to agreement between the measurements within 5% but should be accepted on a tentative basis.

Kodachenko[7] measured solubility in *N*-propionylpiperidine and in *N*-carbethoxypiperidine at 298.15 K; 101.3 kPa. Mole fraction solubilities calculated from the published data are 0.130 and 0.0957, respectively. No other data are available for comparison.

2-Methyl-5-ethylpyridine

Measurements were made by Ryutani[15] (253–273 K; 395–1497 kPa). The measurements are self-consistent but no other measurements are available for comparison.

1-Methyl-2-pyridinone (*N*-methyl pyridone)

Solubility data were reported by Nelson[42] (273, 303 K). No other measurements are available for comparison.

Quinoline

Solubility in quinoline at 293 K was measured by Makitra *et al.*[20] No other data are available for comparison.

Tetrahydro-1,4-isoxazine (*morpholine*)

Measurements were made by Ryutani[15] (253–283 K; 395–1277 kPa). The measurements are self-consistent but not other measurements are available for comparison.

4-Morpholinecarboxaldehyde

Measurements were made by Ryutani[15] (263–303 K; 395–1479 kPa). The measurements are self-consistent. A measurement at 273.15 was reported by Hamill and Vogt which corresponds to a mole fraction solubility of 0.098 at 101.3 kPa. Extrapolation of Ryutani's data by the Krichevsky–Il'inskaya equation[38] indicates a mole fraction solubility of about 0.143 under these conditions. Ryutani's measurements are probably the more reliable but further measurements on the system are required.

Other nitrogen compounds

Measurements of the solubility at a single temperature and pressure have been reported in the following solvents:
N-Nitrosodimethylamine (Levine & Isham[39] 303.15 K; 101.3 kPa)
Nitrobenzene (Makitra *et al.*[20] 293 K ; 101.3 kPa)
Dimethylcyanamide (Nelson[40] 273, 303 K; 101.3 kPa)
1,1-Dimethylhydrazine (Nelson[41] 273 K; 101.3 kPa)
No data for similar systems are available for comparison.

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Components:
(1) Ethyne; C_2H_2; [74-86-2]
(2) Ammonia; H_3N; [7664-41-7]

Original Measurements:
E. Bodor and G. Pfeifer, Veszprémi Vegyip. Egy. Közl. **1**, 109–113 (1957).

Variables:
T/K = 199–223;
p_1 /kPa = 32.0–105.2

Prepared By:
P. G. T. Fogg

Experimental Data

t/°C	T/K*	p_1 /mm Hg	p_1 /kPa	Solubility of C_2H_2 (cm^3/g)†	x_1*
−74.2	199	349	46.5	806	0.382
		400	53.3	946	0.421
		453	60.4	1119	0.462
		532	70.9	1431	0.524
		581	77.5	1707	0.567
		643	85.7	2154	0.623
		690	92.0	2591	0.666
		730	97.3	2883	0.689
		754	100.5	3166	0.709
		760	101.3	3020	0.699
−65	208.2	272	36.3	326	0.200
		417	55.6	531	0.290
		532	70.9	700	0.350
		619	82.5	860	0.398
		712	94.9	1068	0.451
		760	101.3	1150	0.469
		789	105.2	1267	0.493
−50	223.2	240	32.0	147	0.102
		344	45.9	204	0.135
		432	57.6	283	0.179
		530	70.7	355	0.214
		627	83.6	443	0.254
		760	101.3	560	0.301

*Calculated by compiler.
†Vol. of C_2H_2 /mass of NH_3.

Auxiliary Information

Method/Apparatus/Procedure:
A volumetric method was used as described in Ref. 1. The pressure was measured after known amounts of gas had been added, in increments, to a vessel of known dimensions. Corrections were made for the partial pressure of ammonia as given in Ref. 2. Solubilities at a partial pressure of C_2H_2 of 760 mm Hg (101.3 kPa) were tabulated. Solubilities at other pressure were given in graphical form and electronically digitized by the compiler.

Source and Purity of Materials:
No information.

Estimated Error:
No information.

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Components:
(1) Ethyne; C_2H_2; [74-86-2]
(2) Ammonia; H_3N; [7664-41-7]

Original Measurements:
S. M. Khodeeva, Zhur. Fiz. Khim. **35**, 629–634 (1961); Russ. J. Phys. Chem. **35**, 306–308 (1961).

Variables:
T/K = 197.2–230.8;
P/kPa = 15.2–105.1

Prepared By:
P. G. T. Fogg

Experimental Data

t/°C	T/K*	P/mm Hg	P/kPa*	x_1	Henry's constant, H** /mmHg	/kPa
−42.4	230.8	564.0	75.19	0.032	3640	485
		570.0	75.99	0.031		
		575.5	76.73	0.031		
		577.5	76.99	0.031		
		577.5	76.99	0.031		
		639.0	85.19	0.059		
		651.0	86.79	0.058		
		656.0	87.46	0.059		
		712.0	94.93	0.075		
		716.0	95.46	0.074		
−49.0	224.2	415.5	55.40	0.032	3230	430
		422.0	56.26	0.032		
		431.5	57.53	0.039		
		528.5	70.46	0.075		
		540.0	71.99	0.075		
		580.0	77.33	0.091		
		587.0	78.26	0.091		
		589.5	78.59	0.100		
		679.0	90.53	0.112		
		689.0	91.86	0.112		
		715.5	95.39	0.143		
−58.5	214.7	346.0	46.13	0.092	2170	289
		346.0	46.13	0.092		
		397.5	53.00	0.101		
		397.5	53.00	0.101		
		405.5	54.06	0.114		
		453.0	60.40	0.134		
		453.0	60.40	0.134		
		477.5	63.66	0.154		
		486.0	64.79	0.153		
		534.5	71.26	0.179		
		607.0	80.93	0.214		
		625.0	83.33	0.214		
		788.0	105.06	0.299		
−64.1	209.1	264.0	35.20	0.097	1660	221
		355.5	47.40	0.142		
		360.5	48.06	0.163		
		362.0	48.26	0.154		
		367.0	48.93	0.154		
		407.5	54.33	0.179		
		428.0	57.06	0.215		
		455.0	60.66	0.198		

		537.0	71.59	0.263		
		583.0	77.73	0.299		
−72.9	200.3	114.0	15.20	0.053	1340	179
		176.0	23.46	0.077		
		228.0	30.40	0.139		
		259.0	34.53	0.146		
		305.0	40.66	0.190		
		411.0	54.80	0.236		
		446.5	59.53	0.263		
		473.0	63.06	0.300		
−76.0	197.2	141.0	18.80	0.093	1060	141
		174.0	23.20	0.139		
		177.0	23.60	0.139		
		208.5	27.80	0.170		
		245.0	32.66	0.208		
		246.0	32.80	0.208		
		287.0	38.26	0.220		
		304.0	40.53	0.252		
		308.0	41.06	0.252		
		373.0	49.73	0.300		

*Calculated by the compiler.
**$H = p_1/x_1$ (averaged over pressure range).

Auxiliary Information

Method/Apparatus/Procedure:

The apparatus was similar to that described in Ref. 1. The glass absorption cell was connected to a vacuum line and contained a magnetic stirrer. Ammonia from a storage bulb was allowed to condense in the cell which had been first evacuated and cooled in liquid nitrogen. The quantity of ammonia which was condensed was calculated from the volume and temperature of the storage bulb and the decrease in pressure. The cell was then brought to the appropriate temperature in a cryostat controlled to ±0.1 °C. Temperatures were measured by a pentane thermometer calibrated against the vapor pressures of liquid ammonia.[2] Ethyne was then introduced into the cell from a second storage bulb and the mixture stirred. Absorption of ethyne at equilibrium was calculated from the decrease in pressure, volume, and temperature of the ethyne gas. To avoid direct contact with mercury the pressure of ethyne was measured by balancing against the pressure of air across a glass membrane fitted with a pointer. The pressure of air was regulated by a mercury manometer and could be read to ±0.5 mm Hg.

Source and Purity of Materials:

(1) Ethyne purified as described in Ref. 3.
(2) Ammonia from a cylinder was passed through fused KOH and condensed in a glass bulb cooled in liquid nitrogen. Traces of uncondensed gases were then pumped away with a vacuum pump. Melting point −77.6±0.1 °C.

Estimated Error:

δT/K = ±0.1;
δP/kPa = ±0.07 (authors).

References:

[1]D. S. Tsiklis and G. M. Svetlova, Zhur. Fiz. Khim. **32**, 1476 (1958).
[2]D. R. Stull, Ind. Eng. Chem. **39**, 517, 1684 (1947).
[3]D. S. Tsiklis, A. N. Kofman, and L. I. Shenderei, Zhur. Fiz. Khim. **33**, 2012 (1959).

Components:

(1) Ethyne; C_2H_2; [74-86-2]
(2) Ammonia; NH_3;[7664-41-7]
(3) Water; H_2O;[7732-18-5]

Original Measurements:

H. Hannaert, M. Haccuria, and M. P. Mathieu, Ind. Chim. Belge **32**, 156–164 (1967).

Variables:

T/K = 208.15–318.15

Prepared By:

E. L. Boozer and H. L. Clever

Experimental Data

T/K	$100x_1$/mol%	$Kp\nu$/atm* at 293.15	Enthalpy of dissolution, ΔH/kcal mol^{-1}	A
Ammonia				
208.15–228.15**	1–5	21	3.52	4
Ammonia+water***				
233.15–273.15	0.1	775	2.72	5

*$\log_{10}(KP\nu/\text{atm}) = A - (\Delta H/\text{cal mol}^{-1})/(2.3R(T/\text{K}))$.

The author's definitions are:
$K = y_1/x_1$ = mole fraction gas in gas phase/mole fraction gas in liquid phase,
P/atm = total pressure;
ν = coefficient of fugacity.

The function $KP\nu$/atm is equivalent to a Henry's constant in the form $H_{1,2}$/atm = $(f_1/\text{atm})/x_1$ where f_1 is the fugacity.
**The temperature range is given in the original paper as 45–65 °C. This seems likely to be a misprint for −45–−65 °C (volume editor).
***25% ammonia, probably this is mass per cent (compiler).

Auxiliary Information

Method/Apparatus/Procedure:

The static pressures over saturated solutions were measured.

Source and Purity of Materials:

(1) Ethyne. Commercial product. Purified by passage over activated carbon and vacuum fusion. Purity 99.8%–99.9%.
(2) Ammonia. Source not given. Industrial product. Contained 0.1% water.
Density, ρ/g cm^{-3} = 0.717 at −65 °C and 0.705 at −50 °C.

Estimated Error:

2%–5% (authors).

Components:
(1) Ethyne; C_2H_2; [74-86-2]
(2) Solvents containing nitrogen

Original Measurements:
N. D. Scott and C. R. Harris, (du Pont) Brit. Patent 521281, 1940; U.S. Patent, 2146448, 1939; D.R. Patent 748245, 1944.

Variables:
T/K = 293–296;
101.3 kPa

Prepared By:
P. G. T. Fogg

Experimental Data

t/°C	T/K	Bunsen coefficient	Ostwald coefficient	x_1
N,N′-Dimethylformamide; C_3H_7NO; [68-12-2]				
20	293.15	33–37	37.6	0.108
25	298.15	28–32	32.7	0.098
N,N′-Dimethylacetamide; C_4H_9NO; [127-19-5]				
20	293.15	27.8	29.8	0.104
Trimethylcarbamate; $C_4H_9NO_2$				
23	296.15	18.5	20.1	0.079
Diethylformamide; $C_5H_{11}NO$; [617-84-5]				
21	294.15	20.6	22.2	0.094
Dimethylacetonylamine; $C_5H_{11}NO$				
23	296.15	14.3	15.5	0.068
Trimethylglycine, (*betaine*); $C_5H_{11}NO_2$; [107-43-7]				
23	296.15	15.5	16.8	0.071
Dimethyloxamethane, (*N,N-dimethyl ethyloxamate*); $C_6H_{11}NO_3$				
24	297.15	14.0	15.2	0.067
N,N,N′,N′-Tetramethylaminoacetamide; $C_6H_{14}N_2O$				
23	296.15	16.4	17.8	0.090
Tetramethylurea; $C_4H_9NO_2$; [632-22-4]				
20	293.15	29.2	31.3	0.136
Tetraethylurea; $C_9H_{20}N_2O$				
20	293.15	14.8	15.9	0.111
22	295.15	12.5	13.5	0.096

Auxiliary Information

Not available.

Components:
(1) Ethyne; C_2H_2; [74-86-2]
(2) *N,N*-Dimethylformamide; C_3H_7NO; [68-12-2]

Original Measurements:
A. Maillard and W. Rosenthal, Compt. Rend. **234**, 2546–2548 (1952).

Variables:
T/K = 293.15–303.15;
p_1 /kPa = 101.3

Prepared By:
P. G. T. Fogg

Experimental Data

t/°C	T/K	Ostwald coefficient, L[a]	Mole fraction solubility, x_1 at p_1 = 101.3 kPa[b]
20	293.15	36.33	0.1053
22	295.15	34.17	0.0990
24	297.15	31.95	0.0926
26	299.15	30.23	0.0875
28	301.15	28.43	0.0823
30	303.15	26.92	0.0778

[a]Defined as concentration of gas in the liquid phase/concentration in gas phase.
[b]Calculated by the compiler.

Auxiliary Information

Method/Apparatus/Procedure:
The authors stated that equilibrium pressures were measured as a function of composition and that temperature was controlled by a thermostat. No other details were given. Data were presented in the form of small scale graphs (4.5×5.0 cm or less). The compiler obtained data from the graphs by use of a scanner and digitizing program.

Source and Purity of Materials:
No information.

Estimated Error:
$\delta L = \pm 0.1$ (estimated error in taking data from the graphs).

Components:
(1) Ethyne; C_2H_2; [74-86-2]
(2) Nitrogen compounds

Original Measurements:
J. C. Eck, Patent US2664997, 1954.

Variables:
T/K=293.15;
101.3 kPa

Prepared By:
P. G. T. Fogg

Experimental Data

t/°C	T/K	Bunsen coefficient	Ostwald coefficient	x_1
N,N-dimethylformamide; C_3H_7NO; [68-12-2]				
20	293.15	36	38.6	0.111
1-Methyl-2-pyrrolidinone (*N-methylpyrrolidone*); C_5H_9NO; [872-50-4]				
20	293.15	43	46.1	0.157
1-Ethyl-2-pyrrolidinone, (*N-ethylpyrrolidone*) $C_6H_{11}NO$				
20	293.15	39	41.9	0.181
1-Propyl-2-pyrrolidinone, (*N-propylpyrrolidone*) $C_7H_{13}NO$				
20	293.15	38	40.8	0.167
1-Hexyl-2-pyrrolidinone, (*N-hexylpyrrolidone*) $C_{10}H_{19}NO$				
20	293.15	33	35.4	0.222
1-Isopropyl-2-pyrrolidinone, (*N-isopropylpyrrolidone*) $C_7H_{13}NO$				
20	293.15	33	35.4	0.151
1-Octyl-2-pyrrolidinone, (*N-octylpyrrolidone*) $C_{12}H_{23}NO$				
20	293.15	30	32.2	0.21

Auxiliary Information

No information.

Components:
(1) Ethyne; C_2H_2; [74-86-2]
(2) *N,N*-Dimethylformamide; C_3H_7NO; [68-12-2]
1,1,3,3,-Tetramethylurea; $C_5H_{12}N_2O$; [632-22-4]
N,N-Dimethylacetamide; C_4H_9NO; [127-19-5]
1-Methyl 2-pyrrolidinone, (*N-Methyl-2-pyrrolidone*); C_5H_9NO; [872-50-4]

Original Measurements:
P. Hölemann and R. Hasselmann, *Forschungsberichte des Wirtschafts- und Verkehrsministeriums Nord-Westfalen*, No. 109, Forschungsstelle für Acetylen (Westdeutscher Verlag, Köln-Opladen, Germany, 1954).

Variables:
T/K=288–313;
p_1 /kPa=0–2061

Prepared By:
P. G. T. Fogg

Experimental Data

Solvent	t/°C	T/K	p_1 /Torr*	p_1 /atm	p_1 /kPa**	Sol. coefficients***	x_1	$\delta V/V_1$ ▲
N,N-dimethylformamide	15	288.2	376	0.49	50.1	50.6	0.1243†	2
	25	298.15	598	0.79	79.7	37.7	0.0957†	2.13
	25	298.2		0.8	81.0	37.8	0.0782	
	25	298.2		5.84	591.6	30.6	0.3341	
	25	298.2		5.84	591.6	30.1	0.3304	
	25	298.2		10.7	1080	27.9	0.4552	
	25	298.2		15.5	1572	27.6	0.5460	
	25	298.2		20.3	2058	27.8	0.6133	
	25	298.2		25.2	2552	28.1	0.6653	
	40	313.15	341	0.45	45.5	24.7	0.0648†	3.07
1,1,3,3-Tetramethylurea	15	288.15	530	0.7	70.6	37.0	0.1417†	1.95
	25	298.2	780	1.03	103.9	27.9	0.1107†	2.07
	40	313.2	720	0.95	96.0	20.4	0.0834†	2.18
N,N-Dimethylacetamide	15	288.2		1	101.3	No data		1.9
	25	298.2	679	0.89	90.5	41.9	0.1230†	1.94
	40	313.2		1	101.3	No data		2.05
	25	298.2		0.6	60.8	41.9	0.0776	
	25	298.2		5.84	591.6	30.4	0.3727	
	25	298.2		10.7	1081.	25.1	0.4728	
	25	298.2		15.5	1572.	24.1	0.5558	
N-Methyl-2-pyrrolidone	15	288.2	275	0.36	36.5	65.0	0.0822	1.9
	25	298.2	200	0.26	26.3	41.4	0.0398	2.12
	25	298.2	400	0.53	53.7	40.7	0.0754	
	25	298.2	438	0.58	58.8	41.6	0.0836	
	25	298.2	500	0.66	66.9	40.2	0.0915	
	25	298.2	600	0.79	80.0	39.3	0.1056	
	25	298.2	700	0.92	93.2	37.9	0.1173	
	25	298.2		1	101.3	36.8	0.1229	
	25	298.2	800	1.05	106.4	36.2	0.1267	
	25	298.2		1.97	199.6	34.3	0.2046	
	25	298.2		2.92	295.8	31.45	0.2591	
	25	298.2		3.88	393	29.2	0.3014	
	25	298.2		6.8	688.8	25.25	0.3953	
	25	298.2		10.7	1081	22.55	0.4781	
	25	298.2		20.4	2061.	20.9	0.6182	
	40	313.2	457	0.60	60.8	27.2	0.0586	2.4

*Maximum pressure of measurements in the case of measurements made with the low pressure apparatus and represented graphically.
**Calculated by compiler.
***The solubility coefficient was defined as mg(gas)/(g(solvent)×p_1 /atm). Except for *N*-methyl 2-pyrrolidone this was constant for measurements below atmospheric pressure, i.e., data were consistent with Henry's law.
†Value for p_1=101.3 kPa.
▲Increase in (volume/cm^3) of the liquid phase/(dm^3 of gas dissolved) (reduced to NTP).

Auxiliary Information

Method/Apparatus/Procedure:

Ostwald type apparatus was used for measurements below 1 atm. The increase in volume of the liquid phase on dissolution of the gas could be measured. The apparatus is fully described in Ref. 1. Measurements were made from low pressures to the maximum values given above. Individual data points were published as plots of mg(gas)/g (solvent) against partial pressure. Except in the case of *N*-methyl-2-pyrrolidone the points fell very close to straight lines through the origin. In these cases values of the solubility coefficient equal to the slopes of the lines were tabulated by the authors. Mole fraction solubilities for a pressure of 101.3 kPa (1 atm) are given above. A different apparatus was used for measurements at 1 atm and above. Ethyne at elevated pressure passed from a cylinder through a vessel containing a measured quantity of solvent. The passage of gas was controlled by inlet and outlet valves. The pressure over the solution was measured when the system had reached equilibrium with both valves closed. The dissolved ethyne was subsequently measured by allowing it to escape at lower pressure into standardised bulbs connected to a mercury manometer. The authors made allowance for the partial pressure of the solvent when the solubility coefficient was calculated. Full details of the apparatus were given by the authors.

Source and Purity of Materials:

Dimethylacetamide, dimethylformamide and *N*-methyl-2-pyrrolidone were supplied by BASF. Tetramethylurea was the purest obtainable. Solvents were purified by fractional distillation under reduced pressure. Density and vapor pressures were measured.

Solvent	t/°C	Density/ g cm^{-3}	p_2^0/mm Hg
Dimethylformamide	15	0.9608	3.9
	25	0.9533	5.3
	40	0.9446	6.8
Tetramethylurea	15	1.0058	
	25	1.0001	3
	40	0.9885	
Dimethylacetamide	25	0.9409	10.1
N-Methyl-2-pyrrolidone	15	1.0357	5
	25	1.0288	6.5
	40	1.016	8.2

Estimated Error:

Low pressure apparatus: δT/K = ±0.05; δp_1 = ±0.5 mm Hg high pressure apparatus: δT/K = ±0.05; δp_1 = 0.05 kg cm^{-2} = 4.9 kPa (authors).

References:

[1]P. Hölemann and R. Hasselmann, *Forschungsberichte des Wirtschafts- und Verkehrsministeriums Nord-Westfalen*, No. 14, Forschungsstelle für Acetylen (Westdeutscher Verlag, Köln-Opladen, Germany, 1952).

Components:

(1) Ethyne; C_2H_2; [74-86-2]
(2) *N,N*-Dimethylformamide; C_3H_7NO; [68-12-2]

Original Measurements:

Howard, Schoch, and Mayforth, Pet. Refiner **33**, 143–146 (1954).

Variables:

T/K = 273.2–423.2;
p_1 /kPa = 101.3

Prepared By:

P. G. T. Fogg

Experimental Data

p_1 /mm Hg	p_1 /kPa*	t/°C	T/K*	Bunsen coefficient α	x_1*
760	101.3	0	273.2	67.0	0.1858
		10	283.2	49.6	0.1457
		20	293.2	37.4	0.1150
		25	298.2	31.4	0.0988
		30	303.2	28.0	0.0894
		40	313.2	21.4	0.0705
		50	323.2	16.0	0.0541
		60	333.2	13.0	0.0449
		80	353.2	7.5	0.0269
		100	373.2	4.0	0.0148
		125	398.2	1.6	0.0061
		130	403.2	1.4	0.0054
		140	413.2	1.2	0.0047
		150	423.2	1.0	0.0040

*Calculated by the compiler.

Auxiliary Information

No information.

Components:
(1) Ethyne; C_2H_2; [74-86-2]
(2) *N,N*-Dimethylformamide; C_3H_7NO; [68-12-2]

Original Measurements:
H. Lagarde and J. Cambon, Soud. Tech. Conn. **9**, 7–11 (1955).

Variables:
T/K=288.15 K; p_1 /kPa=131–3171

Prepared By:
P. G. T. Fogg

Experimental Data
T=288.15 K

p_1 /kg cm^{-2}	p_1 /kPa*	Solubility** V_{gas}/V_{solv}	Mole fraction* x_1	$\Delta_{mass}/\Delta_{vol}$‡
1.34	131	39.06	0.142	
1.90	186	36.80	0.182	
3.23	317	34.00	0.261	
4.52	443	31.16	0.315	
6.10	598	29.23	0.371	
7.44	730	27.87	0.409	
9.68	949	26.52	0.467	
11.56	1134	26.01	0.511	
11.93	1170	26.01	0.520	0.581
13.91	1364	25.70	0.560	0.581
14.94	1465	25.93	0.582	0.580
16.51	1619	26.08	0.612	0.576
18.22	1787	26.10	0.640	0.572
19.30	1893	26.72	0.661	0.569
20.92	2052	27.40	0.689	0.565
22.64	2220	27.95	0.714	0.560
24.38	2391	29.16	0.742	0.555
30.60	3001	38.55	0.841	0.530
32.33	3171	44.57	0.870	0.519

*Calculated by the compiler.
**Volume of gas, measured at 101.3 kPa and 288.15 K, dissolved by 1 vol of pure solvent at 288.15 K and the partial pressure of acetylene specified.
‡Mass of dissolved gas divided by the increase in volume of the liquid.

Auxiliary Information

Method/Apparatus/Procedure:
The apparatus consisted of a light alloy cylinder fitted with a narrow bore glass gauge to measure the height of liquid and also a pressure gauge. A measured quantity of solvent was introduced followed by ethyne. The weight of gas introduced was found from the increase in weight of the cylinder and contents. The cylinder and contents were held in a thermostat bath. When equilibrium was attained the final pressure was recorded. The height of liquid in the glass gauge was measured with a cathetometer to determine the increase in volume of the liquid phase.

Source and Purity of Materials:
(1) Purified by distillation; less than 0.05% of impurities.
(2) Pure industrial solvent; gaseous impurities removed under vacuum.

Estimated Error:
δT/K=±0.002 (authors).

Components:
(1) Ethyne; C_2H_2; [74-86-2]
(2) Nitrogen compounds

Original Measurements:
W. T. Nelson, Patent US 2801217, 1957.

Variables:
T/K=298; 303;
P/kPa=101.3

Prepared By:
P.G.T. Fogg

Experimental Data

t/°C	T/K*	Bunsen coefficient	Ostwald coefficient	x_1*
Trimethylcarbamate; $C_4H_9O_2N$				
25	298.15	15.4	16.8	0.067
Dimethylammoniumdimethylcarbamate				
25	298.15	16.2	17.7	
N,N-dimethylformamide; C_3H_7NO; [68-12-2]				
30	303.15	25.1	27.9	0.081

Auxiliary Information

No information.

Components:
(1) Ethyne; C_2H_2; [74-86-2]
(2) *N,N*-Dimethylformamide; C_3H_7NO; [68-12-2]

Original Measurements:
E. Haidegger, I. Szebenyi, and A. Szekely, Magy. Kem. Foly. **64**, 365–371 (1958).

Variables:
T/K=278.15–313.15;
p_1 /kPa=26.6–120.0

Prepared By:
H. L. Clever

Experimental Data

t/°C	T/K	p_1 /mm Hg	Absorption coefficient /cm^3(STP)cm^{-3}	Bunsen coefficient α /cm^3(STP)cm^{-3} atm^{-1}
5	278.15	200	13.20	50.16
		400	26.57	50.48
		600	39.13	49.56
		760	49.11	49.11
		900	58.42	49.33
20	293.15	200	9.98	37.90
		400	19.55	37.14
		600	28.78	36.45
		760	36.28	36.28
		900	42.65	36.01
30	303.15	200	6.50	24.70
		400	13.80	26.22
		600	20.80	26.34
		760	26.90	26.90
		900	32.00	27.02
40	313.15	200	3.15	12.00
		400	8.90	16.90
		600	15.05	19.06
		760	20.11	20.11
		900	25.50	21.53

The compiler calculated the Bunsen coefficients.

Auxiliary Information

Method/Apparatus/Procedure:
The apparatus consisted of an absorption flask in a thermostated bath and a water-jacketed buret.

Source and Purity of Materials:
(1) Ethyne, 98%. Contained 0.4% N_2 and 1.6% CO_2.
(2) *N,N*-Dimethylformamide. Distilled, dried. Refractive index n_D^{25}=1.4265, density, ρ^{25}=0.9451 g cm^{-3}. The water content was 0.2 mass %.

Estimated Error:
Error in absorption coefficient at pressures of 600 mm Hg and above=±5% (compiler).

Components:
(1) Ethyne; C_2H_2; [74-86-2]
(2) *N,N*-Dimethylformamide; C_3H_7NO; [68-12-2]

Original Measurements:
B. Ryutani, Nippon Kagaku Zasshi **81**, 1192–1201 (1960).

Variables:
T/K=273.15;
P/kPa=395–1277

Prepared By:
Sim-wan Annie Bligh and P. G. T. Fogg

Experimental Data

t/°C	T/K	P/atm	P/kPa*	S^a (cm^3 g^{-1})	x_1*	Density/g cm^{-3} Solvent	Density/g cm^{-3} Solution	ΔV^b (cm^3 g^{-1})
0	273.15	3.9	395	187	0.3814	.9689	.8607	.385
		6.8	689	303.1	0.4999		.8298	.602
		9.7	983	426.7	0.5845		.8061	.83
		12.6	1277	545.2	0.6426		.7737	1.088
−5	268.15	3.9	395	255.1	0.4569		.8996	.423
		6.8	689	368.7	0.5487		.8549	.655
		9.3	942	501.2	0.6230		.8327	.886
		10.7	1084	549.8	0.6445		.8073	1.017
−10	263.15	3.9	395	290.3	0.4891	.9789	.8919	.482
		6.8	689	436.1	0.5898		.8496	.758
		9.7	983	552.9	0.6458		.7733	1.111
		12.6	1277	828.9	0.7321		.7683	1.547
−15	258.15	6.8	689	473.8	0.6097		.8229	.874
		9.7	983	673.7	0.6896		.7716	1.304
		12.6	1277	1001.9	0.7676		.7177	2.015
−20	253.15	3.9	395	332.8	0.5232	.9884	.8608	.604
		6.8	689	538.8	0.6399		.8155	.99
		9.7	983	812.5	0.7282		.7563	1.569
		11.2	1135	1054.9	0.7767		.7212	2.092
		12.6	1277	1219.9	0.8009		.6969	2.481

*Calculated by the compiler.
[a]S is the volume/cm^3 of gas, corrected to 273.15 K and 101.3 kPa, dissolved by the weight/g of solvent.
[b]ΔV is the change in volume of the liquid due to dissolution of gas.

Auxiliary Information

Method/Apparatus/Procedure:
Absorption was measured by a static method. Densities of saturated solutions were measured by the balancing column method[1] in which saturated solution and mercury in one side of a U-tube were balanced against mercury in the other side of the U-tube with both sides of the tube subject to the same pressure of gas. Heights of liquid columns were measured by a traveling microscope.

Source and Purity of Materials:
(1) Dried with silica gel; purity 99.5%–99.6%.
(2) Boiling point 62.0 °C (30 mm Hg) n_D^{20} 1.4307.

Estimated Error:
No information.

References:
[1]Weissberger, *Technique of Organic Chemistry*, Vol. I, Physical Methods, Part I (Interscience, New York, 1949), p. 285.

Components:
(1) Ethyne; C_2H_2; [74-86-2]
(2) *N,N*-Dimethylformamide; C_3H_7NO; [68-12-2]

Original Measurements:
E. R. Shenderei and F. P. Ivanovskii, Gazov. Prom. **7**(7), 38–44 (1962).

Variables:
T/K = 218–298;
p_1 /kPa = 13–101

Prepared By:
A. Skrzecz and P.G.T. Fogg

Experimental Data

t/°C	T/K*	p_1 /mm Hg	p_1 /kPa*	Solubility/cm^3 g^{-1}**	x_1
25	298.1	100	13.3	4.65	0.0150
		300	40.0	13.35	0.0420
		500	66.7	21.4	0.0660
		600	101.3	31.3	0.0931
0	273.1	100	13.3	10.35	0.0330
		300	40.0	28.7	0.0860
		500	66.7	44.75	0.1280
		600	101.3	64.2	0.1741
−10	263.1	100	13.3	15.32	0.0478
		300	40.0	41.2	0.1185
		500	66.7	62.6	0.1701
		600	101.3	88.1	0.2220
−20	253.1	100	13.3	23.1	0.0705
		300	40.0	57.3	0.1580
		500	66.7	83.5	0.2170
		600	101.3	111.6	0.2750
−30	243.1	100	13.3	34.7	0.1021
		300	40.0	80.7	0.2090
		500	66.7	111.7	0.2770
		600	101.3	157	0.3400
−40	233.1	100	13.3	53.7	0.1480
		300	40.0	106.7	0.2720
		500	66.7	160.5	0.3450
		600	101.3	209	0.4070
−55	218.1	100	13.3	93	0.2330
		300	40.0	183.5	0.3740
		500	66.7	252.5	0.4530
		600	101.3	336	0.5250

*Calculated by the compilers.
**Volume of gas reduced to 101.3 kPa and 273.15 K dissolved in 1 g of solvent.

Auxiliary Information

Method/Apparatus/Procedure:
The method was described in Ref. 1. No more details were reported in the paper.

Source and Purity of Materials:
No information.

Estimated Error:
No information.

References:
[1]E. R. Shenderei, Ya. D. Zel'venskii, and F. P. Ivanovskii, Gazov. Prom. (**12**), 36 (1958).

Components:
(1) Ethyne; C_2H_2; [74-86-2]
(2) *N,N*-Dimethylformamide; C_3H_7NO; [68-12-2]

Original Measurements:
British Oxygen Co. Ltd, reported by S. A. Miller, *Acetylene—Its Properties, Manufacture and Uses* (Academic, New York, 1965), Vol. I.

Variables:
T/K = 213–333;
p_1 /kPa = 10–3040

Prepared By:
P. G. T. Fogg

Experimental Data

t/°C	T/K	p_1 /atm	p_1 /kPa	Solubility: g kg^{-1} of DMF	Solubility: g dm^{-3} of solution	x_1
−60	213.15	0.1	10.13	106		0.229
		0.2	20.27	164		0.315
		0.5	50.66	281		0.441
		1	101.32	444		0.555
−40	233.15	0.1	10.13	49		0.121
		0.2	20.27	84		0.191
		0.5	50.66	153		0.301
		1	101.32	238		0.401
−20	253.15	0.1	10.13	22		0.058
		0.2	20.27	40		0.101
		0.5	50.66	83		0.189
		1	101.3	138		0.279
0	273.15	0.1	10.13	9.4		0.0257
		0.2	20.27	18.7		0.0499
		0.5	50.66	43.2		0.1082
		1	101.32	77.3		0.1783
		5	506.62	258		0.42
		10	1013.25	521		0.594
		15	1519.87	736		0.674
5	278.15	0.1	10.13	7.9		0.0217
		0.2	20.27	15.6		0.042
		0.5	50.66	36.4		0.0927
		1	101.32	66.6		0.1575
		5	506.62	224		0.386
		10	1013.25	447		0.557
		15	1519.87	649		0.646
10	283.15	0.1	10.13	6.5		0.0179
		0.2	20.27	12.9		0.0349
		0.5	50.66	30.9		0.0798
		1	101.32	57.3	51.9	0.1386
		5	506.62	196	148	0.355
		10	1013.25	391	238	0.523
		15	1519.87	582	298	0.62
		20	2026.5	728	332	0.671
15	288.15	0.1	10.13	5.5		0.0152
		0.2	20.27	10.9		0.0297
		0.5	50.66	26.3		0.0688
		1	101.32	49.5	44.6	0.122
		5	506.62	173	133	0.327
		10	1013.25	341	218	0.489
		15	1519.87	509	278	0.588

		20	2026.5	653	317	0.647
		25	2533.12	742	338	0.676
20	293.15	0.1	10.13	4.7		0.013
		0.2	20.27	9.2		0.0252
		0.5	50.66	22.4		0.0592
		1	101.32	42.7	38.1	0.107
		5	506.62	154	119	0.302
		10	1013.25	301	199	0.458
		15	1519.87	452	260	0.559
		20	2026.5	593	303	0.625
		25	2533.12	702	331	0.663
25	298.15	0.1	10.13	4		0.0111
		0.2	20.27	7.8		0.0214
		0.5	50.66	19.2		0.0511
		1	101.32	37.2	32.9	0.0946
		5	506.62	138	108	0.279
		10	1013.25	269	183	0.43
		15	1519.87	404	243	0.531
		20	2026.5	536	289	0.601
		25	2533.12	654	323	0.647
		30	3039.75	739		0.675
30	303.15	0.1	10.13	3.3		0.0092
		0.2	20.27	6.6		0.0182
		0.5	50.66	16.5		0.0443
		1	101.32	32.3	28.3	0.0831
		5	506.62	125	97	0.26
		10	1013.25	241	167	0.404
		15	1519.87	362	225	0.504
		20	2026.5	485	273	0.577
		25	2533.12	602	310	0.628
		30	3039.75	701		0.663
40	313.15	0.1	10.13	2.5		0.007
		0.2	20.27	5		0.0138
		0.5	50.66	12.3		0.0334
		1	101.32	24.4		0.0641
		5	506.62	103		0.224
		10	1013.25	197		0.356
		15	1519.87	295		0.453
		20	2026.5	398		0.528
		25	2533.12	504		0.586
		30	3039.75	607		0.63
50	323.15	0.1	10.13	1.9		0.0053
		0.2	20.27	3.8		0.0106
		0.5	50.66	9.5		0.026
		1	101.32	18.8		0.0501
		5	506.62	86		0.195
		10	1013.25	164		0.315
		15	1519.87	245		0.408
		20	2026.5	331		0.482
		25	2533.12	421		0.542
60	333.15	5	506.62	74		0.172
		10	1013.25	138		0.279
		15	1519.87	208		0.369
		20	2026.5	281		0.441
		25	2533.12	359		0.502
		30	3039.75	442		0.554

It was stated that mole fraction solubility fitted the equation given below to within ±0.4% for the ranges 250–750 g kg^{-1} and 0–60 °C.

$$x_1 = (p_1/\text{atm})(a - b\ \log_{10}(p_1/\text{atm}))$$

where $\log_{10} a = 705/(T/\text{K}) - 3.4305$

and $\log_{10} b = 917/(T/\text{K}) - 4.4427$.

It was also stated that measurements down to −60 °C and 0.1 atm could be correlated with those at 1 atm, 15 °C, and 20 °C by the following modified van Laar equation:

$$\log Y = A/\left\{1 + \frac{A}{B}\left(\frac{x_1}{1-x_1}\right)^{4/3}\right\}^2,$$

where the activity coefficient is given by

$$Y = f/x_1 f^{o}.$$

f is the fugacity of ethyne in the solution and f^{o} is the fugacity of liquid ethyne at the same temperature. The author stated that fugacities were calculated from the Clausius equation of state as described by Din.[1] He also stated that a graph was constructed relating A and B with T from these fugacities and experimental solubility values.

Auxiliary Information

Method/Apparatus/Procedure:
No information.

Source and Purity of Materials:
No information.

Estimated Error:
See above.

References:
[1]F. Din, *Thermodynamic Functions of Gases*, (Butterworths, London, 1956), Vol. 2.

Components:
(1) Ethyne; C_2H_2 ; [74-86-2]
(2) *N,N*-Dimethylformamide; C_3H_7NO; [68-12-2]

Original Measurements:
Quoted by V. I. Bushinskii and B. V. Matyushenskii, Zh. Prikl. Khim. **41**, 1168–1170 (1968); J. Appl. Chem. USSR **41**, 1114–1115 (1968).

Variables:
T/K = 298.15;
P/kPa = 13.3 – 101.3

Prepared By:
P. G. T. Fogg

Experimental Data

t/ °C	T/K	P/mm Hg	P/kPa*	Mole ratio	x_1*
25	298.15	100	13.3	0.0217	0.0212
		300	40.0	0.0592	0.0559
		500	66.7	0.0910	0.0830
		760	101.3	0.1260	0.1120

*Calculated by the compiler.

Auxiliary Information

No information.

Components:
(1) Ethyne; C_2H_2 ; [74-86-2]
(2) Compounds containing nitrogen

Original Measurements:
G. F. Kodachenko, Khim. Prom. (Moscow) **49**(2), 106–108 (1973); Sov. Chem. Ind. **49**(2), 92–95 (1973).

Variables:
T/K = 298.15;
P/kPa = 101.3

Prepared By:
P. G. T. Fogg

Experimental Data

Solvent	Vol/Vol	x_1*
N-Formylpiperidine; C_6H_4NO; [2591-86-8]	24.5	0.1011
N-Acetylpiperidine; $C_7H_{13}NO$; [618-42-8]	21.4	0.0994
N-Propionylpiperidine; $C_8H_{15}NO$	26.1	0.1301
N-Formylhexamethyleneimine; $C_7H_{14}NO$	24.6	0.1123
N-Acetylhexamethyleneimine; $C_8H_{15}NO$	23.2	0.1185
N-Propionylhexamethyleneimine; $C_9H_{17}NO_2$	21.2	0.119
N-Carbethoxypiperidine; $C_8H_{15}NO_2$	16.4	0.0957
N-Carbethoxyhexamethyleneimine; $C_9H_{17}NO_2$	15.8	0.1
1-Methyl-2-pyrrolidinone, (*N-methylpyrrolidone*); $C_5H_{11}NO$; [872-50-4]	39.8	0.1222

*Calculated by the compiler. The compiler has assumed that vol/vol data are Ostwald coefficients not Bunsen coefficients.

Auxiliary Information

Method/Apparatus/Procedure:
Measurements were conducted at 298.15 and 760 mm Hg using a chromatographic technique described earlier.[1,2]

Source and Purity of Materials:
(1) No information.
(2) *N*-Formylpiperidine and *N*-formyl-hexamethyleneimine were produced by formulation of piperidine and hexamethyleneimine respectively by formic acid.[2] Acetyl and propionyl derivatives were made by corresponding reactions with acetyl chloride or propionyl chloride. Carbethoxy derivatives were made by similar reactions with the ethyl ester of chloro-formic acid.

Estimated Error:
No information.

References:
[1]G. A. Kurkchi and A. V. Iogansen, *Gas Chromatography* (papers from The Second All-Union Conference, Nauka, Moscow, 1964), p. 50.
[2]G. S. Kolesnikov and T. V. Smirnova, Zh. Obshcheti Khim. **27**, 3005 (1957).

Components:
(1) Ethyne; C_2H_2 ; [74-86-2]
(2) *N,N*-Dimethylformamide; C_3H_7NO; [68-12-2]

Original Measurements:
T. S. Sirlibaev, A. A. Yul'chibaev, Kh. U. Usmanov, E. F. Narkhodzhaev, and P. A. Aristanbekov, Nauchn. Trudy Tashkent. Univ. (**435**), 131–135 (1973).

Variables:
T/K = 283–313;
P/kPa = 101.3–1620.8

Prepared By:
P. G. T. Fogg and Yu. P. Yampolskii

Experimental Data

t/°C	T/K*	S**/cm^3 g^{-1} atm^{-1}	x_1 at p_1 = 101.3 kPa*
10	283.2	34.6	0.1024
15	288.2	25.6	0.0778
20	293.2	22.3	0.0685
30	303.2	17.8	0.0554
40	313.2	14.5	0.0456

*Calculated by a compiler.
**Volume of gas absorbed, reduced to 273.15 K and 101.3 kPa, divided by the weight of solvent and the pressure.

Auxiliary Information

Method/Apparatus/Procedure:
The apparatus was described in Ref. 1. Data were taken from a graph by a compiler. The solubility was said to obey Henry's law over the range of measurements.

Source and Purity of Materials:
No information.

Estimated Error:
No information.

References:
[1]E. R. Shenderei, Ya. D. Zel'venskii, and F. P. Ivanovskii, Khim. Prom. (**5**), 370 (1960).

Components:
(1) Ethyne; C_2H_2 ; [74-86-2]
(2) *N,N*-Dimethylformamide, (*N,N-dimethylmethanamide, DMF, dimethylformamide*); C_3H_7NO; [68-12-2]
(3) 3-Methyl-1*H*-pyrazole; $C_4H_6N_2$; [1453-58-3]

Original Measurements:
V. A. Granzhan, V. I. Seraya, R. Ya. Mushchii, and V. V. Kvasova, Khim. Tekhnol. (Kiev) (**5**), 23–25 (1975).

Variables:
T/K = 293–313;
P/kPa = 101.3.

Prepared By:
A. Skrzecz and P. G. T. Fogg

Experimental Data

t/°C	T/K	x_2†	H/Torr	H/(Torr g cm^{-3})	x_1 at p_1 = 760 Torr*
20	293.2	0	58884	212.39	0.012 91
		0.3252	28607	98.29	0.026 57
		0.5296	19062	62.94	0.039 87
		0.9012	8783.8	26.08	0.086 52
30	303.2	0	87648	318.25	0.008 67
		0.3252	43426	150.64	0.017 50
		0.5296	23730	79.63	0.032 03
		0.9012	10613	32.98	0.071 61
40	313.2	0	116098	426.3	0.006 55
		0.3252	52940	184.44	0.014 36
		0.5296	33435	112.91	0.022 73
		0.9012	14811	42.82	0.051 31

The authors found that experimental data fitted the equations:

$$\log_{10}(H/\text{Torr}) = 8.67 - 1230.8/(T/\text{K}) \quad \text{at} \quad x_2 = 0.3252,$$
$$\log_{10}(H/\text{Torr}) = 8.08 - 1116.5/(T/\text{K}) \quad \text{at} \quad x_2 = 0.5296,$$
$$\log_{10}(H/\text{Torr}) = 7.47 - 1037.1/(T/\text{K}) \quad \text{at} \quad x_2 = 0.9012$$

*Calculated by the compiler.
†Concentration of 2 before dissolution of gas.

Auxiliary Information

Method/Apparatus/Procedure:
The procedure for solubility measurements was described in Ref. 1. In the measured range of temperatures and pressures gas solubility satisfy Henry's law. Henry's constants were reported in two types of units. No more details were reported in the paper.

Source and Purity of Materials:
No information.

Estimated Error:
No information.

References:
[1]V. A. Granzhan, O. G. Kirillova, and N. Z. Pin'kovskaya, Zh. Prikl. Khim. **42**, 2381 (1969).

Components:
(1) Ethyne; C_2H_2 ; [74-86-2]
(2) *N,N*-Dimethylformamide; C_3H_7NO; [68-12-2]
(3) Water; H_2O; [7732-18-5]

Original Measurements:
Howard, Schoch, and Mayforth, Pet. Refiner **33**, 143–146 (1954).

Variables:
p_1 /kPa=4.9–101.3;
T/K=273.2–303.2; Mass % water=0–10

Prepared By:
P. G. T. Fogg

Experimental Data

Mass % water	p_1 /mm Hg	p_1 /kPa*	t/°C	T/K*	Solubility vol/vol**	x_1*
0.4	37	4.9	25	298.2	1.5	0.0051
0.4	94	12.5			3.9	0.0133
0.4	152	20.3			6.3	0.0213
0.4	212	28.3			8.7	0.0291
0.4	272.5	36.3			11.0	0.0365
0.4	332.5	44.3			13.3	0.0438
0.4	452	60.3			17.9	0.0581
0.4	574.5	76.6			22.3	0.0714
0.4	699	93.2			26.6	0.0840
0.4	760	101.3			28.9	0.0906
0.4	782	104.2			29.5	0.0923
0	760	101.3	30	303.2	28.0	0.0894
0.35	760	101.3			24.8	0.0792
1	760	101.3			23.8	0.0749
5	760	101.3			20.2	0.0577
10	760	101.3			16.4	0.0415

*Calculated by the compiler.
**Volume of gas, reduced to 273.15 K and 101.3 kPa, dissolved by the solvent at the temperature indicated.

Auxiliary Information

No information.

Components:
(1) Ethyne; C_2H_2 ; [74-86-2]
(2) Water; H_2O; [7732-18-5]
(3) *N,N*-Dimethylformamide; C_3H_7NO; [68-12-2]

Original Measurements:
E. Haidegger, I. Szebenyi, and A. Szekely, Magy. Kem. Foly. **64**, 365–371 (1958).

Variables:
T/K=293.15, 303.13;
p_1 /kPa=26.-6–120.0

Prepared By:
H. L. Clever

Experimental Data

			Absorption coefficient/cm^3(STP)cm^{-3} Water/mass%			
t/°C	T/K	p_1 /mm Hg	0.2	2	5	6.8
20	283.15	200	9.98	9.38	7.80	6.65
		400	19.55	18.20	15.15	13.45
		600	28.78	27.00	22.63	20.05
		760	36.28	34.05	28.80	25.00
		900	42.65	40.30	33.85	29.50
30	303.15	200	6.50	5.70	3.62	3.40
		400	13.80	12.30	9.98	9.15
		600	20.80	18.60	16.02	15.10
		760	26.90	23.65	20.85	19.70
		900	32.00	28.40	25.20	23.60

Auxiliary Information

Method/Apparatus/Procedure:
The apparatus consisted of an absorption flask in a thermostated bath and a water-jacketed buret.

Source and Purity of Materials:
(1) Ethyne, 98%. Contained 0.4% N_2 and 1.6% CO_2.
(2) Water. Distilled.
(3) *N,N*-Dimethylformamide. Distilled, dried. Refractive index n_D^{25}=1.4265, density, ρ^{25}=0.9451 g cm^{-3}. The water content was 0.2 mass%.

Estimated Error:
Error in absorption coefficient at pressures of 600 mm Hg and above=±5% (compiler).

Components:
(1) Ethyne; C_2H_2 ; [74-86-2]
(2) *N,N*-dimethylformamide; C_3H_7NO; [68-12-2]
(3) Water; H_2O; [7732-18-5]

Original Measurements:
G. E. Braude, I. L. Leites, and I. V. Dedova, Khim. Prom. 232–235 (1961).

Variables:
T/K = 298.15–413.15;
wt % H_2O = 0.5–15.3

Prepared By:
P. G. T. Fogg

Experimental Data

t/°C	T/K	Mass % water in solvent	Henry's constant, H /mmHg	Henry's constant, H /kPa*	Mole fraction of ethyne, x_1*
25	298.15	1	7700	1030	0.0987
		4	9900	1320	0.0768
		12	17 500	2330	0.0434
		15	21 300	2840	0.0357
40	313.15	1	11 600	1550	0.0655
		4	14 300	1910	0.0531
		12	25 500	3400	0.0298
		15	29 000	3870	0.0262
80	353.15	1	26 600	3550	0.0286
		4	33 100	4410	0.023
		12	53 400	7120	0.0142
		15.3	67 900	9050	0.0112
100	373.15	0.5	37 400	4990	0.0203
		4	44 400	5920	0.0171
		12	68 100	9080	0.0112
		15.3	79 600	10610	0.0095
120	393.15	0.5	45 800	6110	0.0166
		4	68 000	9070	0.0112
140	413.15	0.5	62 000	8270	0.0123

Henry's constant, H, is defined as $H = p_1/x_1$.
*Calculated by the compiler.

Auxiliary Information

Method/Apparatus/Procedure:
A static method was used with magnetic stirring of the solvent. Measurements were made at partial pressures of gas to 760 mm Hg.

Source and Purity of Materials:
(1) From a cylinder and subjected to additional purification.
(2) No information.

Estimated Error:
No information.

Components:
(1) Ethyne; C_2H_2 ; [74-86-2]
(2) *N,N*-Dimethylformamide; C_3H_7NO; [68-12-2]
(3) Water; H_2O; [7732-18-5]

Original Measurements:
E. R. Shenderei and F. P. Ivanovskii, Gazov. Prom. **7**(7), 38–44 (1962).

Variables:
T/K = 218–298; mass %water = 0–10

Prepared By:
A. Skrzecz and P. G. T. Fogg

Experimental Data

t/°C	T/K*	Water concentration[a] m_3* 100/(m_3+m_2)=mass %	Water concentration[a] $x_3/(x_3+x_2)$*	K_H /mm Hg[b]	x_1(1 atm)*
25	298.1	0	0	6397	0.1062
0	273.1	0	0	2754	0.2163
−10	263.1	0	0	1774	0.2999
		2	0.076	2153	0.2609
		5	0.176	2729	0.2178
		10	0.31	4539	0.1434
−20	253.1	0	0	1153	0.3973
		2	0.076	1382	0.3548
		5	0.176	1695	0.3096
		10	0.31	2965	0.2040
−30	243.1	0	0	713	0.5160
		2	0.076	824	0.4798
		5	0.176	1033	0.4239
		10	0.31	1871	0.2889
−40	233.1	0	0	402	0.6540
		2	0.076	468	0.6189
		5	0.176	593	0.5617
		10	0.31	1086	0.4117
−55	218.1	0	0	155	0.8306

*Calculated by the compilers.
[a]"Water concentration in the solution" was assumed by the compilers to be the water concentration in binary water-dimethylformamide mixture.
[b]$K_H = p_1$ /(mole fraction of 1).

Auxiliary Information

Method/Apparatus/Procedure:
The method was described in Ref. 1. No more details were reported in the paper.

Source and Purity of Materials:
No information.

Estimated Error:
No information.

References:
[1]E. R. Shenderei, Ya. D. Zel'venskii, and F. P. Ivanovskii, Gazov. Prom. (**12**), 36 (1958).

Components:
(1) Ethyne; C_2H_2; [74-86-2]
(2) *N,N*-Dimethylformamide; C_3H_7NO; [68-12-2]
(3) Sodium iodide; NaI; [7681-82-5]

Original Measurements:
A. Maillard and W. Rosenthal, Compt. Rend. **234**, 2546–2548 (1952).

Variables:
T/K = 293.15–303.15;
p_1 /kPa = 101.3;
m_3 /mol kg^{-1} = 0–2.86

Prepared By:
P. G. T. Fogg

Experimental Data

t/°C	T/K	Mass % of NaI[a]	Ostwald coefficient, L[b]	Molal concentration of NaI[c] m_3 /mol kg^{-1}	Sechenov constant[c] k_{smc} /kg mol^{-1}
20	293.15	5.4	31.57	0.381	0.160
22	295.15		29.98		0.149
24	297.15		28.62		0.126
26	299.15		27.11		0.124
28	301.15		25.95		0.104
30	303.15		24.72		0.097

[a]Mass of NaI/g in 100 g of solution.
[b]Defined as concentration of gas in the liquid phase/concentration in gas phase.
[c]Calculated by the compiler.

$$k_{smc} = ((1/m_3\ /\text{mol kg}^{-1}))\log_{10}(L^0/L).$$

Auxiliary Information

Method/Apparatus/Procedure:
The authors stated that equilibrium pressures were measured as a function of composition and that temperature was controlled by a thermostat. No other details were given. Data were presented in the form of small scale graphs (4.5×5.0 cm or less). The compiler obtained data from the graphs by use of a scanner and digitizing program.

Source and Purity of Materials:
No information.

Estimated Error:
$\delta L = \pm 0.1$ (estimated error in taking data from the graphs).

Components:
(1) Ethyne; C_2H_2;[74-86-2]
(2) 1-Methyl-2-pyrrolidinone; C_5H_9NO; [872-50-4]

Original Measurements:
British Oxygen Co. Ltd, reported by S. A. Miller, *Acetylene—Its Properties, Manufacture and Uses* (Academic, New York, 1965), Vol. I.

Variables:
T/K = 290.15, 293.15;
p_1 /kPa = 101.3–2229

Prepared By:
P. G. T. Fogg

Experimental Data

t/°C	T/K	p_1 /kPa	Bunsen coefficient, α	x_1*
20	293.15	101.3	38.8	0.1447

*Estimated by the compiler.

The author states that the mole fraction solubility at 17 °C (290.15 K) and 7–22 atm (709.3–2229 kPa) fits the equation:

$$x_1 = (p_1\ /\text{atm})(0.1130 - 0.0620\ \log_{10}(p_1\ /\text{atm})).$$

Solubilities estimated by the compiler from this equation are given below.

t/°C	T/K	p_1 /atm	p_1 /kPa	x_1
17	290.15	7	709.3	0.424
		12	1215.9	0.553
		17	1722.5	0.624
		22	2229.1	0.655

Dilation (V/V_o) at 19 °C was stated to fit the equations:
$V/V_o = 1.038 + 1.61s$, where s is the weight ratio of gas to solvent
$V/V_o = 1.095 + 0.370\ p_1$ /atm.

Auxiliary Information

Method/Apparatus/Procedure:
No information.

Source and Purity of Materials:
No information.

Estimated Error:
No information.

Components:
(1) Ethyne; C_2H_2; [74-86-2]
(2) 1-Methyl-2-pyrrolidinone, (*N-methyl-2-pyrrolidone*); C_5H_9NO; [872-50-4]

Original Measurements:
Kh. U. Usmanov, T. S. Sirlibaev, A. A. Yul'chibaev, and E. F. Narkhodzhaev, Deposited data VINITI 484-75 1975 (see Chem. Abs. 86-178231).

Variables:
T/K = 283.2–313.2;
p_1 /kPa = 202.6–1013.2

Prepared By:
Yu. P. Yampolskii

Experimental Data

t/°C	T/K*	p_1 /atm	p_1 /kPa	S**/cm^3 g^{-1}	x_1
10	283.2	2	202.6	63.2	0.221
		5	506.5	134.4	0.350
		8	810.4	185.1	0.476
		10	1013.0	225.3	0.480
		12	1215.6	270.3	0.522
		15	1519.5	340.0	0.659
20	293.2	2	202.6	37.4	0.131
		5	506.5	111.2	0.310
		8	810.4	138.3	0.340
		10	1013.0	165.0	0.400
		12	1215.6	202.0	0.451
		15	1519.5	255.1	0.506
30	303.2	2	202.6	30.0	0.107
		5	506.5	75.2	0.235
		8	810.4	107.1	0.303
		10	1013.0	135.1	0.353
		12	1215.6	162.0	0.393
		15	1519.5	207.4	0.520
40	313.2	2	202.6	20.0	0.075
		5	506.5	53.1	0.176
		8	810.4	80.3	0.245
		10	1013.0	105.2	0.301
		12	1215.6	130.3	0.350
		15	1519.5	160.1	0.398

*Calculated by compiler.
**Volume of gas/cm^3, reduced to 273.15 K and 101.3 kPa, absorbed by 1 g of solvent.

Auxiliary Information

Method/Apparatus/Procedure:
The method was described in Ref. 1.

Source and Purity of Materials:
No information.

Estimated Error:
No information.

References:
[1]E. R. Shenderei, Ya. D. Zel'venskii, and F. P. Ivanovskii, Khim. Prom. (**5**), 370 (1960).

Components:
(1) Ethyne; C_2H_2; [74-86-2]
(2) 1-Methyl-2-pyrrolidinone; C_5H_9NO; [872-50-4]

Original Measurements:
L. Lorenz, (Badische Anilin), Patent Ger855552, 1952; Patent US2599649, 1952, Patent Brit689444, 1953.

Variables:
T/K = 293

Prepared By:
P. G. T. Fogg

Experimental Data

t/°C	T/K*	Bunsen coefficient*	Ostwald coefficient	x_1
20	293.15	36.3	39.0	0.125

*Calculated by the compiler.

Auxiliary Information

No information.

Components:
(1) Ethyne; C_2H_2; [74-86-2]
(2) 1-Methyl-2-pyrrolidinone; C_5H_9NO; [872-50-4]

Original Measurements:
H. Lagarde and J. Cambon, Soud. Tech. Conn. **9**, 7–11 (1955).

Variables:
T/K = 288.15 K; p_1 /kPa = 202 – 3346

Prepared By:
P. G. T. Fogg

Experimental Data
T = 288.15 K

p_1 /kg cm^{-2}	p_1 /kPa*	Solubility** V_{gas}/V_{solv}	x_1	p_1 /kg cm^{-2}	p_1 /kPa*	Solubility** V_{gas}/V_{solv}	x_1
2.06	202	33.50	0.216	16.57	1625	20.90	0.614
4.40	431	27.05	0.327	19.45	1907	20.92	0.659
10.16	996	21.92	0.489	25.40	2491	22.80	0.748
14.70	1442	20.20	0.572	26.50	2599	23.50	0.765
15.35	1505	20.40	0.586	34.12	3346	39.13	0.890

*Calculated by the compiler.
**Volume of gas, measured at 101.3 kPa and 288.15 K, dissolved by 1 vol of pure solvent at 288.15 K and the partial pressure of acetylene specified.
‡Mass of dissolved gas divided by the increase in volume of the liquid.

Auxiliary Information

Method/Apparatus/Procedure:
The apparatus consisted of a light alloy cylinder fitted with a narrow bore glass gauge to measure the height of liquid and also a pressure gauge. A measured quantity of solvent was introduced followed by ethyne. The weight of gas introduced was found from the increase in weight of the cylinder and contents. The cylinder and contents were held in a thermostat bath. When equilibrium was attained the final pressure was recorded. The height of liquid in the glass gauge was measured with a cathetometer to determine the increase in volume of the liquid phase.

Source and Purity of Materials:
(1) Purified by distillation; less than 0.05% of impurities.
(2) Pure industrial solvent; gaseous impurities removed under vacuum.

Estimated Error:
δT/K = ±0.002 (authors).

Components:
(1) Ethyne; C_2H_2; [74-86-2]
(2) 1-Methyl-2-pyrrolidinone, (*N-methylpyrrolidone*); C_5H_9NO; [872-50-4]
(3) Water; H_2O;[7732-18-5]

Original Measurements:
E. R. Shenderei and F. P. Ivanovskii, Khim. Prom. (**2**), 91–97 (1963).

Variables:
T/K = 273.15–298.15;
p_1 /kPa = 13.3–101.3;
mol% water = 0 – 55.7.

Prepared By:
P. G. T. Fogg and A. Skrzecz

Experimental Data

Mol % water before C_2H_2 added	t/°C	T/K	p_1 /mm Hg	p_1 /kPa	Gas solubility* /cm^3 g^{-1}	x_1**
0	0	273.15	100	13.3	12.65	0.0535
			300	40.0	32.10	0.1255
			500	66.7	48.20	0.1773
			760	101.3	65.00	0.2252
0	5	278.15	100	13.3	10.05	0.0430
			300	40.0	26.57	0.1062
			500	66.7	40.30	0.1527
			760	101.3	56.62	0.2021
0	10	283.15	100	13.3	8.25	0.0356
			300	40.0	22.90	0.0929
			500	66.7	35.30	0.1363
			760	101.3	49.25	0.1805
0	15	288.15	100	13.3	6.25	0.0272
			300	40.0	18.45	0.0762
			500	66.7	29.70	0.1173
			760	101.3	42.25	0.1589
0	25	298.15	100	13.3	4.97	0.0217
			300	40.0	14.26	0.0600
			500	66.7	22.45	0.0912
			760	101.3	32.38	0.1265
10.4	0	273.15	100	13.3	9.95	0.0391
			300	40.0	26.10	0.0965
			500	66.7	39.30	0.1385
			760	101.3	54.70	0.1829
10.4	5	278.15	100	13.3	8.78	0.0347
			300	40.0	23.10	0.0864
			500	66.7	35.40	0.1265
			760	101.3	48.80	0.1664
10.4	10	283.15	100	13.3	7.27	0.0289
			300	40.0	19.30	0.0732
			500	66.7	30.10	0.1097
			760	101.3	41.65	0.1456
10.4	15	288.15	100	13.3	6.06	0.0242
			300	40.0	16.65	0.0638
			500	66.7	26.00	0.0962
			760	101.3	36.70	0.1306
10.4	25	298.15	100	13.3	4.12	0.0166
			300	40.0	11.70	0.0457
			500	66.7	18.60	0.0707
			760	101.3	26.70	0.0985
24.1	0	273.15	100	13.3	8.50	0.0296
			300	40.0	22.35	0.0743
			500	66.7	34.40	0.1099
			760	101.3	47.30	0.1452
24.1	5	278.15	100	13.3	7.35	0.0257
			300	40.0	19.55	0.0656

			500	66.7	30.30	0.0981
			760	101.3	42.30	0.1319
24.1	10	283.15	100	13.3	5.81	0.0204
			300	40.0	15.78	0.0536
			500	66.7	25.30	0.0833
			760	101.3	35.80	0.1139
24.1	15	288.15	100	13.3	5.04	0.0178
			300	40.0	14.05	0.0480
			500	66.7	22.18	0.0738
			760	101.3	31.70	0.1022
24.1	25	298.15	100	13.3	3.51	0.0130
			300	40.0	10.15	0.0366
			500	66.7	16.20	0.0571
			760	101.3	23.60	0.0811
37.8	0	273.15	100	13.3	6.17	0.0187
			300	40.0	17.10	0.0502
			500	66.7	27.07	0.0772
			760	101.3	38.20	0.1056
37.8	5	278.15	100	13.3	5.28	0.0161
			300	40.0	14.95	0.0442
			500	66.7	23.52	0.0677
			760	101.3	33.65	0.0942
37.8	10	283.15	100	13.3	4.37	0.0133
			300	40.0	12.30	0.0366
			500	66.7	19.71	0.0574
			760	101.3	28.45	0.0808
37.8	15	288.15	100	13.3	3.74	0.0114
			300	40.0	10.65	0.0319
			500	66.7	17.10	0.0502
			760	101.3	24.80	0.0712
55.7	0	273.15	100	13.3	3.05	0.0074
			300	40.0	9.01	0.0215
			500	66.7	14.85	0.0349
			760	101.3	22.00	0.0508
55.7	5	278.15	100	13.3	2.64	0.0064
			300	40.0	7.71	0.0184
			500	66.7	12.75	0.0301
			760	101.3	18.85	0.0439
55.7	10	283.15	100	13.3	2.25	0.0054
			300	40.0	6.73	0.0161
			500	66.7	11.00	0.0261
			760	101.3	16.55	0.0387
55.7	15	288.15	100	13.3	1.99	0.0048
			300	40.0	5.82	0.0140
			500	66.7	9.66	0.0230
			760	101.3	14.55	0.0342

*Volume of gas, reduced to 273.15 K and 101.3 kPa, dissolved by 1 g of solvent.
**Moles of ethyne/(moles of ethyne+1-methyl-2-pyrrolidinone+water); recalculated by compiler.

Auxiliary Information

Method/Apparatus/Procedure:
Experimental method given in Ref. 1.

Source and Purity of Materials:
(2) Boiling point=206 °C (760 mm Hg) ρ=1.0220 g cm^{-3}; n_D^{20}=1.4700; η(20 °C)=1.84×10^{-3} Pa s.

Estimated Error:
No information.

References:
[1]E. R. Shenderei, Ya. D. Zel'vensky, and F. P. Ivanovskii, Gaz. Prom. (**12**), 36 (1958).

Components:
(1) Ethyne; C_2H_2; [74-86-2]
(2) Carbon dioxide; CO_2; [124- 38-9]
(3) Nitrogen; N_2; [7727-37-9]
(4) 1-Methyl-2-pyrrolidinone, (*N-methylpyrrolidone*); C_5H_7NO; [872-50-4]

Original Measurements:
Yu. A. Demidova and V. M. Shleinikov, Izv. Vyssh. Uchebn. Zaved., Khim., Khim. Technol. **15** (7), 1000–1003 (1972).

Variables:
T/K=253–293;
p_1 /kPa=60–112;
p_2 /kPa=4–61;
p_3 /kPa=719–1348

Prepared By:
Yu. P. Yampolskii

Experimental Data

p_1 /atm	p_1 /kPa	p_2 /atm	p_2 /kPa	p_3 /atm	p_3 /kPa	t/°C	T/K*	S/cm^3 g^{-1}**	x_1
1.11	112	0.60	61	13.3	1348	−20	253.2	133.2	0.369
						−10	263.2	97.3	0.299
						0	273.2	72.3	0.241
						20	293.2	44.1	0.162
0.89	90	0.48	49	10.6	1074	−20	253.2	110.2	0.326
						−10	263.2	84	0.269
						0	273.2	61.4	0.212
						20	293.2	36.4	0.138
0.74	75	0.04	4	9.2	932	−20	253.2	99.8	0.304
						−10	263.2	70.6	0.236
						0	273.2	49.4	0.178
						20	293.2	29.6	0.115
0.59	60	0.32	32	7.1	719	−20	253.2	87.1	0.276
						−10	263.2	61.9	0.213
						0	273.2	42.4	0.157
						20	293.2	21.6	0.086

*Compiler.
**Volume of gas (reduced to 273.15 K and 101.3 kPa)/mass of solvent.

Auxiliary Information

Method/Apparatus/Procedure:
A dynamic method of measurement of solubility was used as described in Refs. 1 and 2.

Source and Purity of Materials:
No information.

Estimated Error:
$\delta S/S$=5%–7%.

References:
[1]I. P. Usyukin, V. M. Shleinikov, A. V. Timofeev, and G. N. Shchekina, Nefeper. Neftekhim. (**11**), 35 (1963).
[2]V. N. Kiriyakov, I. P. Usyukin, V. M. Shleinikov, Gaz. Prom. (**10**), 49 (1965).

Components:
(1) Ethyne; C_2H_2 ; [74-86-2]
(2) 1-Methyl-2-pyrrolidinone, (*N-methyl-2-pyrrolidone*); C_5H_9NO; [872-50-4]
(3) Naphthalene; $C_{10}H_8$; [91-20-3]
(4) Water; H_2O; [7732-18-5]
(5) Acetic acid; $C_2H_4O_2$; [64-19-7]

Original Measurements:
V. A. Granzhan and V. V. Kvasova, Zh. Fiz. Khim. **50**(6) 1630 (1976); [VINITI 721-76, deposited from 11th March, 1976].

Variables:
T/K=273.2–313.2; P/kPa=13.3–93.3; Mass % of 3,4, or 5=0–10.6,

Prepared By:
Yu. P. Yampolskii

Experimental Data

Mass %[3]	Mass %[4]	Mass %[5]	t/ °C	T/K*	K**	A**	x_1 at p_1=760 mm Hg
0	0	0	0	273.2	1856	1.3462	0.2121
			20	293.2	4035	1.1117	0.1337
			40	313.2	9029.7	0	0.0842
5	0	0	0	273.2	2098	1.2273	0.2037
			20	293.2	5254	0.7987	0.1167
			40	313.2	9611.8	0	0.0791
10	0	0	0	273.2	2774	1.1115	0.1750
			20	293.2	5381	0.7588	0.1154
			40	313.2	11020	0	0.0690
5.09	5.07	0	0	273.2	3914	1.2101	0.1338
			20	293.2	9183	0	0.0828
			40	313.2	14113	0	0.0539
10.03	5.08	0	0	273.2	3873	1.1143	0.1378
			20	293.2	9627	0	0.0789
			40	313.2	15200	0	0.0500
0	4.99	2.03	0	273.2	4255	1.2570	0.1246
			20	293.2	9161	0	0.0830
			40	313.2	16058	0	0.0473
0	10.56	2.03	0	273.2	9080	0	0.0837
			20	293.2	14855	0	0.0512
			40	313.2	24475	0	0.0311
0	10.18	8.25	0	273.2	9331	0	0.0814
			20	293.2	15438	0	0.0492
			40	313.2	23565	0	0.0323

*Calculated by compiler.
**The authors fitted data to equations of the form: $\log_{10}\{(P/\text{mm Hg})/x_1\}=\log_{10} K+Ax_1$. Values of K and of A are given above. The editor has assumed that concentration of 3, 4, and 5 correspond to the mixed solvent before dissolution of ethyne.

Auxiliary Information

Method/Apparatus/Procedure:
The experimental technique was described in Ref. 1.

Source and Purity of Materials:
No information.

Estimated Error:
No information.

References:
[1]G. E. Braude and S. F. Shakhova, Khim. Prom (**3**), 177 (1961).

Components:
(1) Ethyne; C_2H_2 ; [74-86-2]
(2) 1,5-Dimethylpyrrolidinone; $C_6H_{11}NO$

Original Measurements:
B. Ryutani, Nippon Kagaku Zasshi **81**, 1192–1201 (1960).

Variables:
T/K=253.15–293.15; P/kPa=395–1429

Prepared By:
Sim-wan Annie Bligh and P. G. T. Fogg

Experimental Data

t/ °C	T/K	P/atm	P/kPa*	S* (cm^3 g^{-1})	x_1*	Density/g cm^{-3} Solvent	Density/g cm^{-3} Solution	ΔV^b (cm^3 g^{-1})
20	293.15	3.9	395	50.8	0.2059	1.0028	0.8925	0.190
		6.8	689	108.4	0.3563		0.8765	0.289
		9.7	983	152.6	0.4379		0.8574	0.378
		12.6	1277	197.3	0.5018		0.8402	0.469
		14.1	1429	224.9	0.5345		0.8338	0.519
10	283.15	3.9	395	90.0	0.3148	1.0114	0.9053	0.233
		6.8	689	176.7	0.4743		0.9023	0.350
		9.7	983	235.9	0.5463		0.8788	0.499
		12.6	1277	299.8	0.6048		0.8576	0.588
0	273.15	3.9	395	146.8	0.4284	1.0200	0.9244	0.288
		6.8	689	222.8	0.5322		0.8909	0.436
		9.7	983	302.4	0.6069		0.8700	0.577
		12.6	1277	403.8	0.6734		0.8512	0.751
−10	263.15	3.9	395	201.6	0.5072	1.0287	0.8967	0.407
		6.8	689	289.8	0.5967		0.8567	0.592
		9.7	983	401.2	0.6719		0.8285	0.803
		12.6	1277	550.4	0.7375		0.7933	1.103
−20	253.15	3.9	395	239.3	0.5499	1.0376	0.8806	0.491
		6.8	689	377.8	0.6586		0.8423	0.750
		9.7	983	565.0	0.7426		0.7992	1.118
		11.2	1135	737.7	0.7902		0.7672	1.469
		12.6	1277	881.8	0.8182		0.7190	1.867

*Calculated by the compiler.
[a]S is the volume/cm^3 of gas, corrected to 273.15 K and 101.3 kPa, dissolved by the weight/g of solvent.
[b]ΔV is the change in volume of the liquid due to dissolution of gas.

Auxiliary Information

Method/Apparatus/Procedure:
Absorption was measured by a static method. Densities of saturated solutions were measured by the balancing column method[1] in which saturated solution and mercury in one side of a U-tube were balanced against mercury in the other side of the U-tube with both sides of the tube subject to the same pressure of gas. Heights of liquid columns were measured by a traveling microscope.

Source and Purity of Materials:
(1) Dried with silica gel; purity 99.5%–99.6%
(2) Boiling point 102.7 °C (24 mm Hg); n_D^{20} 1.4642.

Estimated Error:
No information.

References:
[1]Weissberger, *Technique of Organic Chemistry*, Physical Methods, Part I (Interscience, New York, 1949). Vol. I. p. 285.

Components:
(1) Ethyne; C_2H_2 ; [74-86-2]
(2) 2.1-(1′-Pyrrolidylcarbonyl)-pyrrolidine; $C_9H_{16}ON_2$

Original Measurements:
R. A. Franz, Patent US2868328, 1959.

Variables:
T/K = 298

Prepared By:
P. G. T. Fogg

Experimental Data

t/ °C	T/K	Bunsen coefficient*	Ostwald coefficient	x_1*
25	298.15	17.0	18.6	0.107

*Calculated by the compiler.

Auxiliary Information

No information.

Components:
(1) Ethyne; C_2H_2 ; [74-86-2]
(2) *N,N*-Dimethylacetamide; C_4H_9NO; [127-19-5]

Original Measurements:
V. A. Granzhan, V. V. Kvasova, and V. I. Seraya, Zh. Fiz. Khim. **49**, 811 (1975); [VINITI 2939-74; deposited from 25th November, 1974].

Variables:
T/K = 253.2–303.2;
p_1 /kPa = 12–100

Prepared By:
Yu. P. Yampolskii

Experimental Data

t/ °C	T/K*	p_1 /mm Hg	p_1 /kPa*	S**/cm^3 g^{-1}	x_1
−20	253.2	106	14.1	21.06	0.0757
		187	24.9	33.55	0.1153
		243	32.4	39.89	0.1342
		303	40.4	47.51	0.1558
		423	56.4	59.53	0.1879
		504	67.2	68.95	0.2113
		518	69.1	69.22	0.2120
		626	83.5	79.63	0.2363
0	273.2	93	12.4	7.99	0.0301
		178	23.7	14.40	0.0530
		187	24.9	15.98	0.0585
		276	36.8	22.21	0.0794
		330	44.0	26.15	0.0922
		414	55.2	31.86	0.1102
		619	82.5	46.21	0.1522
		712	94.9	51.02	0.1654
		745	99.3	53.10	0.1710
30	303.2	121	16.1	3.97	0.0152
		262	34.9	8.32	0.0313
		327	43.6	10.22	0.0382
		366	48.8	11.20	0.0417
		403	53.7	12.51	0.0464
		421	56.1	13.36	0.0494
		462	61.6	14.79	0.0544
		514	68.5	16.77	0.0612
		669	89.2	21.56	0.0773
		734	97.9	23.59	0.0840

*Calculated by compiler.
**Volume of gas, reduced to 273.15 K and 101.3 kPa, dissolved by 1 g of solvent.

Auxiliary Information

Method/Apparatus/Procedure:
The method of solubility measurement and gas pretreatment are described in Refs. 1 and 2.

Source and Purity of Materials:
(2) Purified by distillation; 99% pure (gas chromatography); ρ^{20} = 0.9434 g cm^{-3}; η = 1.07 mPa s.

Estimated Error:
No information.

References:
[1]G. E. Braude and S. F. Shakhova, Khim. Prom. 1961 (**3**), 177 (1961).
[2]V. A. Granzhan, O. G. Kirillova, N. Z. Pin'kovskaya, Zh. Prikl. Khim. **42**, 2381 (1969).

Components:
(1) Ethyne; C_2H_2 ; [74-86-2]
(2) 1,1,3,3-Tetramethylurea, (*tetramethylcarbamide*); $C_5H_{12}N_2O$; [632-22-4]

Original Measurements:
G. Schay, Gy. Szekely, Gy. Racz, and G. Traply, Periodica Polytech. **2**, 1–24 (1958).

Variables:
T/K = 273.15, 333.15;
p_1 /kPa = 101.3

Prepared By:
P. G. T. Fogg

Experimental Data

t/ °C	T/K	p_1 /mm Hg	p_1 /kPa	Volume of gas absorbed*/cm^3 g^{-1}	Mole fraction solubility, x_1
25	298.15	760	101.3	28.3	0.1292
60	333.15	760	101.3	10.8	0.0536

*Volumes of gas were reduced to 273.15 K and 101.3 kPa.

Auxiliary Information

Method/Apparatus/Procedure:
Static methods were used. For measurements above room temperature condensation of solvent vapor in the cooler parts of the system was reduced by use of capillary tubes to connect parts of the apparatus. In addition the pressure was measured by a null method. A magnetic stirrer was used to stir the solvent in the absorption cell.

Source and Purity of Materials:
No information.

Estimated Error:
No information.

Components:
(1) Ethyne; C_2H_2 ; [74-86-2]
(2) 3-Methyl-1*H*-pyrazole; $C_4H_6N_2$; [1453-58-3]

Original Measurements:
V. A. Granzhan, V. I. Seraya, R. Ya. Mushchii, and V. V. Kvasova, Khim. Tekhnol. (Kiev) **(5)**, 23–25 (1975).

Variables:
T/K = 293–313

Prepared By:
A. Skrzecz, and P. G. T. Fogg

Experimental Data

t/ °C	T/K	H/Torr	H/kPa$_1$*	H/(Torr/g cm^{-3})	x_1 at p_1 = 101.3 kPa*
20	293.2	58884	7851	212.39	0.012 91
30	303.2	87648	11685	318.25	0.008 67
40	313.2	116098	15478	426.30	0.006 55

*Calculated by the compiler.

The authors found that experimental data fitted the equation:

$$\log_{10}(H/\text{Torr}) = 9.40 - 1355.3/(T/\text{K}).$$

Auxiliary Information

Method/Apparatus/Procedure:
The procedure for solubility measurements was described in Ref. 1. In the measured range of the temperatures and pressures gas solubility satisfy Henry's law. Henry's constants were reported in two types of units. No more details were reported in the paper.

Source and Purity of Materials:
No information.

Estimated Error:
No information.

References:
[1]V. A. Granzhan, O. G. Kirillova, and N. Z. Pin'kovskaya, Zh. Prikl. Khim. **42**, 2381 (1969).

Components:
(1) Ethyne; C_2H_2 ; [74-86-2]
(2) 3-Methyl-1 *H*-pyrazole; $C_4H_6N_2$; [1453-58-3]
(3) Water; H_2O; [7732-18-5]

Original Measurements:
V. A. Granzhan, V. I. Seraya, R. Ya. Mushchii, and V. V. Kvasova, Khim. Tekhnol. (Kiev) **(5)**, 23–25 (1975).

Variables:
T/K = 293–313

Prepared By:
A. Skrzecz and P. G. T. Fogg

Experimental Data

t/ °C	T/K	x_3 †	H/Torr	H/(Torr/g cm^{-3})	x_1 at p_1 = 760 Torr*
0	273.2	0.1035	48640	166.34	0.01563
		0.1672	56952	179.08	0.01334
		0.3454	76912	206.06	0.00988
20	293.2	0	58884	212.39	0.01291
		0.1035	75862	254.13	0.01002
		0.1672	90316	287.32	0.00841
		0.3454	119400	317.46	0.00637
30	303.2	0	87648	318.25	0.00867
		0.1035	100096	346.03	0.00759
		0.1672	129360	399.71	0.00588
		0.3454	155250	423.40	0.00490

*Calculated by the compiler.
†Before addition of gas.

The authors found that experimental data fitted the equations:
$\log_{10}(H/\text{Torr}) = 7.78 - 847.3/(T/\text{K})$ at $x_3 = 0.1035$
$\log_{10}(H/\text{Torr}) = 8.23 - 952.2/(T/\text{K})$ at $x_3 = 0.1672$
$\log_{10}(H/\text{Torr}) = 7.91 - 827.8/(T/\text{K})$ at $x_3 = 0.3454$

Auxiliary Information

Method/Apparatus/Procedure:
The procedure for solubility measurements was described in Ref. 1. In the measured range of temperatures and pressures gas solubility satisfy Henry's law. Henry's constants were reported in two types of units. No more details were reported in the paper.

Source and Purity of Materials:
No information.

Estimated Error:
No information.

References:
[1]V. A. Granzhan, O. G. Kirillova, and N. Z. Pin'kovskaya, Zh. Prikl. Khim. **42**, 2381 (1969).

Components:
(1) Ethyne; C_2H_2 ; [74-86-2]
(2) 1,3-Dimethyl-1 *H*-pyrazole; $C_5H_8N_2$; [694-48-4]
(3) 1,5-Dimethyl-1 *H*-pyrazole; $C_5H_8N_2$; [694-31-5]

Original Measurements:
V. A. Granzhan, V. I. Seraya, R. Ya. Mushchii, and V. V. Kvasova, Khim. Tekhnol. (Kiev) **(5)**, 23–25 (1975).

Variables:
T/K = 273–303

Prepared By:
A. Skrzecz and P. G. T. Fogg

Experimental Data
The solvent was an equimolar mixture of 2 and 3.

t/ °C	T/K	H/Torr	H/(Torr/g cm^{-3})	x_1 at p_1 = 760 Torr*
0	273.2	8968.6	35.11	0.08474
20	293.2	14662	59.44	0.05183
30	303.2	18105	74.29	0.04198

*Calculated by the compiler.

The authors found that experimental data fitted the equation:
$$\log_{10}(H/\text{Torr}) = 7.04 - 842.72/(T/\text{K}).$$

Auxiliary Information

Method/Apparatus/Procedure:
The procedure for solubility measurements was described in Ref. 1. In the measured range of temperatures and pressures gas solubility satisfy Henry's law. Henry's constants were reported in two types of units. No more details were reported in the paper.

Source and Purity of Materials:
No information.

Estimated Error:
No information.

References:
[1]V. A. Granzhan, O. G. Kirillova, and N. Z. Pin'kovskaya, Zh. Prikl. Khim. **42**, 2381 (1969).

Components:
(1) Ethyne; C_2H_2 ; [74-86-2]
(2) Organic nitrogen compounds

Original Measurements:
W. S. Dorsey, (Union Oil of California) Patent U.S.2670810, 1954.

Variables:
T/K = 297

Prepared By:
P. G. T. Fogg

Experimental Data

t/ °C	T/K*	Bunsen coefficient	Ostwald coefficient	x_1*
1-Formylpyrrolidine, (*N-formylpyrrolidine*); C_5H_9NO				
24	296.95	19.7	21.4	0.075
1-Formylpiperidine, (*N-formylpiperidine*); $C_6H_{11}NO$; [2591-86-8]				
24	297.15	13.8	15	0.061
1-Acetylpyrrolidine, (*N-acetylpyrrolidine*); $C_6H_{11}NO$				
24	296.85	22.5	24.4	0.107
1-Acetylpiperidine, (*N-acetylpiperidine*); $C_7H_{13}NO$; [618-42-8]				
24	296.95	19.1	20.8	0.099

*Calculated by the compiler.

Auxiliary Information

No information.

Components:
(1) Ethyne; C_2H_2 ; [74-86-2]
(2) Organic solvents containing nitrogen

Original Measurements:
Patent literature as indicated below.

Variables:
T/K = 273–303

Prepared By:
P. G. T. Fogg

Experimental Data

t/°C	T/K*	Bunsen coefficient	Ostwald coefficient	x_1*
N-Nitrosodimethylamine; $C_2H_6N_2O$; [62-75-9]				
M. Levine and R. M. Isham, Patent US2623611, 1952; Patent US2703154, 1955				
30	303.15	13.1*	14.6	0.042
Ethylenediamine; $C_2H_8N_2$; [107-15-3]				
W. T. Nelson, Patent US2779458, 1957				
25	298.15	13.4	14.6*	0.039
Dimethylcyanamide; $C_3H_6N_2$; [1467-79-4]				
W. T. Nelson, Patent US2795322, 1957				
0	273.1	24.5	24.5	
30	303.15	11.72	13	
1-Methyl-2-pyridinone, (*N-Methyl-2-pyridone*); C_6H_7NO				
W. T. Nelson, Patent US2849396, 1958				
0	273.15	29.1	29.1*	0.11
30	303.15	12	13.3*	0.05
1-Methyl-1*H*-pyrrole, (*N-Methylpyrrole*); C_5H_7N; [96-54-8]				
W. T. Nelson, Patent US2859833, 1958				
25	298.15	7.3	8.0*	0.028
1,1-Dimethylhydrazine; $C_2H_8N_2$; [57-14-7]				
W. T. Nelson, Patent, US2926750, 1960				
0	273.15	33.4	33.4	0.059

*Calculated by the compiler.

Auxiliary Information

No information.

Components:
(1) Ethyne; C_2H_2; [74-86-2]
(2) *N*-Methyl caprolactam; $C_7H_{13}NO$; [2556-73-2]

Original Measurements:
V. A. Granzhan, V. V. Kvasova, and V. I. Seraya, Zh. Fiz. Khim. **49**, 811 (1975); VINITI 2939-74; deposited from 25th November, 1974.

Variables:
T/K = 253.2–313.2;
p_1 /kPa = 25–104

Prepared By:
Yu.P. Yampolskii

Experimental Data

t/°C	T/K*	p_1 /mm Hg	p_1 /kPa*	x_1	S**/cm^3 g^{-1}
0	273.2	206	27.46	0.0622	12.30
		290.5	38.73	0.0877	16.96
		381.5	50.86	0.1022	21.17
		430.5	57.40	0.1194	23.92
		465	61.99	0.1270	25.62
		490.5	65.39	0.1307	26.52
		577	76.93	0.1516	30.81
		636.5	84.86	0.1653	34.93
		681	90.79	0.1706	36.28
		730	97.33	0.1828	39.46
20	293.2	191	25.46	0.0322	5.86
		277.5	37.00	0.0466	8.62
		317	42.26	0.0514	9.56
		441	58.80	0.0709	13.47
		465.5	62.06	0.0762	14.55
		516	68.79	0.0842	16.21
		605.5	80.73	0.0966	18.86
		665	88.66	0.1053	20.75
		712	94.93	0.1128	22.43
		777	103.59	0.1222	24.54
40	313.2	209.5	27.93	0.0217	3.92
		295.5	39.40	0.0312	5.67
		329.5	43.93	0.0348	6.35
		414.5	55.26	0.0428	7.88
		445.5	59.40	0.0453	8.37
		482.5	64.33	0.0499	9.27
		544	72.53	0.0552	10.20
		646.5	86.19	0.0668	12.63
		699.5	93.26	0.0732	13.92
		724	96.53	0.0729	13.87
		784.5	104.59	0.0787	15.07

*Calculated by compiler.
**Volume of gas, reduced to 273.15 K and 101.3 kPa, dissolved by 1 g of solvent.

Auxiliary Information

Method/Apparatus/Procedure:
The method of solubility measurement and gas pretreatment are described in Refs. 1 and 2.

Source and Purity of Materials:
(2) ρ^{20} = 1.0115 g cm^{-3};
η^{20} = 5.64 mPa s.

Estimated Error:
No information.

References:
[1]G. E. Braude and S. F. Shakhova, Khim. Prom. (**3**), 177 (1961).
[2]V. A. Granzhan, O. G. Kirillova, and N. Z. Pin'kovskaya, Zh. Prikl. Khim. **42**, 2381 (1969).

Components:
(1) Ethyne; C_2H_2 ; [74-86-2]
(2) 2-Methyl-5-ethylpyridine; $C_8H_{11}N$; [104-90-5]

Original Measurements:
B. Ryutani, Nippon Kagaku Zasshi **81**, 1192–1201 (1960).

Variables:
T/K = 253.15–273.15;
P/kPa = 395–1479

Prepared By:
Sim-wan Annie Blight and P. G. T. Fogg

Experimental Data

t/°C	T/K	P/atm	P/kPa*	S^a (cm^3 g^{-1})	x_1*	density/g cm^{-3} Solvent	density/g cm^{-3} Solution	ΔV^b (cm^3 g^{-1})
0	273.15	3.9	395	70.5	0.2782	0.9372	0.9009	0.135
		6.8	689	114.8	0.3856		0.8761	0.228
		9.7	983	171.4	0.4838		0.8575	0.334
		12.6	1277	229.9	0.5569		0.8337	0.456
−10	263.15	3.9	395	92.7	0.3363	0.9462	0.9037	0.17
		6.8	689	169	0.4802		0.886	0.296
		9.7	983	247.5	0.575		0.8583	0.447
		12.6	1277	346.9	0.6548		0.8113	0.678
		14.6	1479	415.8	0.6945		0.8062	0.789
−20	253.15	3.9	395	99	0.3512	0.9553	0.8818	0.219
		6.8	689	185.4	0.5034		0.8492	0.387
		9.7	983	327.8	0.6418		0.8135	0.656
		12.6	1277	467.6	0.7188		0.7701	0.964

*Calculated by the compiler.
[a]S is the volume/cm^3 of gas, corrected to 273.15 K and 101.3 kPa, dissolved by the weight/g of solvent.
[b]ΔV is the change in volume of the liquid due to dissolution of gas.

Auxiliary Information

Method/Apparatus/Procedure:
Absorption was measured by a static method. Densities of saturated solutions were measured by the balancing column method[1] in which saturated solution and mercury in one side of a U-tube were balanced against mercury in the other side of the U-tube with both sides of the tube subject to the same pressure of gas. Heights of liquid columns were measured by a traveling microscope. Details are given in Ref. 2.

Source and Purity of Materials:
(1) Dried with silica gel; purity 99.5%–99.6%.
(2) Boiling point 74.5 °C (20 mm Hg) n_D^{20} 1.4984.

Estimated Error:
δT/K = ±0.1 (author).

References:
[1]Weissberger, *Technique of Organic Chemistry* Physical Methods, Part I (Interscience, New York, 1949), Vol. I, p. 285.
[2]B. Ryutani, Nippon Kagaku Zasshi **80**, 1407 (1959).

Components:
(1) Ethyne; C_2H_2 ; [74-86-2]
(2) 4-Morpholinecarboxaldehyde, (*N-formylmorpholine*); $C_5H_9NO_2$; [4394-85-8]

Original Measurements:
B. Ryutani, Nippon Kagaku Zasshi **81**, 1192–1201 (1960).

Variables:
T/K = 263.15–303.15;
P/kPa = 395–1479

Prepared By:
Sim-wan Annie Blight and P. G. T. Fogg

Experimental Data

t/°C	T/K	P/atm	P/kPa*	S^a (cm^3 g^{-1})	x_1*	Density/g cm^{-3} Solvent	Density/g cm^{-3} Solution	ΔV^b (cm^3 g^{-1})
30	303.15	6.8	689	46.2	0.1935	1.144	1.024	0.155
		9.7	983	71.8	0.2716		1.0005	0.21
		12.6	1277	106	0.3551		0.9862	0.266
		14.6	1479	136.6	0.415		0.983	0.306
20	293.15	3.9	395	41.8	0.1784	solid	1.06	
		6.8	689	74.1	0.2779		1.0245	
		9.7	983	125.9	0.3954		1.0089	
		12.6	1277	149.4	0.4369		0.9672	
		14.6	1479	177.4	0.4796		0.9534	
10	283.15	3.9	395	57.4	0.2297	solid	1.053	
		6.8	689	111.4	0.3665		1.0165	
		9.7	983	153.6	0.4438		0.9762	
		12.6	1277	208.6	0.52		0.9429	
0	273.15	3.9	395	92.2	0.3238	solid	1.0583	
		6.8	689	149.1	0.4364		0.9966	
		9.7	983	202.7	0.5129		0.9459	
		12.6	1277	284.2	0.5961		0.9159	
−10	263.15	3.9	395	126.9	0.3973	solid	1.0477	
		6.8	689	222.2	0.5358		0.9933	
		9.7	983	312.4	0.6187		0.9349	
		12.6	1277	445.2	0.6981		0.8804	

*Calculated by the compiler.
[a]S is the volume/cm^3 of gas, corrected to 273.15 K and 101.3 kPa, dissolved by the weight/g of solvent.
[b]ΔV is the change in volume of the liquid due to dissolution of gas.

Auxiliary Information

Method/Apparatus/Procedure:
Absorption was measured by a static method. Densities of saturated solutions were measured by the balancing column method[1] in which saturated solution and mercury in one side of a U-tube were balanced against mercury in the other side of the U-tube with both sides of the tube subject to the same pressure of gas. Heights of liquid columns were measured by a traveling microscope. Details are given in Ref. 2.

Source and Purity of Materials:
(1) Dried with silica gel; purity 99.5%–99.6%.
(2) Boiling point 90.3 °C (4 mm Hg) n_D^{25} 1.4846.

Estimated Error:
δT/K = ±0.1 (author).

References:
[1]Weissberger, *Technique of Organic Chemistry* Physical Methods, Part I (Interscience, New York, 1949), Vol. I, p. 285.
[2]B. Ryutani, Nippon Kagaku Zasshi **80**, 1407 (1959).

Components:
(1) Ethyne; C_2H_2 ; [74-86-2]
(2) Tetrahydro-1,4-isoxazine, (*morpholine*); C_4H_9NO; [110-91-8].

Original Measurements:
B. Ryutani, Nippon Kagaku Zasshi **81**, 1192–1201 (1960).

Variables:
T/K = 253.15–283.15;
P/kPa = 395–1277

Prepared By:
Sim-wan Annie Blight and P. G. T. Fogg

Experimental Data

t/°C	T/K	P/atm	P/kPa*	S^a (cm^3 g^{-1})	x_1*	Density/g cm^{-3} Solvent	Density/g cm^{-3} Solution	ΔV^b (cm^3 g^{-1})
10	283.15	3.9	395	74.8	0.2272	1.0105	0.9361	0.173
		6.8	689	140.9	0.3564		0.9081	0.294
		9.7	983	220.7	0.4645		0.8899	0.425
		12.6	1277	298.6	0.5399		0.8678	0.567
0	273.15	3.9	395	105.2	0.2925	1.0213	0.9373	0.22
		6.8	689	191.7	0.4297		0.9004	0.381
		9.7	983	300.3	0.5413		0.8845	0.55
		11.7	1186	342.2	0.5736		0.8759	0.621
−10	263.15	3.9	395	174	0.4061	1.0323	0.9575	0.279
		6.8	689	283.1	0.5267		0.9052	0.493
		9.7	983	438.8	0.633		0.8672	0.768
		12.6	1277	550.1	0.6838		0.8439	0.971
−20	253.15	3.9	395	237.4	0.4827	1.0432	0.9526	0.383
		6.8	689	399.9	0.6112		0.8892	0.694
		9.7	983	651.3	0.7191		0.8176	1.199
		12.6	1277	969.6	0.7921		0.7313	1.965

*Calculated by the compiler.
[a]S is the volume/cm^3 of gas, corrected to 273.15 K and 101.3 kPa, dissolved by the weight/g of solvent.
[b]ΔV is the change in volume of the liquid due to dissolution of gas.

Auxiliary Information

Method/Apparatus/Procedure:
Absorption was measured by a static method. Densities of saturated solutions were measured by the balancing column method[1] in which saturated solution and mercury in one side of a U-tube were balanced against mercury in the other side of the U-tube with both sides of the tube subject to the same pressure of gas. Heights of liquid columns were measured by a traveling microscope. Experimental details are given in Ref. 2.

Source and Purity of Materials:
(1) Dried with silica gel; purity 99.5%–99.6%.
(2) Boiling point 128.1 °C (760 mm Hg) n_D^{20} 1.4540.

Estimated Error:
δT/K = ±0.1 (author).

References:
[1]Weissberger, *Technique of Organic Chemistry* Physical Methods, Part I (Interscience, New York, 1949), Vol. I, p. 285.
[2]B. Ryutani, Nippon Kagaku Zasshi **80**, 1407 (1959).

Components:
(1) Ethyne; C_2H_2 ; [74-86-2]
(2) Acetonitrile; C_2H_3N; [75-05-8]

Original Measurements:
British Oxygen Co. Ltd., reported by S. A. Miller, *Acetylene—Its Properties, Manufacture and Uses* (Academic, New York, 1965), Vol. I.

Variables:
T/K=273.15–313.15;
p_1 /kPa=506.6–3039.7

Prepared By:
P. G. T. Fogg

Experimental Data

t/°C	T/K	p_1 /atm	p_1 /kPa	Solubility /g kg^{-1} of solvent	Solubility /g dm^{-3} of solution	Mole fraction* of C_2H_2, x_1
0	273.15	5	506.6	218		0.2558
		10	1013.2	502		0.4418
		15	1519.9	959		0.6019
10	283.15	5	506.6	172		0.2133
		10	1013.2	373		0.3703
		15	1519.9	649		0.5057
		20	2026.5	1381		0.6853
15	288.15	15	1519.9		238	
20	293.15	5	506.6	139		0.1798
		10	1013.2	290		0.3138
		15	1519.9	478		0.4298
		20	2026.5	727		0.5341
		25	2533.1	1080		0.63
40	313.15	5	506.6	97		0.1326
		10	1013.2	192		0.2324
		15	1519.9	298		0.3197
		20	2026.5	419		0.3978
		25	2533.1	566		0.4716
		30	3039.7	745		0.5401

*Estimated by the compiler

The author states that the mole fraction solubility in the range 0–60 °C and 7–35 atm (709.3–3546.4 kPa) fits the equation:

$$x_1=(p_1/\text{atm})(a-b\ \log_{10}(p_1/\text{atm}))$$

where $\log_{10} a=630/(T/\text{K})-3.478$ $\log_{10} b=693/(T/\text{K})-4.173$.

Dilation, V/V_o, at 15 °C over the same pressure range was said to fit the equations:

$$V/V_0=0.992+1.46s$$

where s=wt of ethyne/wt of acetonitrile and $V/V_o=1+0.0312p_1/\text{atm}+0.00157(p_1/\text{atm})^2$.

Auxiliary Information

Method/Apparatus/Procedure:
No information.

Source and Purity of Materials:
No information.

Estimated Error:
No information.

Components:
(1) Ethyne; C_2H_2 ; [74-86-2]
(2) Ethylcarbamic acid, ethyl ester, (*N-ethylurethane*); $C_5H_{11}NO_2$; [623-78-9]

Original Measurements:
V. E. Azen, V. A. Granzhan, and O. G. Kirillova, Zh. Prikl. Khim. (Leningrad) **44**, 462–463 (1971).

Variables:
T/K=273–333

Prepared By:
A. Skrzecz and P. G. T. Fogg

Experimental Data

t/°C	T/K	H/Torr	H/kPa*	x_1 at p_1=101.3 kPa*
0	273.2	14493	1932	0.05244
20	293.2	20248	2700	0.03753
40	313.2	32414	4322	0.02345
60	333.2	53070	7075	0.01432

*Calculated by the compiler.

Auxiliary Information

Method/Apparatus/Procedure:
The method was described in Ref. 1. The solubility of ethyne was measured at partial pressures in the range 50–700 Torr. The authors stated that solubilities were consistent with Henry's law within the range of measurements. No more details were reported in the paper.

Source and Purity of Materials:
(1) Source not specified; purified as described in Ref. 1.
(2) Commercial samples; used as received; properties were described by the equations: $d/(\text{g cm}^{-3})=0.9981-0.009\ 45\times t/°\text{C}$ with correlation coefficient=1.000 and mean square deviation=0.0003;
$n_D=1.4301-0.000\ 418\times t/°\text{C}$ with correlation coefficient=1.000 and mean square deviation=0.000 04.

Estimated Error:
No information.

References:
[1]V. A. Granzhan, O. G. Kirillova, and N. Z. Pin'kovskaya, Zh. Prikl. Khim. (Leningrad) **49**, 2381 (1969).

Components:
(1) Ethyne; C_2H_2; [74-86-2]
(2) Diethylcarbamic acid ethyl ester, (*N,N-diethylurethane*); $C_7H_{15}NO_2$; [3553-80-8]

Original Measurements:
V. E. Azen, V. A. Granzhan, and O. G. Kirillova, Zh. Prikl. Khim. (Leningrad) **44**, 462–463 (1971).

Variables:
T/K = 273–333

Prepared By:
A. Skrzecz and P. G. T. Fogg

Experimental Data

t/°C	T/K	H/Torr	H/kPa*	x_1 at p_1 = 101.3 kPa*
0	273.2	4570	609	0.1663
20	293.2	8323	1110	0.0913
40	313.2	12605	1681	0.0603
60	333.2	21747	2899	0.0349

*Calculated by the compiler.

Auxiliary Information

Method/Apparatus/Procedure:
No information.

Source and Purity of Materials:
(1) Source not specified; purified as described in Ref. 1.
(2) Source not specified; distilled; the density fitted the equation:

$$\rho/(\text{g cm}^{-3}) = 0.9471 - 0.000\,995 \times t/°\text{C}$$

correlation coefficient = 1.000; mean square deviation = 0.000 16.

Estimated Error:
No information.

References:
[1]V. A. Granzhan, O. G. Kirillova, and N. Z. Pin'kovskaya, Zh. Prikl. Khim. (Leningrad) **49**, 2381 (1969).

Components:
(1) Ethyne; C_2H_2; [74-86-2]
(2) Glutaramide, N,N,N',N'-tetraethyl-; $C_9H_{18}N_2O_2$; [17642-87-4]

Original Measurements:
G. N. Freidlin and V. I. Bushinskii, Zh. Prikl. Khim. **43** (2), 385–391; J. Appl. Chem. USSR **43**, 390–395 (1970).

Variables:
T/K = 293.2–323.2;
p_1 /kPa = 13.3–101.3

Prepared By:
P. G. T. Fogg and A. Skrzecz

Experimental Data
T/K = 298.15.

t/°C	T/K	p_1 /mm Hg	p_1 /kPa*	Solubility** /cm^3 cm^{-3}	x_1	$K^\dagger$ /mm Hg	$K^\dagger$ /kPa*	$\beta^\dagger$
20	293.15	100	13.3	4.00	0.0423	2190	292	−0.412
		300	40.0	11.50	0.1131			
		500	66.7	19.20	0.1749			
		760‡	101.3	29.00	0.2347			
30	303.15	100	13.3	3.10	0.0333	2920	389	−0.299
		300	40.0	9.00	0.0909			
		500	66.7	15.00	0.1427			
		760‡	101.3	22.80	0.2029			
40	313.15	100	13.3	2.45	0.0267	3600	480	−0.280
		300	40.0	7.30	0.0757			
		500	66.7	12.15	0.1199			
		760‡	101.3	18.50	0.1721			
50	323.15	100	13.3	2.00	0.0221	4365	582	−0.213
		300	40.0	6.00	0.0635			
		500	66.7	10.10	0.1024			
		760‡	101.3	15.25	0.1470			

*Calculated by the compiler.
**Volume of gas absorbed, reduced to 273.15 K and 101.3 kPa, divided by the volume of solvent.
†Constants in the Krichevskii–Il'inskaya equation in the form $\log_{10}(p_1/x_1) = \log_{10} K - \beta(1 - x_2^2)$. The authors incorrectly give values of β as positive quantities.
‡Solubilities at 760 mm Hg are extrapolated values given by the authors.

Auxiliary Information

Method/Apparatus/Procedure:
A static method was used. About 4 cm^3 of solvent was introduced into the absorption vessel which was then cooled to −78 °C. The solvent was degassed under vacuum. The vessel was heated to the required temperature in a thermostat and the vapor pressure of the solvent recorded. Gas from a storage bulb was allowed to come in contact with the solvent which was stirred with a magnetic stirrer. When the system had reached equilibrium the decrease in pressure and final pressure of the gas was recorded.

Source and Purity of Materials:
(1) From a cylinder. Originally prepared from calcium carbide and purified by absorption in acetone at low temperature and collection of the middle fraction when the gas was desorbed.
(2) Tetraethylglutaramide used had the following properties: ρ^{20} = 0.9862 g cm^{-3} η_{20} = 48.0 cP.

Estimated Error:
$\delta x_1/x_1 = \pm 3\%$ (authors).

Components:

(1) Ethyne; C_2H_2; [74-86-2]
(2) Glutaramide, N,N,N',N'-tetraethyl-; $C_{13}H_{26}N_2O_2$; [17642-87-4]
(3) Water; H_2O; [7732-18-5]

Original Measurements:

G. N. Freidlin and V. I. Bushinskii, Zh. Prikl. Khim. **43**(2), 385–391; J. Appl. Chem. USSR **43**, 390–395 (1970).

Variables:

p_1 /kPa = 4.8–66.6;
T/K = 298.2;
$\%H_2O$ = 4.75–20.16.

Prepared By:

P. G. T. Fogg

Experimental Data

T/K = 298.15.

$\%H_2O$†	p_1 /mm Hg	p_1 /kPa*	Solubility‡ /cm^3 cm^{-3}	x_1*
4.75	36.8	4.91	1.26	0.000 342
4.75	74.3	9.90	1.87	0.000 216
4.75	111.8	14.91	2.60	0.000 300
4.75	172.7	23.02	3.64	0.000 420
4.75	229.2	30.55	4.85	0.000 560
4.75	280.6	37.42	5.71	0.000 34
4.75	327.5	43.67	6.58	0.000 69
4.75	383.7	51.16	7.53	0.001 038
4.75	477.1	63.61	8.87	0.001 602
9.36	41.2	5.49	1.00	0.002 125
9.36	59.9	7.98	1.30	0.002 601
9.36	111.4	14.85	2.17	0.003 034
9.36	162.9	21.71	3.03	0.003 553
9.36	219	29.20	3.94	0.004 414
9.36	284.6	37.94	5.06	0.000 281
9.36	354.6	47.28	6.10	0.000 409
9.36	415.6	55.41	7.22	0.000 76
9.36	499.5	66.59	8.26	0.001 111
20.16	36.2	4.83	0.65	0.001 493
20.16	59.6	7.94	1.00	0.001 939
20.16	111	14.79	1.77	0.002 416
20.16	181	24.13	2.77	0.002 83
20.16	255.8	34.1	3.93	0.003 399
20.16	321.1	42.81	4.84	0.000 152
20.16	400.3	53.37	5.83	0.000 251
20.16	470.5	62.73	6.96	0.000 467

†Assumed by the compiler to mean mass % of water before dissolution of gas.
*Calculated by the compiler.
‡Volume of gas absorbed, reduced to 273.15 K and 101.3 kPa, divided by the volume of solvent.

Values of solubility for various pressures were given in graphical form. The compiler used computer aided digitization to obtain numerical values.

Auxiliary Information

Method/Apparatus/Procedure:

A static method was used. About 4 cm^3 of solvent was introduced into the absorption vessel which was then cooled to −78 °C. The solvent was degassed under vacuum. The vessel was heated to the required temperature in a thermostat and the vapor pressure of the solvent recorded. Gas from a storage bulb was allowed to come in contact with the solvent which was stirred with a magnetic stirrer. When the system had reached equilibrium the decrease in pressure and final pressure of the gas was recorded.

Source and Purity of Materials:

(1) From a cylinder. Originally prepared from calcium carbide and purified by absorption in acetone at low temperature and collection of the middle fraction when the gas was desorbed.
(2) Tetraethylglutaramide used had the following properties: ρ^{20} = 0.9862 g cm^{-3}; η_{20} = 48.0 cP.

Estimated Error:

$\delta x_1 / x_1 = \pm 5\%$ (compiler).

Components:
(1) Ethyne; C_2H_2; [74-86-2]
(2) Formic hexamethyleneamide; $C_8H_{16}O_2N_2$
(3) Water; H_2O; [7732-18-5]

Original Measurements:
V. A. Granzhan, O. G. Kirillova, and N. Z. Pin'kovskaya, Zhur. Prikl. Khim. **42**, 2381–2384 (1969); J. Appl. Chem. U.S.S.R. **42**, 2242–2244 (1969).

Variables:
T/K = 293.15–333.15;
p_1 /kPa = 10.4–86.9;
mass % H_2O = 0–9.95

Prepared By:
P. G. T. Fogg

Experimental Data

Mass % H_2O	t/°C	T/K	p_1 /mm Hg	p_1 /kPa	Absorption/cm^3 g*	x_1
0	20	293.15	159	21.19	4.5	0.033 78
			171	22.79	4.71	0.035 30
			216.5	28.86	5.62	0.041 84
			261.5	34.86	7.21	0.053 05
			271	36.12	7.51	0.055 14
			320.5	42.72	8.43	0.061 47
			329	43.85	9.16	0.066 44
			369	49.18	9.8	0.070 76
			416	55.45	11.14	0.079 66
			475.5	63.38	12.74	0.090 07
			541	72.11	14.32	0.100 13
	40	313.15	93.5	12.46	1.59	0.012 20
			97.5	12.99	1.83	0.014 02
			112	14.93	1.86	0.014 25
			150	19.99	2.9	0.022 04
			174.5	23.26	3.42	0.025 89
			193	25.72	3.61	0.027 28
			282.5	37.65	5.39	0.040 20
			377	50.25	6.92	0.051 02
			476	63.45	9	0.065 36
			537.5	71.64	9.98	0.071 96
			574.5	76.57	10.85	0.077 75
1.65	20	293.15	84	11.19	1.87	0.012 57
			126	16.79	3.36	0.022 36
			147.5	19.66	3.27	0.021 78
			210.5	28.06	5.02	0.033 05
			250	33.32	6.29	0.041 07
			303.5	40.45	7.49	0.048 52
			390.5	52.05	9.66	0.061 71
			447.5	59.65	10.92	0.069 20
			465.5	62.05	11.49	0.072 55
			538	71.71	12.81	0.080 22
	40	313.15	122.5	16.33	1.76	0.011 84
			169	22.52	2.54	0.017 00
			212.5	28.32	2.9	0.019 36
			220	29.32	3.52	0.023 40
			289	38.52	4.54	0.029 98
			326.5	43.52	4.96	0.032 67
			338	45.05	5.07	0.033 37
			434	57.85	5.99	0.039 18
			512	68.24	7.45	0.048 27
			550	73.31	7.85	0.050 73
			618.5	82.44	8.88	0.057 01
	60	333.15	197.5	26.32	2.42	0.016 21
			261.5	34.86	3.23	0.021 52
			301.5	40.19	3.34	0.022 23
			359	47.85	4.32	0.028 57
			392	52.25	4.73	0.031 20
			393.5	52.45	4.25	0.028 12
			403.5	53.78	4.77	0.031 45
			461.5	61.51	5.26	0.034 57
			547	72.91	6.43	0.041 94
			592	78.91	7.03	0.045 68
9.95	20	293.15	100.5	13.39	1.72	0.007 16
			103.5	13.8	1.95	0.008 11
			111	14.8	2.04	0.008 48
			160	21.33	2.95	0.012 22
			166.5	22.19	2.96	0.012 26
			177	23.59	3.13	0.012 96
			217.5	28.99	3.73	0.015 40
			240	31.99	4.25	0.017 51
			300.5	40.05	5.13	0.021 06
			401	53.45	6.96	0.028 36
			468	62.38	8.31	0.033 68
			581	77.44	10.04	0.040 40
	40	313.15	78	10.4	0.72	0.003 01
			101	13.46	1.14	0.004 76
			115.5	15.39	1.35	0.005 63
			130	17.33	1.51	0.006 29
			264.5	35.26	2.88	0.011 93
			348.5	46.45	4.03	0.016 62
			454	60.51	5.05	0.020 74
			511	68.11	5.83	0.023 87
			554.5	73.91	6.19	0.025 30
	60	333.15	210.5	28.06	1.68	0.007 00
			277.5	36.99	2.26	0.009 39
			331	44.12	2.87	0.011 89
			363	48.38	2.98	0.012 34
			441	58.78	3.56	0.014 71
			531.5	70.84	4.43	0.018 24
			652	86.9	5.28	0.021 66

*Volume of gas, measured at 273.15 K and 101.3 kPa, divided by the mass of solvent.

Auxiliary Information

Method/Apparatus/Procedure:
Apparatus similar to that described in Ref. 1.

Source and Purity of Materials:
(1) Ethene from a cylinder passed through concentrated sulfuric acid and dissolved in acetone at −70 °C. The solution was warmed and the first third of the evolved gas was passed to waste. The middle fraction of gas passed through activated charcoal before being used for the measurements.
(2) Formic hexamethylene amide supplied by G. F. Kodachenko was purified by vacuum distillation. The refractive indices, surface tensions, densities and viscosities were measured at various temperatures and experimental data are given in the paper.

Estimated Error:
No information.

References:
[1]G. E. Braude and S. F. Shakhova, Khim. Prom. (**3**), 177 (1961).

Components:
(1) Ethyne; C_2H_2; [74-86-2]
(2) Water; H_2O; [7732-18-5]
(3) Alkanolamines

Original Measurements:
E. Sada, H. Kumazawa, and M. A. Butt, J. Chem. Eng. Data. **23**,161–163 (1978).

Variables:
T/K=298.15; concentration of alkanolamine/mol l^{-1} =0–3.27;
P/kPa=101.3.

Prepared By:
C. L. Young

Experimental Data
T/K=298.15; P/kPa=101.3.

Alkanolamine	Concentration of alkanolamine/mol l^{-1}	Bunsen coefficient α
Ethanol, 2-amino-, (*ethanolamine*); C_2H_7NO;	0	0.9413
[141-43-5]	0.317	0.9608
	0.870	0.9677
	1.362	0.9735
	1.834	0.9770
	2.557	0.9802
	3.165	0.9812
2-Propanol, 1-amino-, (*isopropanolamine*);	0	0.9413
C_3H_9NO; [78-96-6]	0.309	0.9661
	0.744	0.9541
	1.341	0.9503
	1.792	0.9417
	2.243	0.9347
	2.761	0.9267
	3.212	0.9195
Ethanol, 2,2′-iminobis-, (*diethanolamine*);	0	0.9413
$C_4 11_{11}NO_2$; [111-42-2]	0.445	0.9554
	0.975	0.9519
	1.478	0.9470
	1.813	0.9402
	2.238	0.9213
	2.898	0.9075
2-Propanol,1,1′-iminobis-,	0	0.9413
(*diisopropanolamine*); $C_6H_{15}NO_2$; [110-97-4]	0.283	0.9530
	0.555	0.9318
	0.985	0.8998
	1.383	0.8622
	1.844	0.8362
	2.494	0.8144
	3.223	0.7974
Ethanol,2,2′,2″-nitrilotris (*triethanolamine*);	0	0.9413
$C_6H_{15}NO_3$; [102-71-6]	0.272	0.9645
	0.508	0.9574
	0.990	0.9419
	1.703	0.9334
	2.211	0.9264
	2.515	0.9226
	2.924	0.9127

Auxiliary Information

Method/Apparatus/Procedure:
Equilibrium was established between a measured volume of gas and a measured amount of gas-free liquid in a cell fitted with a magnetic stirrer. The amount of gas absorbed was estimated from change in volume of the gas. The concentration of alkanolamine determined by titration. Details are in source and Refs. 1 and 2.

Source and Purity of Materials:
(1) Commercial sample, minimum purity 99.9 mole %.
(2) Distilled and degassed.
(3) Reagent grade of guaranteed quality.

Estimated Error:
δT/K=±0.2;
$\delta\alpha$=±2% (estimated by compiler).

References:
[1]E. Sada, H. Kumazawa, and M. A. Butt, J. Chem. Eng. Data **22**, 277 (1977).
[2]S. Onda, E. Sada, Kobayashi, Jr., S. Kito, and K. Ito, J. Chem. Eng. Jpn. **3**, 18 (1970).

3.11. Halocompounds

Components:
(1) Ethyne; C_2H_2; [74-86-2]
(2) Halocompounds

Evaluator:
Peter G. T. Fogg,
University of North London,
London, United Kingdom.

Critical Evaluation

Trichloromethane

Solubility was measured by Leites and Ivanovskii[1] (243 K; 101.3 kPa), Makitra *et al.*[2] (293 K; 99.2 kPa), and Ryutani[3] (273 K; 395–1277 kPa). Trichloromethane has a significant vapor pressure at the above temperatures (243 K; 1.3 kPa, 293 K; 20.7 kPa) and, in each case, the pressures are total pressures, not partial pressures of ethyne. Mole fraction solubilities, extrapolated where necessary to a total pressure of 101.3 kPa, fit the equation:

$$\ln x_1 = -8.6277 + 1368.56/(T/\mathrm{K})$$

standard deviation in values of $x_1 = 2.7\times 10^{-3}$.

Values of x_1, corrected to a partial pressure of 101.3 kPa fit the equation:

$$\ln x_1 = -7.4595 + 1082.82/(T/\mathrm{K})$$

standard deviation in values of $x_1 = 1.6\times 10^{-3}$.

These two equations are based on three measurements in the range 243–293 K. In view of the magnitude of the standard deviations in values of x_1 the equations should be used only as a tentative guide to the solubility in this temperature range.

Ryutani[3] measured solubility in mixtures of trichloromethane (0.496 mole fraction) and dimethoxyethane. Solubility is less than the mean value of the solubilities in each of the pure solvents. The data are consistent over the pressure range of 395–1277 kPa.

Tetrachloromethane

Measurements were reported by Makitra *et al.*[2] (293 K; 99.2 kPa), Khodeeva and Kukina[4] (293–393 K; 253–5066 kPa), Horiuti[5] (273–313 K; 101.3 kPa), Miyano and Hayduk[6] (273–323 K; 101.3 kPa), Hannaert *et al.*[7] (258–293 K; 101.3 kPa). The solubility published by Makitra is rejected. There is good agreement between solubilities at a partial pressure of 101.3 kPa published by Horiuti, by Miyano and by Hannaert. These data fit the equation:

$$\ln x_1 = -54.5977 + 3218.21/(T/\mathrm{K}) + 6.90547\ \ln(T/\mathrm{K})$$

standard deviation in values of $x_1 = 3.1\times 10^{-4}$.

This equation is recommended for the temperature range 258–323 K. Measurements over a pressure range reported by Khodeeva and Kukina[4] require confirmation by other workers before they can be accepted.

1,1-Dichloroethane

Measurements reported by Danov and Golubev[8] for 194–243 K; 13.3–133 kPa are self-consistent. Values of the mole fraction solubility at a partial pressure of 101.3 kPa fit the equation:

$$\ln x_1 = -26.8897 + 2098.85/(T/\mathrm{K}) + 2.83062\ \ln(T/\mathrm{K})$$

standard deviation in values of $x_1 = 1.6\times 10^{-3}$.

This equation should be accepted on a tentative basis for the temperature range 205–243 K until it is confirmed by other workers.

1,2-Dichloroethane

Measurements have been reported by Boda and Kish[9] (268, 273 K; 20–92 kPa), Kireev and Romanchuk[10] (273 K; 13.3–101.3 kPa), Hannaert *et al.*[7] (273–333), Hölemann and Hasselmann[11] (298 K) and Usyukin and Shleinikov[12] (253–293). Data for 101.3 kPa published by Boda, Kireev, and by Hölemann are consistent with each other. Data from Hannaert and Usyukin correspond to higher solubilities.

The Boda, Kireev, and Hölemann data fit the equation:

$$\ln x_1 = -312.71 + 14497/(T/\mathrm{K}) + 45.671\ \ln(T/\mathrm{K})$$

standard deviation in values of $x_1 = 2.27\times 10^{-4}$.

This equation is valid for the range 268–298 K.

The evaluator has assumed that the Boda *et al.*'s data correspond to a partial pressure of ethyne of 101.3 kPa. At 273 K the difference between solubilities at a partial pressure and a total pressure of 101.3 kPa is about 3%. The difference is greater at higher temperatures.

The equation is based on four data points and should be accepted on a tentative basis until more data are available.

1,1,1-Trichloroethane

Solubility was measured by Makitra *et al.*[2] (273–323 K; 13.3–96.7 kPa). The pressures which are reported appear to be total pressure with no correction for the partial pressure of the solvent. Mole fraction solubilities calculated from the data given and extrapolated to a total pressure of 101.3 kPa fit the equation:

$$\ln x_1 = -28.1663 + 2863.62/(T/\mathrm{K}) + 2.50749\ \ln(T/\mathrm{K})$$

standard deviation in values of $x_1 = 9.7\times 10^{-5}$.

When solubilities are corrected to a partial pressure of 101.3 kPa the corresponding equation is

$$\ln x_1 = -350.752 + 16357.3/(T/\mathrm{K}) + 51.2147\ \ln(T/\mathrm{K})$$

standard deviation in values of $x_1 = 3.0\times 10^{-4}$.

These equations are based on measurements in the range 273–323 K. These equations should be accepted on a tentative basis until confirmed by further measurements on this system.

1,1,2-Trichloroethane

Solubility was measured by Makitra *et al.*[2] (273–353 K; 13.3–96.7 kPa). The pressures which are reported appear to be total pressure with no correction for the partial pressure of the solvent. Mole fraction solubilities calculated from the data given and extrapolated to a total pressure of 101.3 kPa fit the equation:

$$\ln x_1 = -9.47553 + 1589.63/(T/\mathrm{K})$$

standard deviation in values of $x_1 = 1.3\times 10^{-4}$.

When solubilities are corrected to a partial pressure of 101.3 kPa the corresponding equation is

$$\ln x_1 = -142.029 + 7314.17/(T/\mathrm{K}) + 19.8972\ \ln(T/\mathrm{K})$$

standard deviation in values of $x_1 = 2.9\times 10^{-4}$.

These equations are based on measurements in the range 273–353 K. These equations should be accepted on a tentative basis until confirmed by further measurements on this system.

1,1,2,2-Tetrachloroethane

Solubility was measured by Makitra *et al.*[2] (273–353 K; 13.3–96.7 kPa). The pressures which are reported appear to be total pressures with no correction for the partial pressure of the solvent. There appears to be a discrepancy between graphical data and tabulated data. Mole fraction solubilities calculated from the tabulated data and extrapolated to a total pressure of 101.3 kPa fit the equation:

$$\ln x_1 = -57.0828 + 3461.94/(T/\mathrm{K}) + 7.29675\ \ln(T/\mathrm{K})$$

standard deviation in values of $x_1 = 4.2\times 10^{-4}$.

When solubilities are corrected to a partial pressure of 101.3 kPa the corresponding equation is

$$\ln x_1 = -98.2232 + 5240.11/(T/\mathrm{K}) + 13.4712\ \ln(T/\mathrm{K})$$

standard deviation in values of $x_1 = 4.4\times 10^{-4}$.

These equations are based on measurements in the range 273–353 K. These equations should be accepted on a tentative basis until confirmed by further measurements on this system.

Chloroethene (*vinyl chloride*)

Measurements have been reported by Danov and Golubev[8] (194–243 K; 13–133 kPa) and by Kiss[13] (297–324 K; 6–105 kPa). The Danov data are self-consistent and may be accepted on a tentative basis. Mole fraction solubilities at a partial pressure of 101.3 kPa fit the equation:

$$\ln x_1 = -9.94729 + 1786.11/(T/\mathrm{K})$$

standard deviation in values of $x_1 = 2.6\times 10^{-3}$.

This equation is based on data for 205–243 K.

The data from Kiss are for a different temperature range but are less consistent. The evaluator considers that these data are less reliable. However mole fraction solubilities at 101.3 kPa and 311–317 K from these data fit an extrapolation of the equation given above. At lower temperatures Kiss' values of solubilities are higher than given by the equation; at higher temperatures they are lower.

trans-1,2-Dichloroethene

Danov and Golubev[8] measured solubility at 226–256 K; 13.3–133 kPa. Mole fraction solubility, x_1, varies linearly with pressure over the range studied. Values of x_1 at 101.3 kPa fit the equation:

$$\ln x_1 = -8.1405 + 1273.4/(T/\mathrm{K})$$

standard deviation in values of $x_1 = 9.7\times 10^{-4}$.

This equation is based on data for 226–256 K. The data are self-consistent within the limits of the standard deviation and can be accepted on a provisional basis. No data from other workers are available for comparison.

Ethyl iodide & ethyl bromide

Three measurements have been reported briefly by Gand[14] at 292.15–293.15 K; 62.5–86.1 kPa. Pressures probably correspond to total pressures. The evaluator has corrected the data for the partial pressure of the solvent and extrapolated the solubilities to a partial pressure of ethyne of 101.3 kPa. The average value of the solubility is

$$x_1 = 0.0138 \pm 2\times 10^{-4}$$

average temperature = 292.6 K

This value should be accepted on a very tentative basis and used only as a guide.

The evaluator considers that a single measurement by Gand of the solubility in ethyl bromide at 298.15 K; 34.1 kPa is unreliable. The reported pressure is less than the vapor pressure of the solvent at the reported temperature. From the nature of the report it is unlikely that allowance was made for the vapor pressure of the solvent.

No other measurements on these systems are available for comparison.

Chlorobenzene

Measurements were reported by Horiuti[5] at 273–343 K; 101.3 kPa.

The mole fraction solubility at a partial pressure of 101.3 kPa fits the equation:

$$x_1 = -32.9165 + 2452.14/(T/\mathrm{K}) + 3.59167 \ln(T/\mathrm{K})$$

standard deviation in values of $x_1 = 1.7\times10^{-5}$.

The observed behavior is in line with that of other chloro compounds and the data are likely to be accurate. However the values should be accepted on a tentative basis until confirmed by other workers.

1,1,1,3,3,3-Hexafluoro-2-propanol

Approximate solubility was reported by Robinson and Sund[15] (299 K; 101.3 kPa; $x_1 = 0.009$).

References:

[1]I. L. Leites and F. P. Ivanovskii, Khim. Prom. (**9**), 653–657 (1962).
[2]R. G. Makitra, F. B. Moin, Ya. N. Pirig, and T. I. Politanskaya, Zh. Prikl. Khim. (Leningrad) **60** (3), 696–698 (1987).
[3]B. Ryutani, Nippon Kagaku Zasshi **80**, 1411–1415 (1959).
[4]S. M. Khodeeva and R. P. Kukina, Zh. Fiz. Chem. **42**, 2444–2449 (1968); Russ. J. Phys. Chem. **42**, 1293–1296 (1968).
[5]J. Horiuti, Sci. Pap. Inst. Phys. Chem. Res. (Jpn.) **17**, 125–256 (1931/1932).
[6]Y. Miyano and W. Hayduk, Can. J. Chem. Eng. **59**, 746–751 (1981).
[7]H. Hannaert, M. Haccuria, and M. P. Mathieu, Ind. Chim. Belge **32**, 156–164 (1967).
[8]S. M. Danov and Yu. D. Golubev, Khim. Prom. **44** (2), 116–129 (1968).
[9]G. Boda and A. Kish, Sh. Zh. Fiz. Khim. **41**, 2086–2088 (1967)
[10]V. A. Kireev and M. A. Romanchuk, Zh. Obshch. Khim. **6**, 78–80 (1936).
[11]P. Hölemann and R. Hasselmann, *Forschungsberichte des Wirtschafts- und Verkehrsministeriums Nord-Westfalen*, No. 109 Forschungsstelle für Acetylen (Westdeutscher Verlag, Köln-Opladen, Germany, 1954).
[12]I. P. Usyukin and V. M. Shleinikov, Novosti Nefti Gaz Techn. Neftepererabotka Neftekhim. (**12**), 33–39 (1961).
[13]A. Sándor Kiss, Magy. Kem. Folyoirat **71**(7), 280–282 (1965).
[14]E. Gand, Bull. Soc. Chem. **12**, 1058 (1945).
[15]W. T. Robinson and E. H. Sund, U.S. Patent 3 333 399, 1967.

Components:
(1) Ethyne; C_2H_2; [74-86-2]
(2) Trichloromethane; $CHCl_3$; [67-66-3]

Original Measurements:
B. Ryutani, Nippon Kagaku Zasshi **80**, 1411–1415 (1959).

Variables:
T/K = 273.15;
P/kPa = 395 – 1277

Prepared By:
Sim-wan Annie Bligh and P. G. T. Fogg

Experimental Data

t/°C	T/K	P/atm	P/kPa*	S^a (cm^3 g^{-1})	x_1*	Density/g cm^{-3} Solvent	Density/g cm^{-3} Solution	ΔV^b (cm^3 g^{-1})
0	273.15	3.9	395	24	0.1145	1.5279	1.4711	0.044
		6.8	689	54.5	0.2269		1.4086	0.101
		9.7	983	84.3	0.3122		1.3263	0.174
		12.6	1277	118.2	0.389		1.2835	0.233

*Calculated by the compiler.
[a]S is the volume/cm^3 of gas, corrected to 273.15 K and 101.3 kPa, dissolved by the weight/g of solvent.
[b]ΔV is the change in volume of the liquid due to dissolution of gas.

Auxiliary Information

Method/Apparatus/Procedure:
Absorption was measured by a static method. Densities of saturated solutions were measured by the balancing column method[1] in which saturated solution and mercury in one side of a U-tube were balanced against mercury in the other side of the U-tube with both sides of the tube subject to the same pressure of gas. Heights of liquid columns were measured by a traveling microscope.

Source and Purity of Materials:
(1) Dried with silica gel; purity 99.5%–99.6%.
(2) Boiling point 61.6 °C (760 mm Hg); n_D^{15} 1.4500.

Estimated Error:
No information.

References:

[1]Weissberger, *Technique of Organic Chemistry*, Physical Methods, Part I (Interscience, New York, 1949), Vol. I, p. 285.

Components:
(1) Ethyne; C_2H_2; [74-86-2]
(2) Tetrachloromethane; CCl_4; [56-23-5]

Original Measurements:
S. M. Khodeeva and R. P. Kukina, Zh. Fiz. Chem. **42**, 2444–2449 (1968); Russ. J. Phys. Chem **42**, 1293–1296 (1968).

Variables:
T/K=293.2–393.2;
P/kPa=253–9119

Prepared By:
P. G. T. Fogg

Experimental Data

		Total pressure, P					Henry's constant, H	
t/°C	T/K	/atm	/kPa*	x_1	y_1	p_1/kPa*	atm	/kPa
20	293.15	2.5	253		0.943		62	6282
		5	507	0.06	0.958	495		
		7.5	760		0.963			
		10	1013	0.155	0.965	1003		
		15	1520	0.24	0.967	1511		
		20	2026	0.342	0.972	2018		
		25	2533	0.433	2526			
		30	3040	0.505	3034			
		40	4053					
		50	5066					
40	313.15	2.5	253		0.885			
		5	507	0.05	0.94	480	79	8005
		7.5	760		0.953			
		10	1013	0.113	0.958	988		
		15	1520	0.17	0.96	1496		
		20	2026	0.245	0.963	2005		
		25	2533	0.31		2513		
		30	3040	0.37		3022		
		40	4053	0.47		4038		
60	333.15	2.5	253		0.75		98	9930
		5	507	0.03	0.885	449		
		7.5	760		0.925			
		10	1013	0.1	0.94	960		
		15	1520	0.142	0.95	1469		
		20	2026	0.197	0.952	1979		
		25	2533	0.252		2489		
		30	3040	0.295		2998		
		40	4053	0.39		4017		
		50	5066	0.455		5034		
80	353.15	2.5	253		0.54		117	11 855
		5	507	0.028	0.763	398		
		7.5	760		0.84			
		10	1013	0.075	0.885	910		
		15	1520	0.12	0.92	1421		
		20	2026	0.163	0.935	1933		
		25	2533	0.214		2445		
		30	3040	0.26		2957		
		40	4053	0.315		3976		
		50	5066	0.38		4997		
		60	6080	0.443		6017		
100	373.15	2.5	253		0.217		138	13 983
		5	507	0.027	0.585	316		
		7.5	760		0.715			
		10	1013	0.055	0.795	829		
		15	1520	0.1	0.865	1344		
		20	2026	0.138	0.905	1858		
		25	2533					
		30	3040	0.213		2886		
		40	4053	0.292		3915		
		50	5066	0.328		4935		
		60	6080	0.378		5958		
		70	7093	0.433		6982		
		80	8106	0.49		8006		
		90	9119	0.555		9032		
120	393.15	2.5				253	161	16 313
		5	507		0.35			
		7.5	760		0.557			
		10	1013	0.048	0.677	708		
		15	1520		0.788			
		20	2026	0.113	0.835	1743		
		25	2533		0.868			
		30	3040	0.182	0.895	2778		
		40	4053	0.253		3814		
		50	5066	0.29		4839		
		60	6080	0.345		5870		
		70	7093	0.375		6893		
		80	8106	0.433		7924		
		90	9119	0.48		8953		
		50	5066	0.605		5055		

*Calculated by the compiler.

Auxiliary Information

Method/Apparatus/Procedure:
The variation of pressure with change of temperature of mixtures of known composition in a metal autoclave was measured as described in Ref. 1.

Source and Purity of Materials:
(1) Ethyne from a cylinder passed into acetone at −60 °C. The solution was then warmed slightly and the first gas escaping was rejected. The next fraction of gas was passed through activated charcoal to remove acetone and stored in a flask before use.
(2) Tetrachloromethane of *chemically pure* grade was distilled. The fraction boiling at 75.8 °C (743.5 mm Hg) was used. Melting point=−22.95 °C; n^{20}=1.4600.

Estimated Error:
No information.

References:
[1]E. S. Lebedeva and S. M. Khodeeva, Zhur. Fiz. Khim **35**, 2602 (1961).

Components:
(1) Ethyne; C_2H_2; [74-86-2]
(2) Tetrachloromethane, (*carbon tetrachloride*); CCl_4; [56-23-5]

Original Measurements:
J. Horiuti, Sci. Pap. Inst. Phys. Chem. Res. (Jpn) **17**, 125–256 (1931/1932).

Variables:
T/K = 273.15–313.15;
p_1 /kPa: 101.325(1 atm)

Prepared By:
M. E. Derrick and H. L. Clever

Experimental Data

T/K	Mol fraction x_1	Bunsen coefficient α/cm^3(STP)cm^{-3} atm^{-1}	Ostwald coefficient L/cm^3 cm^{-3}
273.15	0.0164	3.967	3.967
278.15	0.0152	3.650	3.717
283.15	0.014 09	3.359	3.482
288.15	0.013 12	3.107	3.278
293.15	0.012 29	2.890	3.102
298.15	0.011 5	2.686	2.932
298.15	0.0115	2.686	2.932
303.15	0.010 79	2.503	2.778
308.15	0.010 15	2.338	2.638
313.15	0.009 528	2.180	2.499

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.

Auxiliary Information

Method/Apparatus/Procedure:
The apparatus consisted of a gas buret, a solvent reservoir, and an absorption pipet. The volume of the pipet was determined at various meniscus heights by weighing a quantity of water. The meniscus height was read with a cathetometer. The dry gas was introduced into the degassed solvent. The gas and solvent were mixed with a magnetic stirrer until saturation. Care was taken to prevent solvent vapor from mixing with the solute gas in the gas buret. The volume of gas was determined from the gas buret readings, the volume of solvent was determined from the meniscus height in the absorption pipet.

Source and Purity of Materials:
(1) Ethyne: Prepared by the reaction of calcium carbide and water. The gas was passed through several wash solutions, dried, condensed by liquid air, and fractionated from liquid air several times.
(2) Tetrachloromethane: *Kahlbaum*; dried over P_2O_5 and distilled. Boiling point (760 mm Hg) 76.74 °C.

Estimated Error:
$\delta T/K = 0.05$;
$\delta x_1/x_1 = 0.01$.

Components:
(1) Ethyne; C_2H_2; [74-86-2]
(2) Tetrachloromethane, (*carbon tetrachloride*); CCl_4; [56-23-5]
1,2-Dichloroethane; $C_2H_4Cl_2$; [107-06-2]
Chloroethene; C_2H_3Cl; [75-01-4]

Original Measurements:
H. Hannaert, M. Haccuria, and M. P. Mathieu, Ind. Chim. Belge **32**, 156–164 (1967).

Variables:
T/K = 218.15–333.15

Prepared By:
E. L. Boozer and H. L. Clever

Experimental Data

T/K	$100x_1$ /mol%	$Kp\nu$/atm at 293.15*	Enthalpy of dissolution, ΔH/kcal mol^{-1}	A
Tetrachloromethane, (*carbon tetrachloride*)				
258.15–293.15	1–2	78	2.47	3.735
1,2-Dichloroethane				
273.15–333.15	1	45	3.52	4.25
Chloroethene				
218.15–243.15	1–5	61	3.86	4.67

*$\log_{10}(KP\nu/\text{atm}) = A - (\Delta H/\text{cal mol}^{-1})/(2.3R(T/\text{K}))$.

The author's definitions are:
$K = y_1/x_1$ = mole fraction gas in gas phase/mole fraction gas in liquid phase,
P/atm = total pressure; ν = coefficient of fugacity.
The function $KP\nu$/atm is equivalent to a Henry's constant in the form $H_{1,2}$ /atm = (f_1 /atm)/x_1 where f_1 is the fugacity.

Auxiliary Information

Method/Apparatus/Procedure:
The static pressure over a saturated solution was measured.

Source and Purity of Materials:
(1) Ethyne. Commercial product. Purified by passage over activated carbon and vacuum fusion. Purity 99.8%–99.9%.
(2) Methylbenzene. Qualité UCB, density, ρ^{20}/g cm^{-3} = 0.8689. Dimethylbenzenes. Merck and Co. Mixture of 90% dimethylbenzenes, 5% methylbenzene, and 5% ethyl benzene.

Estimated Error:
10%–15% for CCl_4 and $C_2H_4Cl_2$; 2%–5% for C_2H_3Cl (authors).

Components:
(1) Ethyne; C_2H_2; [74-86-2]
(2) Tetrachloromethane; CCl_4; [56-23-5]
Carbon disulfide; CS_2; [75-15-0]

Original Measurements:
Y. Miyano and W. Hayduk, Can. J. Chem. Eng. **59**, 746–751 (1981).

Variables:
T/K=273.15–323.15; p_1 /kPa=101.3

Prepared By:
P. G. T. Fogg

Experimental Data

Solvent	t/°C	T/K	Oswald coefficient, L	x_1
Tetrachloromethane	0	273.15	4.03	0.0168
	25	298.15	2.99	0.0118
	50	323.15	2.34	0.008 85
Carbon disulfide	0	273.15	2.55	0.006 72
	15	288.15	2.27	0.005 78

Auxiliary Information

Method/Apparatus/Procedure:
A glass volumetric apparatus, similar to that described earlier,[1] was used. Degassed solvent came into contact with the gas while it was flowing in a thin film into the solution buret. Dry gas in a gas buret was maintained at barometric pressure by adjustment of mercury level. Temperature was controlled to ±0.05 K by circulation of an ethanediol–water mixture through the jackets surrounding the solubility apparatus. The proportion of solvents in the mixtures was calculated from densities measured by a Digital Precision Density Meter. Gas solubilities were corrected to a partial pressure of 101.325 kPa.

Source and Purity of Materials:
(1) Ethyne supplied by Matheson Company of Canada; minimum purity 99.6%.
(2) Tetrachloromethane—from Matheson, Coleman and Bell; minimum purity 99.0 mol %. Carbon disulfide—from J. T. Baker; purity>99 mol %.

Estimated Error:
δT/K=±0.05 (authors).

References:
[1]W. Hayduk and S. C. Cheng, Can. J. Chem. Eng. **48**, 93 (1970).

Components:
(1) Ethyne; C_2H_2; [74-86-2]
(2) 1,1-Dichloroethane; $C_2H_4Cl_2$; [75-34-3]

Original Measurements:
S. M. Danov and Yu. D. Golubev, Khim. Prom. **44**(2), 116–129 (1968).

Variables:
T/K=194.2–242.7; p_1 /kPa=13.3–133.3.

Prepared By:
P. G. T. Fogg

Experimental Data

t/°C	T/K	p_1 /mm Hg	p_1 /kPa	S/cm^3 g^{-1}*	x_1
−79	194.2	100	13.3	9.6	0.0412
		200	26.7	20.1	0.0824
		300	40.0	38.6	0.1236
		400	53.3	44.2	0.1648
		500	66.7	58.1	0.2060
		600	80.0	73.6	0.2472
−68.6	204.6	100	13.3	6.3	0.0273
		200	26.7	12.9	0.0546
		300	40.0	19.9	0.0819
		400	53.3	27.5	0.1092
		500	66.7	35.4	0.1365
		600	80.0	43.9	0.1638
		760	101.3	58.7	0.2075
		800	106.7	62.7	0.2185
		900	120.0	73	0.2458
		1000	133.3	84.2	0.2731
−63.5	209.7	100	13.3	5.3	0.0229
		200	26.7	10.8	0.0458
		300	40.0	16.6	0.0687
		400	53.3	22.7	0.0916
		500	66.7	29.1	0.1145
		600	80.0	35.8	0.1374
		760	101.3	47.4	0.1746
		800	106.7	50.5	0.1838
		900	120.0	58.4	0.2067
		1000	133.3	66.8	0.2296
−58	215.2	100	13.3	4.4	0.0193
		200	26.7	9.1	0.0386
		300	40.0	13.8	0.0579
		400	53.3	18.7	0.0772
		500	66.7	23.9	0.0965
		600	80.0	29.4	0.1158
		760	101.3	38.6	0.1469
		800	106.7	40.9	0.1546
		900	120.0	47.2	0.1739
		1000	133.3	53.7	0.1932
−52.5	220.7	100	13.3	3.6	0.0157
		200	26.7	7.3	0.0314
		300	40.0	11.2	0.0471
		400	53.3	15.1	0.0628
		500	66.7	19.2	0.0785
		600	80.0	23.4	0.0942
		760	101.3	30.5	0.1199
		800	106.7	32.4	0.1262
		900	120.0	37.1	0.1419

		1000	133.3	41.9	0.1576
−47.5	225.7	100	13.3	3.1	0.0136
		200	26.7	6.3	0.0272
		300	40.0	9.5	0.0408
		400	53.3	12.9	0.0544
		500	66.7	16.4	0.0680
		600	80.0	19.6	0.0816
		760	101.3	25.8	0.1034
		800	106.7	27.4	0.1088
		900	120.0	31.3	0.1224
		1000	133.3	35.3	0.1360
−41.5	231.7	100	13.3	2.7	0.0120
		200	26.7	5.5	0.0240
		300	40.0	8.3	0.0360
		400	53.3	11.3	0.0480
		500	66.7	14.3	0.0600
		600	80.0	17.4	0.0720
		760	101.3	22.5	0.0914
		800	106.7	23.8	0.0962
		900	120.0	27.2	0.1082
		1000	133.3	30.6	0.1202
−36.5	236.7	100	13.3	2.4	0.0104
		200	26.7	4.7	0.0208
		300	40.0	7.2	0.0312
		400	53.3	9.7	0.0416
		500	66.7	12.3	0.0520
		600	80.0	14.8	0.0624
		760	101.3	19.2	0.0787
		800	106.7	20.3	0.0829
		900	120.0	23.1	0.0933
		1000	133.3	25.9	0.1037
−31	242.2	100	13.3	2.1	0.0088
		200	26.7	4	0.0176
		300	40.0	6.2	0.0264
		400	53.3	8.3	0.0352
		500	66.7	10.4	0.0440
		600	80.0	12.6	0.0528
		760	101.3	16.3	0.0676
		800	106.7	17.2	0.0711
		900	120.0	19.5	0.0798
		1000	133.3	21.8	0.0886

*Volume of gas, corrected to 273.15 K and 101.3 kPa, dissolved by 1 g of solvent.

Auxiliary Information

Method/Apparatus/Procedure:
A static method was used. A glass cell was fitted with a magnetic stirrer. This cell was first cooled with liquid nitrogen and measured quantities of solvent and gas introduced by vacuum distillation. The sample was then surrounded by an acetone bath controlled to ±0.1 °C. When the system had reached equilibrium the total pressures were measured by a null method using a glass diaphragm gauge. Measurements were repeated at a different temperature with various ratios of gas to solvent. Graphical representation of experimental data and tabulated smoothed data were published.

Source and Purity of Materials:
(1) Prepared from technical calcium carbide. Purified by dissolution in acetone and treatment with activated charcoal. Final purity ≥99.99%.
(2) Physical constants agreed with literature values.

Estimated Error:
δT/K = ±0.1 (authors).

Components:
(1) Ethyne; C_2H_2; [74-86-2]
(2) 1,2-Dichloroethane; $C_2H_4Cl_2$; [107-06-2]

Original Measurements:
G. Boda and A. Kish, Sh. Zh. Fiz. Khim. **41**, 2086–2088 (1967).

Variables:
T/K = 248–293;
p_1 /K = 20–91

Prepared By:
A. Skrzecz and P. G. T. Fogg

Experimental Data

t/°C	T/K*	p_1 /mm Hg	p_1 /kPa*	V_o /cm^3 g^{-1}	S /cm^3 g^{-1} atm^{-1}	α	x_1*
0	273.1	148	19.7	1.49	7.64	9.80	0.0066
		155	20.7	1.56	7.66	9.83	0.0069
		162	21.6	1.62	7.59	9.73	0.0072
		192	25.6	1.94	7.69	9.87	0.0086
		221	29.5	2.24	7.70	9.87	0.0099
		236	31.5	2.39	7.71	9.88	0.0106
		283	37.7	2.86	7.69	9.86	0.0126
		341	45.5	3.32	7.40	9.48	0.0146
		415	55.3	4.07	7.46	9.57	0.0179
		472	62.9	4.62	7.44	9.54	0.0202
		595	79.3	5.86	7.49	9.60	0.0255
		688	91.7	6.81	7.53	9.65	0.0295
Mean values					7.60	9.70	
−5	268.1	157	20.9	1.85	8.98	11.85	0.0082
		228	30.4	2.66	8.90	11.47	0.0117
		232	30.9	2.67	8.73	11.26	0.0118
		329	43.9	3.78	8.72	11.25	0.0166
		426	56.8	4.92	8.78	11.32	0.0215
		519	69.2	6.09	8.93	11.52	0.0265
		624	83.2	7.15	8.70	11.22	0.0309
Mean values					8.80	11.40	

*Calculated by a compiler V_o = volume of gas (STP) soluble in 1 g of solvent.
S = Kuenen coefficient (V_o/(p_1 /atm)); α = Bunsen coefficient.

Auxiliary Information

Method/Apparatus/Procedure:
A measured volume of gas was mixed with a measured weight of solvent at constant temperature. The change in pressure and volume of the gas were measured when equilibrium was reached.[1,2] The mean values of the Kuenen coefficient were found graphically.

Source and Purity of Materials:
(1) Source not specified; taken from a cylinder, technical grade; purified by an unspecified standard method.
(2) BDH; Boiling point 82–84 °C; used as received.

Estimated Error:
Gas volumes were measured with an accuracy of ±0.2 cm^3.

References:
[1]V. A. Kireev and M. A. Romanchuk, Zh. Obshch. Khim. **6**, 78 (1936).
[2]E. Bodor, G. Bor, B. Mohai, and G. Siposs, Veszpremi Vegyipari Egyelem Kozlemenyei **1**, 55 (1957).

Components:
(1) Ethyne; C_2H_2; [74-86-2]
(2) 1,2-Dichloroethane; $C_2H_4Cl_2$; [107-06-2]

Original Measurements:
P. Hölemann and R. Hasselmann, *Forschungsberichte des Wirtschafts- und Verkehrsministeriums Nord-Westfalen*, No. 109 Forschungsstelle für Acetylen (Westdeutscher Verlag, Köln-Opladen, Germany, 1954).

Variables:
T/K=298;
p_1 /kPa=102.6

Prepared By:
P. G. T. Fogg

Experimental Data

t/°C	T/K	p_1 /Torr*	p_1 /kPa**	Sol. coefficient***	x_1(1 atm)	$\delta V/V_1$†
25	298.15	770	102.6	5.6	0.0208	1.67

*Maximum pressure of measurements.
**Calculated by compiler.
***The solubility coefficient was defined as mg(gas)/(g(solvent)$\times p_1$ /atm). This was constant over the pressure range studied, i.e., data were consistent with Henry's law.
†Increase in (volume/cm^3) of the liquid phase/(dm^3 of gas dissolved) (reduced to NTP).

Auxiliary Information

Method/Apparatus/Procedure:
Ostwald type apparatus was used for measurements below 1 atm. The increase in volume of the liquid phase on dissolution of the gas could be measured. The apparatus is fully described in Ref. 1. Measurements were made from low pressures to the maximum values given above. Individual data points were published as plots of mg(gas/g (solvent)) against partial pressure. The points fell very close to straight lines through the origin. Values of the solubility coefficient equal to the slopes of the lines were tabulated by the authors. The mole fraction solubility for a pressure of 101.3 kPa (1 atm) is given above.

Source and Purity of Materials:
(2) Supplied by BASF. Purified by fractional distillation under reduced pressure. Density and vapor pressure were measured at 25 °C. ρ^{25}/g cm^{-3}=1.2418; p_2^0/mm Hg=79.8.

Estimated Error:
δT/K=±0.05;
δp_1=±0.5 mm Hg.

References:
[1]P. Hölemann and R. Hasselmann, *Forschungsberichte des Wirtschafts- und Verkehrsministeriums Nord-Westfalen*, No. 14 Forschungsstelle für Acetylen (Westdeutscher Verlag, Köln-Opladen, Germany, 1952).

Components:
(1) Ethyne; C_2H_2; [74-86-2]
(2) 1,2-Dichloroethane; $C_2H_4Cl_2$; [107-06-2]

Original Measurements:
V. A. Kireev and M. A. Romanchuk, Zh. Obshch. Khim. **6**, 78–80 (1936).

Variables:
T/K=273;
P/kPa=13–101

Prepared By:
A. Skrzecz and P. G. T. Fogg

Experimental Data

t/°C	T/K*	P/mm Hg	P/kPa*	V_1/V_2[a]	x_1*
0	273.1	100	13.3	1.3	0.0045
		200	26.7	2.6	0.0090
		300	40.0	3.9	0.0134
		400	53.3	5.2	0.0178
		500	66.7	6.4	0.0218
		600	80.0	7.7	0.0261
		700	93.3	9.0	0.0304
		760	101.3	9.8	0.0330

[a]Ratio of volume of gas (STP) to volume of solvent.
*Calculated by a compiler.

Auxiliary Information

Method/Apparatus/Procedure:
The solvent was saturated with the gas at constant temperature and pressure until equilibrium was reached. After decreasing the pressure, the volume of the desorbed gas was measured. The method and apparatus was described in Ref. 1.

Source and Purity of Materials:
(1) Source not specified; taken from a standard cylinder, technical grade; used as received; ρ=1.0857 g dm^{-3}(20 °C).
(2) Source not specified; used as received; d_4^{20}=1.2499; Boiling point=83.2–83.4 °C.

Estimated Error:
No information.

References:
[1]V. A. Kireev, S. I. Kaplan, and M. A. Romanchuk, Zh. Obshch. Khim. **5**, 444 (1935).

Components:
(1) Ethyne; C_2H_2; [74-86-2]
(2) 1,1,1-Trichloroethane; $C_2H_3Cl_3$; [71-55-6]

Original Measurements:
R. G. Makitra, F. B. Moin, Ya. N. Pirig, and T. I. Politanskaya, Zh. Prikl. Khim. (Leningrad) **60** (3), 696–698 (1987).

Variables:
T/K = 273.15–323.15;
P/kPa = 13.3–96.7

Prepared By:
P. G. T. Fogg

Experimental Data

t/ °C	T/K	P/mm Hg†	P/kPa[1]	Solubility*	x_1**
0	273.15	100	13.3	0.60	0.002 63
		200	26.7	1.45	0.006 33
		300	40.0	2.35	0.010 22
		400	53.3	3.20	0.013 86
		500	66.7	4.05	0.017 48
		600	80.0	4.90	0.021 07
		725	96.7	6.00	0.025 68
10	283.15	100	13.3	0.25	0.001 11
		200	26.7	0.95	0.004 20
		300	40.0	1.67	0.007 36
		400	53.3	2.30	0.010 11
		500	66.7	2.95	0.012 93
		600	80.0	3.65	0.015 95
		725	96.7	4.47	0.019 47
20	293.15	200	26.7	0.50	0.002 24
		300	40.0	1.07	0.004 79
		400	53.3	1.60	0.007 14
		500	66.7	2.13	0.009 48
		600	80.0	2.65	0.011 77
		725	96.7	3.35	0.014 83
30	303.15	200	26.7	0.05	0.000 23
		300	40.0	0.50	0.002 27
		400	53.3	1.05	0.004 75
		500	66.7	1.50	0.006 78
		600	80.0	2.00	0.009 02
		725	96.7	2.63	0.011 82
40	313.15	300	40	0.15	0.000 69
		400	53.3	0.6	0.002 76
		500	66.7	1.05	0.004 81
		600	80	1.5	0.006 86
		725	96.7	2.1	0.009 58
50	323.15	400	53.3	0.15	0.000 7
		500	66.7	0.62	0.002 88
		600	80	1.1	0.005 11
		725	96.7	1.66	0.007 68

*Volume of gas, corrected to 273.15 K and 101.3 kPa, dissolved by 1 vol of solvent.
**Calculated by the compiler.
†Total pressure.

Auxiliary Information

Method/Apparatus/Procedure:
Static method as described in Ref. 1.

Source and Purity of Materials:
Gas and solvents were chromatographically pure. Their purity was at least 99%.

Estimated Error:
No information.

References:
[1]E. R. Shenderei, Ya. D. Zel'venskii, and F. P. Ivanovskii, Khim. Prom. (**6**) 370–376 (1960).

Components:
(1) Ethyne; C_2H_2; [74-86-2]
(2) 1,1,2-Trichloroethane; $C_2H_3Cl_3$; [79-00-5]

Original Measurements:
R. G. Makitra, F. B. Moin, Ya. N. Pirig, and T. I. Politanskaya, Zh. Prikl. Khim. (Leningrad) **60**(3), 696–698 (1987).

Variables:
T/K = 273.15–353.15;
P/kPa = 13.3–96.7

Prepared By:
P. G. T. Fogg

Experimental Data

t/ °C	T/K	P/mm Hg†	P/kPa‡	Solubility*	x_1**
0	273.15	100	13.3	0.80	0.003 27
		200	26.7	1.65	0.006 72
		300	40.0	2.50	0.010 15
		400	53.3	3.40	0.013 76
		500	66.7	4.25	0.017 14
		600	80.0	5.10	0.020 49
		725	96.7	6.20	0.024 80
10	283.15	100	13.3	0.60	0.002 48
		200	26.7	1.30	0.005 36
		300	40.0	1.95	0.008 01
		400	53.3	2.65	0.010 86
		500	66.7	3.35	0.013 69
		600	80.0	4.00	0.016 30
		725	96.7	4.90	0.019 89
20	293.15	100	13.3	0.45	0.001 88
		200	26.7	1.00	0.004 16
		300	40.0	1.50	0.006 23
		400	53.3	2.15	0.008 91
		500	66.7	2.70	0.011 16
		600	80.0	3.25	0.013 40
		725	96.7	4.00	0.016 44
30	303.15	100	13.3	0.35	0.001 47
		200	26.7	0.80	0.003 36
		300	40.0	1.30	0.005 46
		400	53.3	1.75	0.007 33
		500	66.7	2.25	0.009 41
		600	80.0	2.70	0.011 27
		725	96.7	3.33	0.013 86
40	313.15	100	13.3	0.20	0.000 85
		200	26.7	0.60	0.002 55
		300	40.0	1.05	0.004 46
		400	53.3	1.45	0.006 14
		500	66.7	1.90	0.008 03
		600	80.0	2.30	0.009 71
		725	96.7	2.82	0.011 88
50	323.15	100	13.3	0.05	0.000 22
		200	26.7	0.45	0.001 93
		300	40.0	0.80	0.003 43
		400	53.3	1.15	0.004 93
		500	66.7	1.55	0.006 63
		600	80.0	1.90	0.008 11
		725	96.7	2.37	0.010 10
60	333.15	200	26.7	0.20	0.000 87
		300	40.0	0.55	0.002 39

		400	53.3	0.90	0.003 90
		500	66.7	1.25	0.005 41
		600	80.0	1.60	0.006 91
		725	96.7	2.00	0.008 63
70	343.15	300	40.0	0.30	0.001 32
		400	53.3	0.60	0.002 63
		500	66.7	0.95	0.004 16
		600	80.0	1.30	0.005 68
		725	96.7	1.70	0.007 42
80	353.15	400	53.3	0.40	0.001 77
		500	66.7	0.75	0.003 32
		600	80.0	1.15	0.005 09
		725	96.7	1.50	0.006 62

*Volume of gas, corrected to 273.15 K and 101.3 kPa, dissolved by 1 vol of solvent.
**Calculated by the compiler.
‡Total pressure.

Auxiliary Information

Method/Apparatus/Procedure:
Static method as described in Ref. 1.

Source and Purity of Materials:
Gas and solvents were chromatographically pure. Their purity was at least 99%.

Estimated Error:
No information.

References:
[1]E. R. Shenderei, Ya. D. Zel'venskii, and F. P. Ivanovskii, Khim. Prom. (**6**) 370–376 (1960).

Components:
(1) Ethyne; C_2H_2; [74-86-2]
(2) 1,1,2,2-Tetrachloroethane; $C_2H_2Cl_4$; [79-34-5]

Original Measurements:
R. G. Makitra, F. B. Moin, Ya. N. Pirig, and T. I. Politanskaya, Zh. Prikl. Khim. (Leningrad) **60** (3), 696–698 (1987).

Variables:
T/K = 273.15–353.15

Prepared By:
P. G. T. Fogg

Experimental Data

t/°C	T/K	P/mm Hg‡	P/kPa‡	Solubility*	x_1**
0	273.15	100	13.3	0.90	0.004 18
		200	26.7	1.80	0.008 32
		300	40.0	2.70	0.012 43
		400	53.3	3.60	0.016 50
		500	66.7	4.50	0.020 54
		600	80.0	5.45	0.024 77
		725	96.7	6.60	0.029 85
10	283.15	100	13.3	0.70	0.003 28
		200	26.7	1.40	0.006 54
		300	40.0	2.10	0.009 78
		400	53.3	2.85	0.013 23
		500	66.7	3.55	0.016 43
		600	80.0	4.30	0.019 83
		725	96.7	5.20	0.023 88
20	293.15	100	13.3	0.60	0.002 84
		200	26.7	1.20	0.005 67
		300	40.0	1.85	0.008 71
		400	53.3	2.45	0.011 50
		500	66.7	3.10	0.014 51
		600	80.0	3.70	0.017 27
		725	96.7	4.50	0.020 92
30	303.15	100	13.3	0.55	0.002 63
		200	26.7	1.10	0.005 25
		300	40.0	1.65	0.007 85
		400	53.3	2.20	0.010 44
		500	66.7	2.75	0.013 01
		600	80.0	3.30	0.015 58
		725	96.7	4.00	0.018 82
40	313.15	100	13.3	0.45	0.002 17
		200	26.7	0.85	0.004 10
		300	40.0	1.30	0.006 26
		400	53.3	1.80	0.008 64
		500	66.7	2.25	0.010 78
		600	80.0	2.70	0.012 91
		725	96.7	3.30	0.015 73
50	323.15	100	13.3	0.35	0.001 71
		200	26.7	0.75	0.003 65
		300	40.0	1.15	0.005 59
		400	53.3	1.55	0.007 52
		500	66.7	2.00	0.009 69
		600	80.0	2.40	0.011 60
		725	96.7	2.90	0.013 99
60	333.15	100	13.3	0.25	0.001 23
		200	26.7	0.51	0.002 51
		300	40.0	1.00	0.004 92

		400	53.3	1.40	0.006 87
		500	66.7	1.75	0.008 57
		600	80.0	2.13	0.010 42
		725	96.7	2.60	0.012 68
70	343.15	100	13.3	0.10	0.000 50
		200	26.7	0.45	0.002 24
		300	40.0	0.85	0.004 23
		400	53.3	1.20	0.005 96
		500	66.7	1.60	0.007 93
		600	80.0	1.90	0.009 40
		725	96.7	2.40	0.011 84
80	353.15	100	13.3	0.05	0.000 25
		200	26.7	0.40	0.002 01
		300	40.0	0.75	0.003 77
		400	53.3	1.10	0.005 52
		500	66.7	1.45	0.007 26
		600	80.0	1.75	0.008 75
		725	96.7	2.20	0.010 98

*Volume of gas, corrected to 273.15 K and 101.3 kPa, dissolved by 1 vol of solvent.
**Calculated by the compiler.
‡Total pressure.

Auxiliary Information

Method/Apparatus/Procedure:
Static method as described in Ref. 1.

Source and Purity of Materials:
Gas and solvent were *chromatographically pure*. Their purity was at least 99%.

Estimated Error:
No information.

References:
[1]E. R. Shenderei, Ya. D. Zel'vinskii, and F. P. Ivanovskii, Khim. Prom. (**6**) 370–376 (1960).

Components:
(1) Ethyne; C_2H_2 ; [74-86-2]
(2) Chloroethene, (*vinyl chloride*); C_2H_3Cl; [75-01-4]

Original Measurements:
A. Sándor Kiss, Magy. Kem. Folyoirat **71**(7), 280–282 (1965).

Variables:
T/K = 297.7–324.2;
p_1 /kPa = 6–105

Prepared By:
P. G. T. Fogg

Experimental Data

t/°C	T/K*	Solubility‡ /cm^3(100g)$^{-1}$	$H \cdot 10^3$† /kg cm^{-2}	H/kPa*	x_1(1 atm)**
24.5	297.7	1231	35.6	0.000 363	0.0368
26	299.2	1160	30.1	0.000 306	0.0311
30	303.2	976	28.2	0.000 287	0.0291
34	307.2	801	21.0	0.000 214	0.0217
38	311.2	617	16.7	0.000 170	0.0173
40.5	313.7	452	12.5	0.000 127	0.0129
44	317.2	340	10.9	0.000 111	0.0113
46.7	319.9	213	5.9	0.000 060	0.0061

Solubility at 51 °C, 324.15 K.

p_1 /kg cm^{-2}	p_1 /kPa*	Solubility‡ /cm^3(100g)$^{-1}$	x_1*	p_1 /kg cm^{-2}	p_1 /kPa*	Solubility‡ /cm^3(100g)$^{-1}$	x_1*
0.06	6	15	0.000 42	0.6	59	56	0.001 58
0.07	7	15	0.000 42	0.7	69	80	0.002 25
0.2	20	20	0.000 56	0.95	93	120	0.003 37
0.33	32	35	0.000 99	1.07	105	164	0.004 60

*Calculated by the compiler.
**Mole fraction solubility estimated by the compiler from values of H for p_1 = 101.3 kPa.
†Henry's law coefficient defined as $H = x_1 / p_1$.
‡Volume of gas, reduced to 101.3 kPa and 273.15 K, dissolved by 100 g of solvent at a partial pressure of 1 kg cm^{-2} (98.07 kPa). The compiler considers that values are not entirely consistent with solubilities calculated from values of H. There appear to be discrepancies ranging from 0.7% to 15%.

Auxiliary Information

Method/Apparatus/Procedure:
Liquid vinyl chloride under pressure was saturated with ethyne to a partial pressure of 1.5 kg cm^{-2}. The absorption vessel was agitated for at least 4 h. Analysis was carried out by gas chromatography.

Source and Purity of Materials:
No information.

Estimated Error:
No information.

Components:
(1) Ethyne; C_2H_2 ; [74-86-2]
(2) Chloroethene, (*vinyl chloride*); C_2H_3Cl; [75-01-4]

Original Measurements:
S. M. Danov and Yu. D. Golubev, Khim. Prom. **44**(2), 116–129 (1968).

Variables:
T/K= 194.2–242.7;
p_1 /kPa= 13.3–133.3

Prepared By:
P. G. T. Fogg

Experimental Data

t/°C	T/K	p_1 /mm Hg	p_1 /kPa	S/cm^3 g^{-1}*	x_1
−79	194.2	100	13.3	22.6	0.0594
		200	26.7	48.4	0.1189
		300	40.0	77.8	0.1784
		400	53.3	112.8	0.2379
		500	66.7	151.7	0.2974
−68.6	204.6	100	13.3	14.5	0.0381
		200	26.7	31.8	0.0762
		300	40.0	47.3	0.1143
		400	53.3	65.8	0.1524
		500	66.7	86.4	0.1905
		600	80.0	108.9	0.2286
		760	101.3	150.2	0.2956
−63.5	209.7	100	13.3	11.8	0.0319
		200	26.7	24.4	0.0638
		300	40.0	38.0	0.0957
		400	53.3	52.5	0.1276
		500	66.7	68.0	0.1525
		600	80.0	85.1	0.1914
		760	101.3	114.1	0.2424
		800	106.7	123.1	0.2552
		900	120.0	144.7	0.2871
−58	215.2	100	13.3	9.4	0.0256
		200	26.7	19.3	0.0512
		300	40.0	29.7	0.0768
		400	53.3	40.7	0.1024
		500	66.7	52.4	0.1280
		600	80.0	64.9	0.1536
		760	101.3	86.3	0.1946
		800	106.7	81.2	
		900	120.0	107.0	0.2304
−52.5	220.7	100	13.3	7.5	0.0205
		200	26.7	15.4	0.0410
		300	40.0	23.5	0.0615
		400	53.3	32.1	0.0820
		500	66.7	41.5	0.1025
		600	80.0	54.8	0.1230
		760	101.3	66.4	0.1558
		800	106.7	70.5	0.1640
		900	120.0	81.3	0.1845
		1000	133.3	93.0	0.2050
−47.5	225.7	100	13.3	6.0	0.0165
		200	26.7	12.2	0.0330
		300	40.0	18.6	0.0495
		400	53.3	25.2	0.0660
		500	66.7	32.1	0.0825
		600	80.0	39.3	0.0990
		760	101.3	51.3	0.1254
		800	106.7	54.4	0.1320
		900	120.0	62.4	0.1485
		1000	133.3	77.3	0.1650
−41.5	231.7	100	13.3	5.2	0.0142
		200	26.7	10.5	0.0284
		300	40.0	15.9	0.0426
		400	53.3	21.5	0.0568
		500	66.7	27.5	0.0710
		600	80.0	33.3	0.0852
		760	101.3	43.3	0.1079
		800	106.7	45.8	0.1136
		900	120.0	52.5	0.1278
		1000	133.3	59.3	0.1420
−36.5	236.7	100	13.3	4.3	0.0119
		200	26.7	8.8	0.0238
		300	40.0	13.4	0.0357
		400	53.3	17.9	0.0476
		500	66.7	23.3	0.0595
		600	80.0	27.5	0.0714
		760	101.3	35.7	0.0904
		800	106.7	37.8	0.0952
		900	120.0	43.2	0.1071
		1000	133.3	48.5	0.1190
−31	242.2	100	13.3	3.7	0.0102
		200	26.7	7.4	0.0204
		300	40.0	11.3	0.0306
		400	53.3	15.2	0.0408
		500	66.7	19.2	0.0510
		600	80.0	23.3	0.0612
			101.3	30.8	0.0775
		800	106.7	31.8	0.0816
		900	120.0	36.2	0.0918
		1000	133.3	40.6	0.1020

*Volume of gas, corrected to 273.15 K and 101.3 kPa, dissolved by 1 g of solvent.

Auxiliary Information

Method/Apparatus/Procedure:
A static method was used. A glass cell was fitted with a magnetic stirrer. This cell was first cooled with liquid nitrogen and measured quantities of solvent and gas introduced by vacuum distillation. The sample was then surrounded by an acetone bath controlled to ±0.1 °C. When the system had reached equilibrium the total pressures were measured by a null method using a glass diaphragm. gauge. Measurements were repeated at a different temperature with various ratios of gas to solvent. Graphical representation of experimental data and tabulated smoothed data were published.

Source and Purity of Materials:
(1) Prepared from technical calcium carbide. Purified by dissolution in acetone and treatment with activated charcoal. Final purity ⩾99.9.
(2) Physical constants agreed with literature values.

Estimated Error:
δT/K= ±0.1 (authors).

Components:
(1) Ethyne; C_2H_2 ; [74-86-2]
(2) *trans*-1,2-Dichloroethene; $C_2H_2Cl_2$; [156-60-5]

Original Measurements:
S. M. Danov and Yu. D. Golubev, Khim. Prom. **44**(2), 116–129 (1968).

Variables:
T/K= 225.7–256.2;
p_1 /kPa= 13.3–133.3

Prepared By:
P. G. T. Fogg

Experimental Data

t/°C	T/K	p_1 /mm Hg	p_1 /kPa	S/cm^3 g^{-1}*	x_1
−47.5	225.7	100	13.3	2.5	0.0108
		200	26.7	5.1	0.0216
		300	40.0	7.8	0.0324
		400	53.3	10.4	0.0432
		500	66.7	13.2	0.0540
		600	80.0	16.0	0.0648
		760	101.3	20.6	0.0821
		800	106.7	21.8	0.0864
		900	120.0	24.0	0.0972
		1000	133.3	27.9	0.1081
−41.5	231.7	100	13.3	2.2	0.0096
		200	26.7	4.5	0.0191
		300	40.0	5.8	0.0286
		400	53.3	9.2	0.0382
		500	66.7	11.6	0.0477
		600	80.0	14.0	0.0573
		760	101.3	18.1	0.0725
		800	106.7	19.1	0.0764
		900	120.0	21.7	0.0859
		1000	133.3	22.0	0.0955
−36.5	236.7	100	13.3	1.9	0.0081
		200	26.7	3.8	0.0162
		300	40.0	5.8	0.0243
		400	53.3	7.7	0.0324
		500	66.7	9.6	0.0405
		600	80.0	11.8	0.0486
		760	101.3	15.1	0.0615
		800	106.7	16.1	0.0648
		900	120.0	18.2	0.0729
		1000	133.3	20.3	0.0810
−31.5	241.7	100	13.3	1.7	0.0074
		200	26.7	3.5	0.0148
		300	40.0	5.3	0.0223
		400	53.3	7.1	0.0297
		500	66.7	8.9	0.0372
		600	80.0	10.8	0.0446
		760	101.3	13.8	0.0565
		800	106.7	14.6	0.0595
		900	120.0	16.6	0.0670
		1000	133.3	18.5	0.0744
−25	248.2	100	13.3	1.5	0.0065
		200	26.7	3.0	0.0131
		300	40.0	4.6	0.0196
		400	53.3	6.2	0.0261
		500	66.7	7.8	0.0326
		600	80.0	9.0	0.0391
		760	101.3	12.0	0.0496
		800	106.7	12.7	0.0522
		900	120.0	14.4	0.0587
		1000	133.3	16.1	0.0653
−22	251.2	100	13.3	1.4	0.0062
		200	26.7	2.8	0.0124
		300	40.0	4.4	0.0186
		400	53.3	5.9	0.0248
		500	66.7	7.3	0.0310
		600	80.0	8.8	0.0372
		760	101.3	11.3	0.0469
		800	106.7	12.1	0.0494
		900	120.0	13.6	0.0556
		1000	133.3	15.2	0.0618
−17	256.2	100	13.3	1.3	0.0055
		200	26.7	2.6	0.0110
		300	40.0	3.9	0.0165
		400	53.3	5.2	0.0220
		500	66.7	6.5	0.0275
		600	80.0	7.9	0.0330
		760	101.3	10.0	0.0417
		800	106.7	10.6	0.0439
		900	120.0	11.4	0.0494
		1000	133.3	13.31	0.0549

*Volume of gas, corrected to 273.15 K and 101.3 kPa, dissolved by 1 of solvent.

Auxiliary Information

Method/Apparatus/Procedure:
A static method was used. A glass cell was fitted with a magnetic stirrer. This cell was first cooled with liquid nitrogen and measured quantities of solvent and gas introduced by vacuum distillation. The sample was then surrounded by an acetone bath controlled to ±0.1 °C. When the system had reached equilibrium the total pressures were measured by a null method using a glass diaphragm gauge. Measurements were repeated at a different temperature with various ratios of gas to solvent. Graphical representation of experimental data and tabulated smoothed data were published.

Source and Purity of Materials:
(1) Prepared from technical calcium carbide. Purified by dissolution in acetone and treatment with activated charcoal. Final purity ⩾99.99%.
(2) Physical constants agreed with literature values.

Estimated Error:
δT/K= ±0.1 (authors).

Components:
(1) Ethyne; C_2H_2 ; [74-86-2]
(2) Ethyl bromide; C_2H_5Br; [74-96-4]
Ethyl iodide; C_2H_5I; [75-03-6]

Original Measurements:
E. Gand, Bull. Soc. Chem. **12**, 1058 (1945).

Variables:
T/K = 292.15–298.15,
p_1 /kPa = 34.1–86.4

Prepared By:
P. G. T. Fogg

Experimental Data

Solvent	t/°C	T/K*	p_1 /mm Hg	p_1 /kPa*	Solubility Vol/Vol**	Solubility x_1*
Ethyl bromide	25.0	298.15	256	34.1	5.46	0.0056
Ethyl iodide	19.0	292.15	646	86.1	3.42	0.0097
	19.2	292.35	648	86.4	3.52	0.0100
	20.0	293.15	469	62.5	3.13	0.0065

*Calculated by the evaluator.

Volumes of gas absorbed correspond to the temperature and pressure at which the measurements were carried out.

Auxiliary Information

Method/Apparatus/Procedure:
No information.

Source and Purity of Materials:
(1) Produced by action of water on calcium carbide; dried.
(2) Purified by methods previously described by the author.

Estimated Error:
No information.

Components:
(1) Ethyne; C_2H_2 ; [74-86-2]
(2) Chlorobenzene; C_6H_5Cl; [108-90-7]

Original Measurements:
J. Horiuti, Sci. Pap. Inst. Phys. Chem. Res. (Jpn) **17**, 125–256 (1931/32).

Variables:
T/K = 273.15–343.15; p_1 /kPa: 101.3 (1 atm).

Prepared By:
M. E. Derrick and H. L Clever

Experimental Data

T/K	Mol fraction x_1	Bunsen coefficient α/cm^3(STP)cm^{-3} atm^{-1}	Ostwald coefficient L/cm^3 cm^{-3}
273.15	0.022 57	5.186	5.186
278.15	0.020 53	4.686	4.772
283.15	0.018 72	4.244	4.299
288.15	0.017 18	3.87	4.082
293.15	0.015 82	3.541	3.8
298.15	0.014 58	3.243	3.54
303.15	0.013 51	2.988	3.316
308.15	0.012 57	2.764	3.118
313.15	0.011 70	2.556	2.93
318.15	0.010 98	2.386	2.779
323.15	0.010 28	2.221	2.628
328.15	0.009 714	2.087	2.507
333.15	0.009 156	1.956	2.386
338.15	0.008 671	1.842	2.28
343.15	0.008 213	1.735	2.18

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.

Auxiliary Information

Method/Apparatus/Procedure:
The apparatus consisted of a gas buret, a solvent reservoir, and an absorption pipet. The volume of the pipet was determined at various meniscus heights by weighing a quantity of water. The meniscus height was read with a cathetometer. The dry gas was introduced into the degassed solvent. The gas and solvent were mixed with a magnetic stirrer until saturation. Care was taken to prevent solvent vapor from mixing with the solute gas in the gas buret The volume of gas was determined from the gas buret readings, the volume of solvent was determined from the meniscus height in the absorption pipet.

Source and Purity of Materials:
(1) Ethyne. Prepared by the reaction of calcium carbide and water. The gas passed through several wash solutions. It was then dried, condensed by liquid air, and fractionated from liquid air several times.
(2) Chlorobenzene. *Kahlbaum*. Dried and distilled. Boiling point (760 mm Hg) 131.96 °C.

Estimated Error:
$\delta T/K = 0.05$;
$\delta x_1 / x_1 = 0.01$.

Components:	Original Measurements:
(1) Ethyne; C_2H_2 ; [74-86-2] (2) 1,1,1,3,3,3-Hexafluoro-2-propanol; $C_3H_2F_6O$; [920-66-1]	W. T. Robinson and E. H. Sund, U.S. Patent 3 333 399, 1967.
Variables:	**Prepared By:**
T/K=299; P/kPa=101	P. G. T Fogg

Experimental Data

				Solubility	
t/°C	T/K	P/atm	P/kPa	cm^3 per 100 cm^3 of solvent	Mole fraction* x_1
26	299	1	101	200	0.0092

*Calculated by the compiler.

Auxiliary Information

Method/Apparatus/Procedure:
A jacketed and agitated flask was fitted with a water manometer, dropping funnel for adding solvent and gas burette. The flask was repeatedly flushed with gas and then filled with gas at room temperature. Solvent was added and the flask agitated. Further gas was added from the gas burette until the pressure in the flask was again equal to atmospheric pressure.

Source and Purity of Materials:
No information.

Estimated Error:
$\delta x_1 = \pm 10\%$.

3.12. Phosphorous Compounds

Components:	Evaluator:
(1) Ethyne; C_2H_2 ;[74-86-2] (2) Phosphorous compounds	Peter G. T. Fogg, University of North London, London, United Kingdom.

Critical Evaluation

Trimethyl phosphate

Measurements reported by Vogt and Hamill[1] (288–298 K; 101.3 kPa) and by Levine and Isham[2] (298 K; 101.3 kPa). At 298 K the mole fraction solubility from Vogt and Hamill is 0.096 and from Levine and Isham is 0.082. Further measurements on this system are needed.

Triethyl phosphate

Measurements reported by Schay *et al.*[3] (273–368 K; 8.3–108.4 kPa), Vogt and Hamill[1] (278–313 K; 101.3 kPa), Levine and Isham[2] (297 K; 101.3 kPa). The vapor pressure of the solvent is 25 mm Hg (3.3 kPa) at 103 °C (376 K). There is no evidence that any author made allowance for the vapor pressure of the solvent which is significant at the highest temperature of the measurements but is negligible at lower temperatures. Levine's value is lower than values from the other authors.

Data from Schay and from Vogt fit the equations:

$$\ln x_1 = 34.119 + 94.458/(T/\mathrm{K}) - 6.3899 \ln(T/\mathrm{K})$$

$$\text{standard deviation in values of } x_1 = 2.39\times 10^{-3}$$

(based on data from 273 to 368 K).

$$\ln x_1 = 38.863 - 109.21/(T/\mathrm{K}) - 7.1026 \ln(T/\mathrm{K})$$

$$\text{standard deviation in values of } x_1 = 2.58\times 10^{-3}$$

(based on data from 273 to 333 K).

These equations should be accepted on a tentative basis until confirmed by additional data.

Tripropyl phosphate

Measurements were reported by Vogt and Hamill[1] (288–298 K; 101.3 kPa) and by Levine and Isham[2] (299 K; 101.3 kPa). The solubility from Levine's measurement is inconsistent with data from Vogt.

Tributyl phosphate

Measurements were reported by Vogt and Hamill[1] (288–298 K; 101.3 kPa), Levine and Isham[2] (301 K; 101.3 kPa), Kosyakov *et al.*[4] (223–313 K; 6.3–98.5 kPa), Makitra[5] (293 K; 97.3 kPa), and by Emets *et al.*[6] (253–293 K). The measurement from Makitra appears to be too low. Data from the other authors at 101.3 kPa or in the case of data from Emets, extrapolated to that pressure, fit the equation:

$$\ln x_1 = 101.13 - 2914.7/(T/\mathrm{K}) - 16.383 \ln(T/\mathrm{K})$$

$$\text{standard deviation in values of } x_1 = 1.57\times 10^{-2}.$$

This equation is valid for the range 253–313 K.

Trioctyl phosphate

A measurement was reported by Levine and Isham[2] (299 K; 101.3 kPa). No other measurements on this system are available for comparison.[7]

Esters of phosphorous acid

Trimethyl phosphite (McKinnis[8])
Triethyl phosphite (Vogt and Hamill[1])
Tripropyl phosphite (Levine and Isham[2])
Tributyl phosphite (Vogt and Hamill[1])

Data for tripropyl phosphite does not appear to be consistent with the data for the other three esters.

Mole fraction solubilities at 298 in diethyl and dipropyl phosphite calculated from data published by Trementozzi[10] are approximately equal to each other and close to values for trimethyl, triethyl and tributyl phosphites.

Hexamethyl phosphoric triamide

Solubilities in this solvent were reported by Schay *et al.*[3] (273–363 K; 9.1–102.5 kPa), Miller[7] (288.15 K; 506–2026.5 kPa), (293.15 K; 101.3 kPa) and by McKinnis[8] (298 K; 101.3 kPa). Levine[2] also reported a value (303.15 K) which may correspond to either a Bunsen coefficient or an Ostwald coefficient. Some of the data from Schay are in graphical form. The solubility data in the high pressure range from Miller is accompanied by data for change in volume on dissolution of the gas. This enables fairly reliable extrapolation to lower pressures by the Krishevsky–Ilinskaya equation[9]. The data for 101.3 kPa from Schay, McKinnis, and Miller can be fitted to the equation:

$$\ln x_1 = 155.812 - 5665.36/(T/\mathrm{K}) - 24.2480 \ln(T/\mathrm{K})$$

$$\text{standard deviation in values of } x_1 = 5.5\times 10^{-3}.$$

This equation is valid for the range 273–363 K.

Trialkoxyethyl phosphates

Hasche[12] measured solubility in a series of trialkoxyalkyl phosphates at 273–311 K at about 101.3 kPa. Ostwald coefficients decreased with increase in carbon atoms. Values for triethoxyethyl phosphate are close to those for trimethoxypropyl phosphate. Values for triethoxypropyl phosphate are close to those for tripropoxyethyl phosphate. Data are self-consistent but need to be confirmed by other workers.

Other phosphorus compounds

Levine and Isham measured solubilities in diethylphosphate monodimethylamide[11] and diethylphosphate monodiethylamide.[2] No other measurements on these systems are available for comparison.

Vogt and Hamill[1] measured the solubility in tripropyl phosphine oxide at 298–308 K. The data are self-consistent but no other measurements on the system are available for comparison.

Reetz[13] and also Howard[14] measured solubilities in different phosphonates. No other measurements on these systems are available for comparison.

Trementozzi and Kosapoloff[15] measured solubility in *tris*Dimethylamidophosphate at 303 and 310 K. No other measurements on these systems are available for comparison.

McKinnis[8] measured solubility in tritetramethylenephosphoramide. No other measurements on this system is available for comparison.

References:

[1]R. R. Vogt and W. H. Hamill, Patent US2580622, 1952.

[2]M. Levine and R. M. Isham, Patent US2623611, 1952.

[3]G. Schay, Gy. Szekely, Gy. Racz, and G. Traply, Periodica Polytech. **2**, 1–24 (1958).

[4]N. E. Kosyakov, V. L. Yushko, I. D. Sergienko, S. F. Khokhlov, and R. F. Taraba, Khim. Prom. (Moscow) **48** (6), 432–8 (1972); Sov Chem. Industry **48**, 370–371 (1972).

[5]R. G. Makitra, F. B. Moin, Ya. N. Pirig, and T. I. Politanskaya, Zh. Prikl. Khim. **53**, 1529–1531 (1980); J. Appl. Chem. USSR **53**, 1179–1181 (1980).

[6]T. V. Emets *et al.*, Tr. Gos. Nauch. -Issled. Proekt. Inst. Azot. Prom. Prod. Org. **13**, 46–53 (1972); details taken from British Gas Translations 5423/BG/LRS/LRST499/80.

[7]British Oxygen Co. Ltd., reported by S. A. Miller, *Acetylene—Its Properties, Manufacture and Uses* (Academic New York, 1965), Vol. I.

[8]A. C. McKinnis, Ind. Eng. Chem. **47**(4), 850–853 (1955).

[9]I. R. Krichevsky and A. A. Il'inskaya, Acta Physicochim. URSS **20**, 327 (1945).

[10]Q. A. Trementozzi, Patent US2726206, 1955.

[11]M. Levine and R. M. Isham, Patent US2703154, 1955.

[12]R. L. Hasche, Patent US2667234, 1954.

[13]T. Reetz, Patent US2799365, 1957; Patent US2800979, 1957.

[14]W. B. Howard, Patent US2800978, 1957.

[15]Q. A. Trementozzi and G. M. Kosapoloff, Brit. Pat. 675294, 1952.

Components:
(1) Ethyne; C_2H_2 ;[74-86-2]
(2) Organophosphorus compounds

Original Measurements:
R. R. Vogt and W. H. Hamill, Patent US2580662, 1952.

Variables:
T/K = 288–298

Prepared By:
P. G. T. Fogg

Experimental Data

Solvent	t/°C	T/K*	V_1 /cm^3 g^{-1}*	x_1**
Phosphoric acid, trimethyl ester,	15	288.15	23.78	0.1210
(*trimethylphosphate*); $C_3H_9O_4P$; [512-56-1]	20	293.15	20.98	0.1083
	25	298.15	18.33	0.0959
Phosphoric acid, triethyl ester, (*triethylphosphate*);	15	288.15	28.53	0.1768
$C_6H_{15}O_4P$; [78-40-0]	20	293.15	25.10	0.1589
	25	298.15	22.02	0.1422
Phosphoric acid, tripropyl ester, (*tripropylphosphate*);	15	288.15	22.73	0.1740
$C_9H_{21}O_4P$; [513-08-6]	20	293.15	19.77	0.1549
	25	298.15	17.06	0.1365
Phosphoric acid, tributyl ester, (*tributylphosphate*);	15	288.15	20.03	0.1806
$C_{12}H_{27}O_4P$; [126-73-8]	20	293.15	17.73	0.1633
	25	298.15	15.74	0.1477
Phosphorous acid, triethyl ester, (*triethylphosphite*);	15	288.15	18.14	0.1108
$C_6H_{15}O_3P$; [122-52-1]	20	293.15	15.43	0.0958
	25	298.15	13.33	0.0839
Phosphorous acid, tributyl ester, (*tributylphosphite*);	15	288.15	11.33	0.1049
$C_{12}H_{27}O_3P$; [102-85-2]	20	293.15	9.91	0.0930
	25	298.15	8.63	0.0820
Tripropyl phosphine oxide	25	298.15	36.55	0.18
$C_9H_{21}PO$	30	303.15	32.00	0.1612
	35	308.15	28.07	0.1442

*Volume of gas measured at 298.15 K and 101.3 kPa.
**Calculated by the compiler.

Triethyl phosphate

Absorption was also given as volume of ethyne, corrected to STP, dissolved at a pressure of 101.3 kPa.

t/°C	T/K	V_1 /cm^3 (NTP) g^{-1}	x_1**
5	278.15	34.4	0.2204
25	298.15	19.9	0.1406
40	313.15	12.9	0.0959

t/°C	T/K	V_1/V_2**	x_1**
90	263.15	2.57	0.0386

**Calculated by the compiler.
***V_1 measured at 298.15 K.

Auxiliary Information

No information.

Components:
(1) Ethyne; C_2H_2 ;[74-86-2]
(2) Organophosphorus compounds

Original Measurements:
US patents

Variables:
T/K; see below.

Prepared By:
P. G. T. Fogg

Experimental Data

t/°C	T/K*	Bunsen coefficient	Ostwald coefficient	x_1*
M. Levine and R. M. Isham, Patent US2623611, 1952				
Phosphoric acid, trimethyl ester, (*trimethylphosphate*); $C_3H_9O_4P$; [512-56-1]				
25	298.15	17	18.6	0.082
Phosphoric acid, triethyl ester, (*triethylphosphate*); $C_6H_{15}O_4P$; [78-40-0]				
24	297.15	18.5	20.1	0.124
Diethylphosphatemonodimethylamide; $C_6H_{16}NO_3P$				
35	308.15	22.1	24.9	
Phosphoric triamide, hexamethyl-, (*phosphorytridimethylamide, trisdimethylamidophosphate*); $C_6H_{18}ON_3P$; [680-31-9]				
30	303.15	42.2	46.9	
Diethylphosphatemonodiethylamide; $C_8H_{20}NO_3P$				
35	308.15	18.4	20.7	
Phosphorous acid, tripropyl ester, (*tripropylphosphite*); $C_9H_{21}O_3P$; [923-99-9]				
22	295.15	6.2	6.7	0.058
Phosphoric acid, tripropyl ester, (*tripropylphosphate*); $C_9H_{21}O_4P$; [513-08-6]				
26	299.15	14.8	16.2	0.129
Phosphoric acid, tributyl ester, (*tributylphosphate*); $C_{12}H_{27}O_4P$; [126-73-8]				
24	297.15	12.1	13.2	0.130
Phosphoric acid, trioctyl ester, (*trioctylphosphate*); $C_{24}H_{51}O_4P$; [1806-54-8]				
28	301.15	5.7	6.3	0.105
Q. A. Trementozzi, Patent US2726206, 1955				
Phosphonic acid, diethyl ester, (*diethylphosphite*); $C_4H_{11}O_3P$; [762-04-9]				
25	298.15	20	21.8	0.104
Phosphonic acid, dipropyl ester, (*dipropylphosphite*); $C_6H_{15}O_3P$; [1809-21-8]				
25	298.15	15	16.4	0.103

*Calculated by the compiler.

Auxiliary Information

No information.

Components:
(1) Ethyne; C_2H_2 ; [74-86-2]
(2) Phosphoric acid, triethyl ester, (*triethylphosphate*); $C_6H_{15}O_4P$; [78-40-0]

Original Measurements:
G. Schay, Gy. Szekely, Gy. Racz, and G. Traply, Periodica Polytech. **2**, 1–24 (1958).

Variables:
T/K = 273–368;
p_1 /kPa = 8.3–108.4

Prepared By:
P. G. T. Fogg

Experimental Data

t/°C	T/K	p_1 /mm Hg	p_1/kPa	Volume of gas absorbed†/cm^3 g^{-1}	Mole fraction solubility, x_1
0	273.15	62	8.3	4.5	0.036
		138	18.4	8.9	0.068
		217	28.9	13.1	0.097
		227	30.3	14.8	0.108
		300	40.0	17.6	0.126
		310	41.3	19.1	0.136
		397	53.0	23.5	0.162
25	298.15	135	18.0	4.0	0.032
		211	28.1	6.5	0.050
		289	38.5	8.1	0.062
		324	43.2	9.4	0.072
		443	59.1	11.8	0.089
		476	63.5	13.0	0.097
		483	64.3	13.4	0.100
		541	72.1	14.4	0.106
		608	81.1	15.8	0.115
		760	101.3*	19.8*	0.140
		813	108.4	21.1	0.148
60	333.15	760	101.3*	8.7*	0.067
67	340.15	106	14.1	1.2	0.010
		255	34.0	2.5	0.020
		510	68.0	4.9	0.039
		765	102.0	7.4	0.057
95	368.15	160	21.4	1.1	0.009
		364	48.5	2.2	0.018
		742	99.0	4.1	0.032

†Volumes of gas were reduced to 273.15 K and 101.3 kPa.
*Values from tabulated data. All other numerical values of pressures and gas volumes were obtained by the compiler from experimental points on a small scale graph (4 cm×4 cm) by computer aided digitization. Mole fraction solubilities were calculated by the compiler.

Auxiliary Information

Method/Apparatus/Procedure:
Static methods were used. For measurements above room temperature condensation of solvent vapor in the cooler parts of the system was reduced by use of capillary tubes to connect parts of the apparatus and by measuring the pressure by a null method. A magnetic stirrer was used to stir the solvent in the absorption cell.

Source and Purity of Materials:
No information.

Estimated Error:
No information.

Components:
(1) Ethyne; C_2H_2 ; [74-86-2]
(2) Phosphoric acid, tributyl ester, (*tributyl phosphate*); $C_{12}H_{27}O_4P$; [126-73-8]

Original Measurements:
T. V. Emets, *et al.*, Tr. Gos. Nauch.-Issled. Proekt. Inst. Azot. Prom. Prod. Org. **13**, 46–53 (1972). Details taken from British Gas Translations 5423/BG/LRS/LRST499/80.

Variables:
T/K = 253.2–293.2;
p_1/kPa = 9.7–86.8

Prepared By:
P. G. T. Fogg

Experimental Data

t/°C	T/K	p_1 /mm Hg	p_1 /kPa	(p_1/x_1)/mm Hg	x_1*
−20	253.15	130	17.3	1905	0.0682
		256	34.1	1925	0.1330
		337	44.9	1955	0.1724
		467	62.3	2140	0.2182
		522	69.6	2120	0.2462
0	273.15	73	9.7	3250	0.0225
		91	12.1	3300	0.0276
		176	23.5	3210	0.0548
		219	29.2	3350	0.0654
		378	50.4	3470	0.1089
		597	79.6	3460	0.1725
20	293.15	136	18.1	5800	0.0234
		173	23.1	5880	0.0294
		351	46.8	5800	0.0605
		441	58.8	5750	0.0767
		461	61.5	5950	0.0775
		651	86.8	6200	0.1050

*Calculated by the compiler.

Auxiliary Information

Method/Apparatus/Procedure:
A static method was used as described in Refs. 1 and 2. A specific volume of gas was put in contact with liquid and the reduction in pressure of the gas was recorded. Temperatures were controlled by a thermostat.

Source and Purity of Materials:
(1) Purity of gas between 98.5% and 99.99%.
(2) Chemically pure grade.

Estimated Error:
No information.

References:
[1]I. R. Krichevskii, *Phase Equilibria in Solutions at High Pressures* (Khimiya, Moscow, 1965).
[2]G. E. Braude, I. L. Leites, and I. V. Dedova, Khim. Prom. (**4**), 232 (1961).

Components:
(1) Ethyne; C_2H_2 ; [74-86-2]
(2) Tributyl phosphate; $C_{12}H_{27}O_4P$; [126-73-8]

Original Measurements:
N. E. Kosyakov, V. L. Yushko, I. D. Sergienko, S. F. Khokhlov, and R. F. Taraba, Khim. Prom. (Moscow) **48**(6), 432–438 (1972); Sov Chem. Industry **48**, 370–371 (1972).

Variables:
T/K = 223–313;
p_1 /kPa = 13–101

Prepared By:
P. G. T. Fogg

Experimental Data

t/°C	T/K	p_1 /Torr	p_1 /kPa*	Mole fraction solubility, x_1
40	313.2	519	69.2	0.071
		607	80.9	0.078
		739	98.5	0.095
20	293.2	405	54	0.095
		520	69.3	0.115
		561	74.8	0.124
		696	92.8	0.145
0	273.2	288	338.4	0.12
		411	54.8	0.154
		413	55.1	0.165
		440	58.7	0.173
		620	82.7	0.209
−20	253.2	174	23.2	0.146
		313	41.7	0.217
		272	36.3	0.2
		259	34.5	0.211
		456	60.8	0.265
		512	68.3	0.285
−40	233.2	86	11.5	0.165
		146	19.5	0.228
		139	18.5	0.239
		366	48.8	0.366
−50	223.2	47	6.3	0.168
		95	12.7	0.252
		113	15.1	0.27
		309	41.2	0.396

*Calculated by the compiler.

The authors gave the solubility data in graphical form. The compiler used a computer based digitization program to obtain numerical values from experimental points.

Auxiliary Information

Method/Apparatus/Procedure:
A static method was used as described in Ref. 1.

Source and Purity of Materials:
(1) Commercial ethyne was purified by freezing. Chromatographic analysis indicated a purity of at least 99%.
(2) Pure grade tributyl phosphate was used.

Estimated error:
δp_1 /kPa = 2;
δx_1 = 0.001 (estimated error in reading the graph).

References:
[1]G. E. Braude and S. F. Shakhova, Khim. Prom. (**3**), 177 (1961).

Components:
(1) Ethyne; C_2H_2 ; [74-86-2]
(2) Phosphoric triamide, hexamethyl; (*hexamethyl phosphoric triamide*); $C_6H_{18}N_3OP$; [680-31-9]

Original Measurements:
G. Schay, Gy. Szekely, Gy. Racz, and G. Traply, Periodica Polytech. **2**, 1–24 (1958).

Variables:
T/K = 273–363;
p_1 /kPa = 9.1–102.5

Prepared By:
P. G. T. Fogg

Experimental Data

t/°C	T/K	p_1 /mm Hg	p_1 /kPa	Volume of gas absorbed*/cm^3 g^{-1}	Mole fraction solubility, x_1**
0	273.15	191	25.5	29.9	0.194
		299	39.8	41.5	0.251
		441	58.8	56.2	0.312
		539	71.9	59.5	0.325
		610	81.4	69.9	0.361
		637	85.0	69.9	0.361
		664	88.6	72.5	0.369
		691	92.2	71.7	0.367
		738	98.4	76.9	0.383
		753	100.3	75.1	0.378
25	298.15	69	9.1	5.1	0.040
		144	19.2	12.0	0.089
		176	23.5	13.9	0.101
		296	39.5	21.4	0.148
		318	42.4	23.1	0.157
		372	49.6	26.3	0.175
		485	64.6	31.0	0.200
		516	68.9	33.6	0.214
		541	72.1	34.9	0.220
		760	101.3†	43.7†	0.261
		760	101.3†	45.3†	0.268
60	333.15	113	15.1	3.1	0.025
		253	33.7	6.4	0.049
		457	60.9	10.5	0.078
		731	97.5	17.2	0.122
		760	101.3†	18.2†	0.128
90	363.15	199	26.5	2.3	0.019
		435	58.0	5.0	0.039
		760	101.3†	8.8†	0.066
		769	102.5	8.8	0.066

*Volumes of gas were reduced to 273.15 K and 101.3 kPa.
**Mole fraction solubilities were calculated by the compiler.
†Numerical data given by the authors. Other data were in graphical form and numerical values of pressures and gas volumes were obtained by the compiler from experimental points on a small scale graph (4 cm×4 cm) by computer aided digitization.

Auxiliary Information

Method/Apparatus/Procedure:
Static methods were used. For measurements above room temperature condensation of solvent vapor in the cooler parts of the system was reduced by use of capillary tubes to connect parts of the apparatus and by measuring the pressure by a null method. A magnetic stirrer was used to stir the solvent in the absorption cell.

Source and Purity of Materials:
No information.

Estimated Error:
No information.

Components:
(1) Ethyne; C_2H_2 ; [74-86-2]
(2) Phosphoric triamide, hexamethyl; $C_6H_{18}N_{30}P$; [680-31-9]

Original Measurements:
British Oxygen Co. Ltd., reported by S. A. Miller, *Acetylene—Its Properties, Manufacture and Uses* (Academic, New York, 1965), Vol. I.

Variables:
T/K = 273.15–333.15;
p_1 /kPa = 101.3–3546

Prepared By:
P. G. T. Fogg

Experimental Data

t/°C	T/K	p_1 /atm	p_1 /kPa	Bunsen. coefficient α	g kg^{-1} of solvent	g dm^{-3} of solution	x_1*
15	288.15	5	506.6		139		0.489
		10	1013.2		218		0.6
		15	1519.9		298	203	0.672
		20	2026.5		378		0.722
20	293.15	1		52.4	60*		0.293

*Estimated by the compiler.

The author states that the mole fraction solubility in the range 0–60 °C and 7–35 atm. (709.3–3546.4 kPa) fits the equation:

$$x_1 = (p_1\ /\text{atm})(a - b\ \log_{10}(p_1\ /\text{atm}))$$

where

$$\log_{10} a = 674/(T/\text{K}) - 3.105 \quad \log_{10} b = 920/(T/\text{K}) - 4.158.$$

Dilation, V/V_o, at 20 °C over the same pressure range was said to fit the equations:

$$V/V_o = 1.039 + 1.45s,$$

where s=wt of ethyne/wt of acetonitrile,

$$V/V_o = 1.074 + 0.287p_1\ /\text{atm}.$$

Auxiliary Information

Method/Apparatus/Procedure:
No information.

Source and Purity of Materials:
No information.

Components:
(1) Ethyne; C_2H_2 ; [74-86-2]
(2) Organic phosphonates

Original Measurements:
US patents

Variables:
T/K = 298

Prepared By:
P. G. T. Fogg

Experimental Data

t/°C	T/K*	Bunsen coefficient	Ostwald coefficient
T. Reetz, Patent US2799365, 1957			
bis(β-dimethylaminoethyl)methanephosphonate; $C_9H_{23}O_3N_2P$			
25	298.15	19.8	21.6
Isopropyl-β-dimethylaminoethylmethanephosphonate; $C_8H_{20}NO_3P$			
25	298.15	19.8	21.6
T. Reetz, Patent US2800979, 1957.			
Diethylacetylmethanephosphonate; $C_7H_{15}O_4P$			
25	298.15	16.1	17.6
W. B. Howard, Patent US2800978, 1957			
Isopropyldimethylamidomethanephosphonate; $C_7H_{16}NO_3P$			
25	298.15	34.9	38.1
Bis(dimethylamido)methanephosphonate; $C_7H_{15}N_2O_3P$			
25	298.15	61.3	66.9
Diethylacetylmethanephosphonate; $C_7H_{15}O_4P$			
25	298.15	16.1	17.6

Auxiliary Information

No information.

Components:
(1) Ethyne; C_2H_2 ; [74-86-2]
(2) Trialkoxyphosphates

Original Measurements:
R. L. Hasche, Patent US2667234, 1954.

Variables:
T/K = 273–311

Prepared By:
P. G. T. Fogg

Experimental Data

t/°C	T/K*	Bunsen coefficient	Ostwald coefficient
Trimethoxyethylphosphate; $C_9H_{21}O_7P$			
0	273.15	33	33
25	298.15	14.1	15.4
38	311.15	9.4	10.7
Triethoxyethylphosphate; $C_{12}H_{27}O_7P$			
0	273.15	28.1	28.1
25	298.15	11.7	12.8
38	311.15	7.6	8.7
Trimethoxypropylphosphate; $C_{12}H_{27}O_7P$			
0	273.15	28.2	28.2
25	298.15	11.5	12.5
38	311.15	6.6	7.5
Triethoxypropylphosphate; $C_{15}H_{33}O_7P$			
0	273.15	25.4	25.4
25	298.15	9.7	10.6
38	311.15	6	6.8
Tripropoxyethylphosphate; $C_{15}H_{33}O_7P$			
0	273.15	25.3	25.3
25	298.15	9.9	10.8
38	311.15	6.2	7.1
Tributoxyethylphosphate; $C_{18}H_{39}O_7P$			
0	273.15	22.1	22.1

*Calculated by the compiler.

Auxiliary Information

No information.

Components:	Original Measurements:
(1) Ethyne; C_2H_2; [74-86-2] (2) *tris*Dimethylamidophosphate; $C_6H_{18}N_3OP$	Q. A. Trementozzi, and G. M. Kosapoloff, Brit. Patent 675294, 1952.
Variables:	**Prepared By:**
T/K=303; 310	P. G. T. Fogg

Experimental Data

t/°C	T/K	Mass$_1$ /mass$_2$	Bunsen coefficient*	Ostwald coefficient	x_1*
30	303.15	0.0461	35.1	39	0.006 65
37	310.15	0.0389	29.1	33	0.005 62

*Calculated by the compiler.

Auxiliary Information

Method/Apparatus/Procedure:

No information available.

Source and Purity of Materials:

Trisdimethylamidophosphate was prepared by reacting phophoryl chloride and dimethylamine in toluene. Phosphoryl chloride (153 g) dissolved in toluene (2 dm^3) reacted with dimethylamine at 50 °C until saturated with the gas. The mixture was then heated to 100 °C and more dimethylamine bubbled through until saturation was again achieved. The solid product was filtered off and heated to remove toluene. The crude product was washed with a concentrated solution of sodium carbonate and distilled under vacuum. Boiling point 76 °C (1 mm Hg); n_D^{25}= 1.4570; vapor pressure 0.07 mm Hg (30 °C).

3.13. Sulfur Compounds

Components:	Evaluator:
(1) Ethyne; C_2H_2; [74-86-2] (2) Sulfur compounds	Peter G. T. Fogg, University of North London, London, United Kingdom.

Critical Evaluation

Sulfinylbismethane (*dimethylsulfoxide*)

Solubility in sulfinylbismethane was measured at 293.15 K by Makitra *et al.*[1] and is also reported by other workers in the patent literature[2] at 992 and 101.3 kPa, respectively. McKinnis[3] reported measurements at 298.15 K and 101.3 kPa. Ryutani[4] reported measurements from 263.15 to 293.15 K at pressures from 395 to 1479 kPa. Miller[5] reported values made at 288 K from 506.5 to 1520 kPa which were based on measurements by Smedslund. The evaluator extrapolated the data given by Ryutani and by Miller to 101.1 kPa using a form of the Krichevsky–Il'inskaya equation.[10] Solubility values at 101.1 kPa from data by McKinnis *et al.* form a consistent pattern over the temperature range. These data fit the equation:

$$\ln x_1 = 356.5 - 13356/(T/\mathrm{K}) - 55.121 \ln(T/\mathrm{K})$$

standard deviation in values of $x_1 = 1.8\times 10^{-2}$.

This equation is valid for the temperature range 263.15–298.15 K.

Data from Makitra and Rummert are low by comparison and considered to be less reliable.

Ryutani also measured solubility in mixtures of sulfinylbismethane (0.472 mole fraction) and water (0.528 mole fraction). The solubility is less than mean value of solubilities in each of the pure solvents. Data are consistent over the pressure range of 395–1277 kPa.

Sulfides

Miyano and Hayduk[6] published data for solubility in carbon disulfide at 273.15 and 288.15 K partial pressure of 101.3 kPa. The data are probably reliable but no other data on this system are available for comparison.

Trofimov *et al.*[7] measured solubilities in ethylbutyl sulfide, dibutyl sulfide, butylvinyl sulfide, and in divinyl sulfide at temperatures from 243 to 293 K over a pressure range to about 101.3 kPa. Results were published in the form of graphs and as constants for an equation relating solubility with temperature and partial pressure of gas. The solubilities calculated for a partial pressure of 101.3 kPa are consistent but no measurements by other workers are available for comparison (Fig. 10).

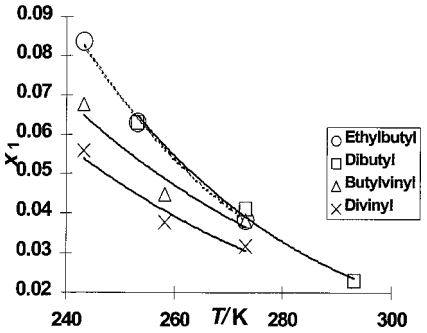

FIG. 10. Solubility of ethyne in organic sulfides from data published by Trofimov *et al.*

Sulfoacids and Tetraethylsulfamide

Makitra *et al.*[8,9] measured the solubility of ethyne in *N*,*N*-diethylamide methanesulfoacid (EM), *N*,*N*-dimethylamide ethanesulfoacid (ME), *N*,*N*-diethylamide ethanesulfoacid (EE), and *N*,*N*-tetraethylsulfamide (TS) at temperatures from 253 to 338 K and pressures from 13.3 to 97.2 kPa. There is some scatter in the data but the overall pattern is consistent. However the variation with mole fraction solubility against pressure does not extrapolate through zero in every case. No solubility data determined by other workers are available for comparison with these data.

Other Sulfur Compounds

Rummert[2] measured solubility in 1,4-oxathianesulfoxide. McKinnis[3] reported a solubility in tetramethylenesulfoxide and in phosphorotrithionic acid, *S*,*S*,*S*-trimethyl ester. Lorenz[11] measured solubility in thiophane-1-oxide. No other measurements on these systems are available for comparison.

References:

[1]R. G. Makitra, F. B. Moin, Ya. N. Pirig, and T. I. Politanskaya, Zh. Prikl. Khim. **53**, 1529–1531 (1980); J. Appl Chem. USSR **53**, 1179–1181 (1980).

[2]Nitroglycerin Aktiebolaget Brit. Patent 791362, 1958; G. Rummert, Brit. Patent 876494, 1961.

[3]A. C. McKinnis, Ind. Eng. Chem. **47**(4), 850–853 (1955).

[4]B. Ryutani, Nippon Kagaku Zasshi **81**, 1192–1201 (1960).

[5]Measurements by Smedslund (Centrallaboratorium, A. B., Finland) and published by Stephan Chemical Co, Chicago, 1955. Details taken from S. A. Miller, *Acetylene—Its Properties, Manufacture and Uses* (Academic, New York, 1965), Vol. I.

[6]Y. Miyano and W. Hayduk, Can. J. Chem. Eng. **59**, 746–751 (1981).

[7]B. A. Trofimov, V. A. Granzhan, V. B. Modonov, V. V. Kryuchkov, S. V. Amosova, and M. G. Voronkov, Izv. Sib. Otd. Akad. Nauk. SSSR ser. Khim. Nauk. (**2**), 107–112 (1979).

[8]R. G. Makitra, F. B. Moin, T. I. Poltanskaya, and A. Yakovyak, Zh. Fiz. Khim. **49**(10), 2723–2724 (1975); dep. VINITI 1877-75.

[9]R. G. Makitra, A. Yakovyak, and T. I. Politanskaya, Zh. Fiz. Khim. **50**, 1619 (1976); VINITI 3545-75; deposited from 11th December 1975.

[10]I. R. Krichevsky and A. A. Il'inskaya, Acta Physicochim. URSS **20**, 327 (1945).

[11]L. Lorenz, Ger. Patent 965657, 1957.

Components:

(1) Ethyne; C_2H_2; [74-86-2]
(2) Sulfinylbismethane, (*dimethylsulfoxide*); C_2H_6SO; [67-68-5]

Original Measurements:

B. Ryutani, Nippon Kagaku Zasshi **81**, 1192–1201 (1960).

Variables:

T/K=263.15–293.15;
P/kPa=395–1479

Prepared By:

Sim-wan Annie Bligh and P. G. T. Fogg

Experimental Data

t/°C	T/K	P/atm	P/kPa*	S^a (cm^3 g^{-1})	x_1*	Density/g cm^{-3} Solvent	Density/g cm^{-3} Solution	ΔV^b (cm^3 g^{-1})
20	293.15	3.9	395	95.7	0.2522	1.1008	1.0191	0.183
		6.8	689	154.8	0.353		0.9787	0.299
		9.7	983	211.3	0.4269		0.9467	0.41
		12.6	1277	276.4	0.4935		0.9221	0.528
		14.6	1479	321.1	0.5309		0.9126	0.6
10	283.15	3.9	395	139.2	0.3292	(solid)	1.0278	
		6.8	689	231.3	0.4491		0.9939	
		9.7	983	316.5	0.5273		0.9598	
		12.6	1277	377	0.5706		0.9118	
		14.6	1479	438.8	0.6073		0.8958	
0	273.15	3.9	395	187.3	0.3977	(solid)	1.0262	
		6.8	689	295	0.5098		0.9818	
		9.7	983	385.4	0.576		0.9296	
		12.6	1277	484	0.6305		0.8898	
−10	263.15	3.9	395	206.8	0.4216	(solid)	0.982	
		6.8	689	391.1	0.5796		0.969	
		9.7	983	501.6	0.6387		0.9146	
		12.6	1277	708.3	0.714		0.8491	

*Calculated by the compiler.
[a]S is the volume/cm^3 of gas, corrected to 273.15 K and 101.3 kPa, dissolved by the weight/g of solvent.
[b]ΔV is the change in volume of the liquid due to dissolution of gas.

Auxiliary Information

Method/Apparatus/Procedure:

Absorption was measured by a static method. Densities of saturated solutions were measured by the balancing column method[1] in which saturated solution and mercury in one side of a U-tube were balanced against mercury in the other side of the U-tube with both sides of the tube subject to the same pressure of gas. Heights of liquid columns were measured by a traveling microscope.

Source and Purity of Materials:

(1) Dried with silica gel; purity 99.5%–99.6%.
(2) Boiling point 75.5–75.8 °C (15 mm Hg) n_D^{20} 1.4217.

Estimated Error:

No information.

References:

[1]Weissberger, *Technique of Organic Chemistry*, Physical Methods, Part I (Interscience, New York, 1949), Vol. I, p. 285.

Components:
(1) Ethyne; C_2H_2; [74-86-2]
(2) Sulfinylbismethane, (*dimethylsulfoxide*); C_2H_6SO; [67-68-5]

Original Measurements:
Measurements by Smedslund (Centrallaboratorium, A. B., Finland) and published by Stephan Chemical Co, Chicago, 1955. Details taken from S. A. Miller, *Acetylene—Its Properties, Manufacture and Uses* (Academic, New York, 1965), Vol. I.

Variables:
T/K=288.15 K;
P/kPa=506.6–2026

Prepared By:
P. G. T. Fogg

Experimental Data

T/K	P/atm	P/kPa*	Solubility/g kg^{-1}**	Solubility/g dm^{-3}***	x_1*
288	5	507	145		0.3032
	10	1013	276		0.453
	15	1520	407	269	0.5498
	20	2026	527		0.6126

*Calculated by the compiler.
**Solubility per kg of solvent.
***Solubility per dm^3 of solution.

Auxiliary Information

Method/Apparatus/Procedure:
Stated by Miller to be from cylinder measurements calculating allowances for ethyne in the gas phase. The following dilation formula was used

$$V=V_0(1.02+0.044\ P).$$

This gave consistent results and was analogous to a formula obeyed by dimethylformamide.[1]

Source and Purity of Materials:
No additional information.

Estimated Error:
No information.

References:
[1]Smedslund, *Nord. Kemistmötet* (Helsingfors, 1950), pp. 7. 199; Patent USP 2, 539, 871, 1951.

Components:
(1) Ethyne; C_2H_2; [74-86-2]
(2) Compounds containing sulfur

Original Measurements:
British and German patents

Variables:
T/K=293; 315

Prepared By:
P. G. T. Fogg

Experimental Data

t/°C;	T/K*	Bunsen coefficient	Ostwald coefficient	x_1*
Nitroglycerin Aktiebolaget, Brit. Patent 791362, 1958				
Dimethylsulfoxide; C_2H_6OS; [67-68-5]				
20	293	27.02	29	0.080
G. Rummert, Brit. Patent 876494, 1961				
Dimethylsulfoxide; C_2H_6OS; [67-68-5]				
20	293	−26.1	28	0.077
1,4-Oxathianesulfoxide; $C_4H_8O_2S$				
42	315	14.7	17	0.047
L. Lorenz, Ger. Patent 965657, 1957				
Thiophane-1-oxide C_4H_4SO				
20	293	28.9	31	0.078

*Calculated by the compiler.

Auxiliary Information

No information.

Components:
(1) Ethyne; C_2H_2
(2) Thioethers

Original Measurements:
B. A. Trofimov, V. A. Granzhan, V. B. Modonov, V. V. Kryuchkov, S. V. Amosova, and M. G. Voronkov, Izv. Sib. Otd. Akad. Nauk. SSSR ser. Khim. Nauk (**2**), 107–112 (1979).

Variables:
T/K=243.2–293.2;
p_1 /kPa=23–102

Prepared By:
P. G. T. Fogg

Experimental Data
Experimental data from graphs published by the authors.

Solvent	T/K	p_1 /mm Hg	p_1 /kPa	x_1
Dibutylthioether	273.2	170	22.7	0.0052
(*dibutyl sulfide*); $C_8H_{18}S$		322	42.9	0.0118
		421	56.1	0.0169
		457	61	0.0189
		562	75	0.0254
		629	83.9	0.0299
		663	88.4	0.0323
		719	95.8	0.0364
		764	101.9	0.0401
Butylvinylthioether	273.2	264	35.2	0.009
(*butylvinyl sulfide*); $C_6H_{12}S$		354	47.2	0.0124
		455	60.7	0.0171
		488	65	0.0191
		570	76	0.0239
		616	82.1	0.0268
		662	88.3	0.0299
		706	94.2	0.0332

The authors published constants, H and A, for the equation:

$$\log_{10}\left(\frac{p_1\ /\text{mm Hg}}{x_1}\right)=\log_{10}(H/\text{mm Hg})-Ax_1\ .$$

The constant, H, is the limiting value of Henry's constant. The compiler calculated values of x_1 at p_1=101.3 kPa from this equation. These are given below:

Solvent	t/°C	T/K	$\log_{10} H$	A	x_1 at p_1=101.3 kPa
Butylethylthioether;	−30	243.15	4.0176	0.7013	0.0835
(*butylethyl sulfide*); $C_6H_{14}S$	−20	253.15	4.1566	1.1717	0.0628
	0	273.15	4.4279	3.4083	0.0383
Dibutylthioether,	−20	253.15	4.1764	1.5057	0.063
(*dibutyl sulfide*); $C_8H_{18}S$	0	273.15	4.4346	4.0881	0.0412
	20	293.15	4.6623	6.2091	0.023
Butylvinylthioether,	−30	243.15	4.1254	1.1046	0.0676
(*butylvinyl sulfide*); $C_6H_{12}S$	−15	258.15	4.3245	2.1241	0.0448
	0	273.15	4.5207	5.7902	0.0381
Divinylthioether,	−30	243.15	4.2355	1.8296	0.0559
(*divinyl sulfide*); C_4H_6S	−15	285.15	4.3658	1.6644	0.0378
	0	273.15	4.4888	3.4421	0.0317

Auxiliary Information

Method/Apparatus/Procedure:
The apparatus and method were similar to those described in previous publications.[1,2]

Source and Purity of Materials:
Solvents were tested by standard methods and were at least 99% pure.

Estimated Error:
No information.

References:
[1]G. E. Braude and S. F. Shakhova, Khim. Prom. (**3**), 177 (1961).
[2]V. A. Granzhan, O. G. Kirillova and N. Z. Pin'kovskaya, Zh. Phys. Khim. **42**, 238 (1969).

Components:
(1) Ethyne; C_2H_2; [74-86-2]
(2) *N,N*-Diethylamide methanesulfoacid $CH_3SO_3N(C_2H_5)_2$; $C_5H_{13}NO_3S$

Original Measurements:
R. G. Makitra, F. B. Moin, T. I. Poltanskaya, and A. Yakovyak, Zh. Fiz. Khim. **49**(10), 2723–2724 (1975); dep. VINITI 1877-75.

Variables:
T/K = 253–338;
p_1 /kPa = 13–95

Prepared By:
Yu. P. Yampolskii and P. G. T. Fogg

Experimental Data

t/°C	T/K	p_1 /mm Hg	p_1 /kPa	Bunsen coefficient, α	x_1*
−20	253.15	100	13.3	2.8	0.013
		200	26.7	5.6	0.034
		300	40.0	11.0	0.066
		400	53.3	13.8	0.084
		500	66.7	19.0	0.111
		600	80.0	23.6	0.143
		725	96.7	32.6	0.197
0	273.15	100	13.3	1.4	0.009
		200	26.7	3.0	0.018
		300	40.0	5.4	0.033
		400	53.3	6.0	0.037
		500	66.7	12.0	0.073
		600	80.0	13.4	0.082
		725	96.7	17.4	0.106
20	293.15	100	13.3	0.9	0.006
		200	26.7	2.3	0.014
		300	40.0	3.7	0.023
		400	53.3	5.2	0.032
		500	66.7	7.0	0.043
		600	80.0	9.2	0.057
		725	96.7	10.4	0.064
35	308.15	100	13.3	0.7	0.004
		200	26.7	1.8	0.011
		300	40.0	3.0	0.019
		400	53.3	3.6	0.022
		500	66.7	4.4	0.027
		600	80.0	5.8	0.036
		725	96.7	7.0	0.043
50	323.15	100	13.3	0.6	0.004
		200	26.7	1.2	0.008
		300	40.0	2.2	0.014
		400	53.3	3.2	0.020
		500	66.7	3.8	0.024
		600	80.0	4.8	0.030
		725	96.7	5.6	0.035
65	338.15	100	13.3	0.3	0.002
		200	26.7	1.0	0.006
		300	40.0	1.6	0.010
		400	53.3	2.0	0.012
		500	66.7	3.0	0.019
		600	80.0	4.0	0.025
		725	96.7	5.0	0.031

*Corrected values of mole fraction solubility. Values of x_1 given by the authors are not consistent with values of α. The evaluator considers that the values of x_1 should be increased by a factor of 10.

Auxiliary Information

Method/Apparatus/Procedure:
Measurements were performed in static conditions with a standard apparatus for solubility measurements.

Source and Purity of Materials:
(1) Ethyne purity 99.5%.
(2) Solvent boiling point 115 °C (4 mm Hg); ρ = 1.1066 g cm^{-3}; η = 10.15 Pa s.

Estimated Error:
No information.

Components:
(1) Ethyne; C_2H_2; [74-86-2]
(2) Sulfur compounds

Original Measurements:
R. G. Makitra, A. Yakovyak, and T. I. Politanskaya, Zh. Fiz. Khim. **50**, 1619 (1976); VINITI 3545-75; deposited from 11th December 1975.

Variables:
T/K = 253.2–338.2;
P/kPa = 13.3–97.2

Prepared By:
Yu. P. Yampolskii

Experimental Data

N,N-Dimethylamide ethanesulfoacid, $C_2H_5SO_3N(CH_3)_2$; $C_4H_{11}NO_3S$, (**I**).

t/°C	T/K*	P/mm Hg	P*/kPa	α**	x_1	t/°C	T/K	P/mm Hg	P*/kPa	α	x_1
20	293.2	100	13.3	1.0	0.005	50	323.2	100	13.3	0.4	0.002
		200	26.7	2.6	0.014			200	26.7	1.4	0.008
		300	40.0	5.8	0.031			300	40.0	3.0	0.016
		400	53.3	8.0	0.043			400	53.3	4.4	0.024
		500	66.7	10.0	0.053			500	66.7	5.3	0.028
		600	80.0	12.2	0.065			600	80.0	6.7	0.036
		722	96.3	14.6	0.078			722	96.3	7.7	0.041
35	308.2	100	13.3	0.6	0.003	65	338.2	100	13.3	0.2	0.001
		200	26.7	2.0	0.011			200	26.7	1.2	0.006
		300	40.0	3.8	0.020			300	40.0	2.6	0.014
		400	53.3	5.2	0.028			400	53.3	3.0	0.016
		500	66.7	6.2	0.033			500	66.7	3.4	0.018
		600	80.0	8.2	0.044			600	80.0	4.2	0.022
		722	96.3	9.6	0.051			722	96.3	6.0	0.032

N,N-Diethylamide ethanesulfoacid, $C_2H_5SO_3N(C_2H_5)_2$; $C_6H_{15}NO_3S$, (**II**).

t/°C	T/K*	P /mm Hg	P* /kPa	α**	x_1	t/°C	T/K	P /mm Hg	P* /kPa	α	x_1
−20	253.2	100	13.3	4.6	0.031	35	308.2	100	13.3	1.0	0.007
		200	26.7	14.2	0.097			200	26.7	1.8	0.012
		300	40.0	22.2	0.151			300	40.0	3.0	0.021
		400	53.3	27.0	0.184			400	53.3	5.2	0.036
		500	66.7	31.0	0.211			500	66.7	6.7	0.046
		600	80.0	37.6	0.256			600	80.0	7.6	0.052
		729	97.2	46.4	0.317			729	97.2	9.4	0.064
0	273.2	100	13.3	1.6	0.011	50	323.2	100	13.3	0.6	0.004
		200	26.7	4.2	0.029			200	26.7	1.2	0.008
		300	40.0	7.8	0.053			300	40.0	2.4	0.016
		400	53.3	12.0	0.082			400	53.3	4.0	0.027
		500	66.7	14.6	0.100			500	66.7	5.0	0.034
		600	80.0	17.8	0.121			600	80.0	6.2	0.042
		729	97.2	21.4	0.146			729	97.2	7.6	0.052
20	293.2	100	13.3	1.2	0.008	65	338.2	100	13.3	0.4	0.003
		200	26.7	2.8	0.019			200	26.7	0.6	0.004
		300	40.0	4.6	0.031			300	40.0	1.0	0.007
		400	53.3	7.0	0.048			400	53.3	1.8	0.012
		500	66.7	8.8	0.060			500	66.7	2.6	0.018
		600	80.0	10.2	0.070			600	80.0	2.8	0.019
		729	97.2	12.0	0.082			729	97.2	5.0	0.034

N,N'-Tetraethylsulfamide, $(C_2H_5)_2NSO_2N(C_2H_5)_2$, $C_8H_{20}N_2O_2S$, (**III**)

t/°C	T/K*	P /mm Hg	P* /kPa	α**	x_1	t/°C	T/K	P /mm Hg	P* /kPa	α	x_1
0	273.2	100	13.3	1.4	0.020	50	323.2	100	13.3	0.4	0.003
		200	26.7	4.2	0.036			200	26.7	1.2	0.010
		300	40.0	7.0	0.060			300	40.0	2.2	0.019
		400	53.3	9.4	0.080			400	53.3	3.0	0.026
		500	66.7	12.6	0.108			500	66.7	3.8	0.033
		600	80.0	15.6	0.133			600	80.0	5.0	0.043
		729	97.2	18.6	0.159			729	97.2	6.8	0.058
20	293.2	100	13.3	1.0	0.009	65	338.2	100	13.3	0.2	0.002
		200	26.7	3.0	0.026			200	26.7	0.8	0.007
		300	40.0	5.0	0.043			300	40.0	1.4	0.014
		400	53.3	6.6	0.056			400	53.3	2.2	0.019
		500	66.7	8.6	0.074			500	66.7	3.2	0.027
		600	80.0	10.8	0.092			600	80.0	3.6	0.031
		729	97.2	12.8	0.109			729	97.2	5.0	0.043
35	308.2	100	13.3	0.6	0.005						
		200	26.7	1.8	0.015						
		300	40.0	3.0	0.026						
		400	53.3	4.4	0.038						
		500	66.7	5.0	0.043						
		600	80.0	6.4	0.055						
		729	97.2	8.6	0.074						

*Calculated by the compiler.
**Volume of gas absorbed, reduced to 273.15 K and 101.3 kPa, divided by volume of solvent.

Auxiliary Information

Method/Apparatus/Procedure:
A static method was used.

Source and Purity of Materials:
(1) Ethyne purity >99.5%.
(2) The solvents had the following properties:

Solvent	Melting Point	d_4^{20}	n_D^{20}
I	4.5	1.1455	1.4477
II	−22.0	1.0752	1.4481
III	−38.5	1.0453	1.4479

Estimated Error:
No information.

3.14. Liquid Gases

Components:
(1) Ethyne; C_2H_2; [74-86-2]
(2) Liquid gases

Evaluator:
Peter G. T. Fogg, University of North London, London, United Kingdom.

Critical Evaluation:

Neumann and Mann[1] measured the solubility of ethyne in liquid methane and ethene and in mixtures of the two. Mole fraction solubility increases with increase in temperature. The data are impressively consistent (Fig. 11). However there are no data from other workers which are available for comparison.

Fedorova[2] measured the solubility of ethyne in liquid nitrogen and in liquid oxygen. Solubility also increases with increase in temperature. The data are reasonably consistent but no data from other sources are available for comparison. (Fig. 12).

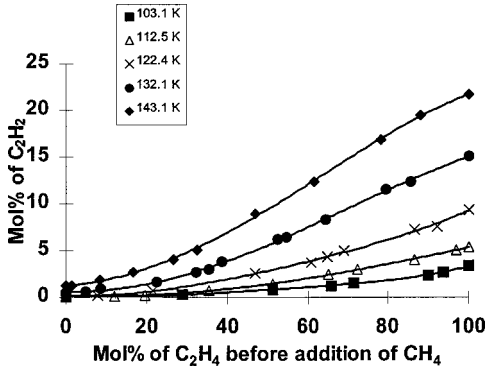

FIG. 11. Variation of solubility of ethyne with composition of mixtures of liquid ethene and methane at various temperatures.

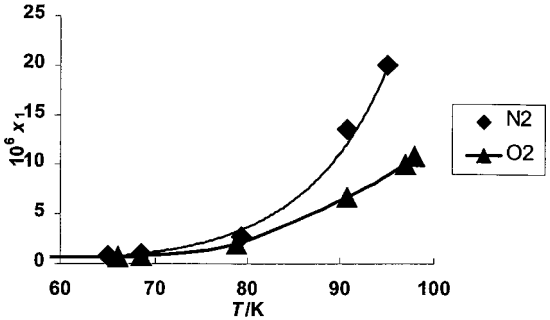

FIG. 12. Variation with temperature of the solubility of ethyne in liquid oxygen and liquid nitrogen.

References:
[1]A. Neumann and R. Mann, Chem. Ing. Tech. **41**, 708–711 (1969).
[2]M. F. Fedorova, Zh. Fiz. Khim. **14**, 422–426 (1940).

Components:
(1) Ethyne; C_2H_2 ; [74-86-2]
(2) Methane; CH_4 ; [74-82-8]
(3) Ethene; C_2H_4 ; [74-84-0]

Original Measurements:
A. Neumann and R. Mann, Chem. Ing. Tech. **41**, 708–711 (1969).

Variables:
T/K=93.3–143.1

Prepared By:
P. G. T. Fogg

Experimental Data

Solubility in Methane

T/K	$x_1 \cdot 10^2$
93.3	0.0068
98.7	0.0139
102.9	0.0225
103.1	0.0245
105.0	0.0335
108.0	0.0425
112.5	0.0800
113.8	0.100
117.6	0.148
120.9	0.202
122.4	0.212
128.9	0.400
132.4	0.545
133.7	0.523
143.1	1.25

Solubility in Ethene

T/K	$x_1 \cdot 10^2$
103.1	3.4
103.9	3.4
105.6	3.6
107.8	4.1
112.5	5.4
112.8	5.4
122.4	9.4
122.5	9.3
132.4	15.1
142.0	22.2
143.1	21.8

Solubility in mixed solvents

T/K	Concentration CH_4 $x_2 \cdot 10^2$	C_2H_4 $x_3 \cdot 10^2$	C_2H_2 $x_1 \cdot 10^2$	T/K	Concentration CH_4 $x_2 \cdot 10^2$	C_2H_4 $x_3 \cdot 10^2$	C_2H_2 $x_1 \cdot 10^2$
103.1	71.1	28.6	0.30	132.4	94.5	4.9	0.60
	48.4	50.8	0.80		90.5	8.5	0.95
	33.6	65.1	1.3		76.2	22.1	1.65
	28.0	70.4	1.6		66.1	31.2	2.7
	9.8	87.8	2.4		62.8	34.2	3.0
	6.1	91.2	2.7		59.1	37.0	3.9
112.5	87.8	12.0	0.15		44.7	49.1	6.2
	80.2	19.5	0.26		42.6	50.9	6.5
	64.3	35.0	0.70		32.5	59.2	8.3
	48.1	50.4	1.5		18.0	70.4	11.6
	34.0	63.5	2.5		12.5	75.1	12.4
	26.6	70.4	3.0	143.1	97.2	1.5	1.3
	12.9	83.0	4.1		89.9	8.2	1.9
	3.1	91.8	5.1		81.3	16.0	2.7
122.4	92.0	7.8	0.20		70.4	25.5	4.05
	78.1	21.2	0.70		64.2	30.6	5.15
	51.8	45.6	2.6		48.5	42.5	9.0
	37.7	58.4	3.8		33.6	54.0	12.4
	33.4	62.2	4.4		18.0	65.1	16.9
	29.4	65.6	5.0		9.5	71.0	19.5
	12.4	80.3	7.3				
	7.2	85.2	7.6				

Auxiliary Information

Method/Apparatus/Procedure:
The apparatus consisted of a stainless steel cylindrical with quartz observation windows attached to a vacuum line with pressure gauges and storage bulbs attached. The cell contained two chambers, each with an observation window. The cylinder was cooled in a cryostat with temperature control to ±0.05 °C. The mixture of gases was condensed into the lower chamber of the cell and stirred by a magnetic stirrer to enable solid ethyne to dissolve. When saturation was reached a sample of the solution was forced by helium gas through a sintered glass disk into the upper chamber. The sample was then allowed to evaporate into a sampling vessel at room temperature. A portion of mixed gases was subsequently removed for analysis by gas chromatography.

Source and Purity of Materials:
(1) Purified through molecular sieve to remove higher hydrocarbons, oxygen, nitrogen and water.
(2) Methane and ethane—purity ≥99.95%.

Estimated Error:
$\delta x_1/x_1 \approx 10\%$ at $10^{-2}\%$ C_2H_2; 3% at 20% C_2H_2; $\delta x_2/x_2 \approx 3\%$; $\delta x_3/x_3 \approx 3\%$ (authors).

Components:
(1) Ethyne; C_2H_2 ; [74-86-2]
(2) Nitrogen; N_2 ; [7727-37-9]; Oxygen; O_2 ; [7782-44-7]

Original Measurements:
M. F. Fedorova, Zh. Fiz. Khim. **14**, 422–426 (1940).

Variables:
T/K = 65–98

Prepared By:
A. Skrzecz and P. G. T. Fogg

Experimental Data
Solubility in liquid nitrogen

T/K	Solubility* cm^3 C_2H_2 /dm^3 solvent	$x_1 \times 10^6$	T/K	Solubility cm^3 C_2H_2 /dm^3 solvent	$x_1 \times 10^6$
95	14.00	19.95	68.5	0.67	0.955
90.7	9.59	13.60	65	0.56	0.791
79.4	1.91	2.72			

Solubility in liquid oxygen

T/K	Solubility* cm^3 C_2H_2 /dm^3 solvent	$x_1 \times 10^6$	T/K	Solubility $cm^3C_2H_2$ /dm^3 solvent	$x_1 \times 10^6$
98	9.50	10.85	68.5	0.69	0.794
97	8.80	10.07	66.0	0.6	0.692
90.7	5.91	6.76	65.1	0.56	0.641
78.9	1.78	2.04			

* The volume of gas was probably corrected to 273.2 K and 101.3 kPa.

Auxiliary Information

Method/Apparatus/Procedure:
Acetylene passed through the liquid solvent, in a Dewar flask, until the solid phase was observed. Saturated solutions, prepared 3–5 days previously, were placed in the thermostat controlled equilibrium vessel for 3–5 h. They were then filtrated for 3–5 min and samples of the homogenous solution were analyzed. Acetylene from evaporated solution was absorbed by a 3% ammoniacal solution of $AgNO_3$. The precipitate was washed and dissolved in concentrated HNO_3 and then titrated with NH_4CNS. Each published measurement of the solubility of solid acetylene is the mean of several experiments.

Source and Purity of Materials:
(1) Prepared in the laboratory from CaC_2 ; purified by removal of H_2S and NH_3.
(2) Sources not specified.

Estimated Error:
Temp. ±0.2–0.3 K; volume of C_2H_2 ± 0.2 cm^3.

3.15. Petroleum Oils

Components:
(1) Ethyne; C_2H_2 ; [74-86-2]
(2) Petroleum oils

Evaluator:
Peter G. T. Fogg, University of North London, London, United Kingdom.

Critical Evaluation

Solubilities in petroleum oils have been measured by various authors[1–5] but no estimate of reliability of data can be made.

The solubility of ethyne in different samples of kerosene has been measured by several authors.[1–4] Solubilities vary from sample to sample because of the variation in proportion of different components. These differences in composition lead to differences in boiling ranges, density, and relative average molecular masses. Variation in solubilities over temperature ranges for two samples of relative molecular mass 156 are shown in Fig. 13. Solubilities in the sample labeled A4 studied by Hannaert *et al.*[2] are close to solubilities calculated from data published by Granzhan and Kvasova.[4] This may possibly indicate that the two samples have closely similar chemical composition. Solubility data for two samples having relative molecular masses of 180 and boiling ranges of 200–250 °C (Hannaert *et al.*) and 190–250 °C (Bliznyuk *et al.*)[3] are shown in Fig. 14. In this case the solubilities show major differences.

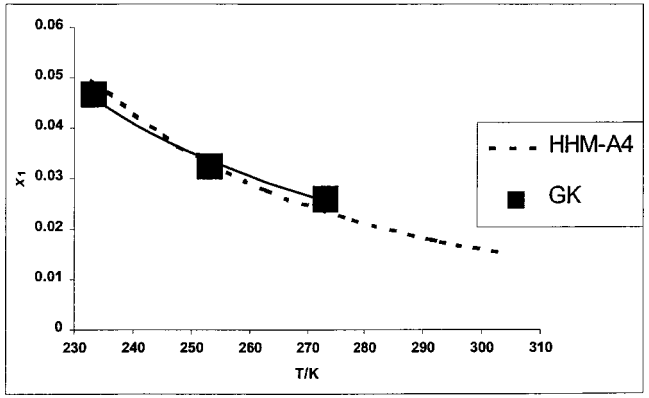

FIG. 13. Solubility of ethyne in samples of kerosene of relative molecular mass 156 studied by Hannaert *et al.* **(HHM-A4)** and by Granzhan and Kvasova **(GK)**.

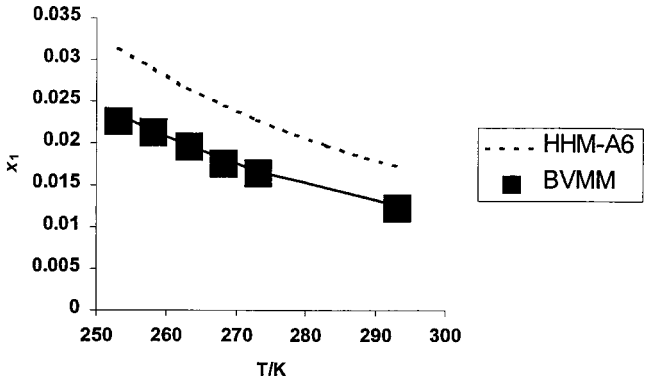

FIG. 14. Solubility of ethyne in samples of kerosene of relative molecular mass 156 studied by Hannaert *et al.* **(HHM-A6)** and by Bliznyuk *et al.* **(BVMM)**.

References:
[1]V. A. Kireev and M. A. Romanchuk, Zh. Obshch. Khim. **6**, 78–80 (1936).
[2]H. Hannaert, M. Haccuria, and M. P. Mathieu, Ind. Chim. Belge **32**, 156–164 (1967).
[3]N. L. Bliznyuk, A. P. Voronkov, V. S. Mislavskaya, and R. Ya. Mushii, Khim. Tekhnol. (Kiev) (**1**), 47–48 (1975).
[4]V. A. Granzhan and V. V. Kvasova, Zh. Prikl. Khim. **49** (4), 935 (1976); VINITI 2704-75, deposited 22nd Sept. 1975.
[5]F. Simon and J. Lukacs, Magy. Ásványolaj-Földgázkíserl. Intéz. Közl. **18**, 57–66 (1977).

Components:
(1) Ethyne; C_2H_2 ; [74-86-2]
(2) Kerosene

Original Measurements:
V. A. Kireev and M. A. Romanchuk, Zh. Obshch. Khim. **6**, 78–80 (1936).

Variables:
T/K = 253–293;
P/kPa = 13.3–101.3

Prepared By:
A. Skrzecz and P. G. T. Fogg

Experimental Data

t/ °C	T/K*	P/mm Hg	P/kPa*	V_1/V_2[a]
−20	253.1	100	13.3	0.35
		200	26.7	0.70
		300	40.0	1.10
		400	53.3	1.50
		500	66.7	1.90
		600	80.0	2.35
		700	93.3	2.90
		760	101.3	3.30
0	273.1	100	13.3	0.20
		200	26.7	0.50
		300	40.0	0.80
		400	53.3	1.05
		500	66.7	1.30
		600	80.0	1.65
		700	93.3	1.90
		760	101.3	2.05
20	293.1	100	13.3	0.35
		200	26.7	0.45
		300	40.0	0.70
		400	53.3	0.90
		500	66.7	1.15
		600	80.0	1.35
		700	93.3	1.60
		760	101.3	1.70

[a]Ratio of volume of gas (STP) to volume of solvent.
*Calculated by a complier.

Auxiliary Information

Method/Apparatus/Procedure:
The solvent was saturated with the gas at constant temperature and pressure until equilibrium was reached. After decreasing the pressure, the volume of the desorbed gas was measured. The method and apparatus was described in Ref. 1.

Source and Purity of Materials:
(1) Source not specified; taken from a standard cylinder, technical grade; used as received; $\rho = 1.0857$ g dm^{-3}(20 °C).
(2) From Baku petroleum; d_4^{20}0.8349; Boiling point 140–250 °C (737 mm Hg).

Estimated Error:
No information.

References:
[1]V. A. Kireev, S. I. Kaplan, and M. A. Romanchuk, Zh. Obshch. Khim. **5**, 444 (1935).

Components:
(1) Ethyne; C_2H_2 ; [74-86-2]
(2) Kerosenes; Gasoline

Original Measurements:
H. Hannaert, M. Haccuria, and M. P. Mathieu, Ind. Chim. Belge **32**, 156–164 (1967).

Variables:
T/K=273–353

Prepared By:
E. L. Boozer and H. L. Clever

Experimental Data

T/K	$100x_1$ /mol%	$Kp\nu$/atm* at 293.15	Enthalpy of dissolution, ΔH/kcal mol^{-1}	A
Kerosene A-1				
233.15–303.15	1–2	52	2	3.2
Kerosene A-2				
233.15–293.15	1–2	53	1.35	2.74
Kerosene A-3				
233.15–273.15	1–2	61.5	1.97	3.265
Kerosene A4/A5				
233.15–293.15	1	61.1	2.225	3.49
Kerosene A-6				
253.15–313.15	1	69	2.11	3.41
298.15–353.15	1	69.5	2.1	3.414
Gasoline				
243.15–293.15	1–2	75	2.325	3.61

*$\log_{10}(KP\nu/\text{atm}) = A - (\Delta H/\text{cal mol}^{-1})/(2.3R(T/\text{K}))$.

The author's definitions are:
$K = y_1/x_1$ = mole fraction gas in gas phase/mole fraction gas in liquid phase, P/atm=total pressure; ν=coefficient of fugacity.
The function $KP\nu$/atm is equivalent to a Henry's constant in the form $H_{1,2}$/atm=(f_1/atm)/x_1, where f_1 is the fugacity.

Auxiliary Information

Method/Apparatus/Procedure:
For temperatures below 303.15 the static saturation pressure for all the kerosenes was measured in an apparatus having a precision of 2%–5%. A chromatographic method was also used for kerosene A-6 in the temperature range 298.15–353.15 K. The static pressures over solutions of ethyne in gasoline were measured with a precision of 10%–15%.

Source and Purity of Materials:
(1) Ethyne. Commercial product. Purified by passage over activated carbon and vacuum fusion. Purity 99.8%–99.9%.
(2) Kerosenes and gasoline.

Sample	Distillation range/t°C	Density, ρ^{20}/g cm^{-3}	Relative molecular mass
A-1	150–280	0.7805	170
A-2	150–185	0.77	145
A-3	207–255	0.784	192
A-4	140–260		156
A-5	200–285	0.8152	190
A-6	200–250	0.786	180
Gasoline	94–168	0.7521	122

Estimated Error:
No information available.

Components:
(1) Ethyne; C_2H_2 ; [74-86-2]
(2) Lighting kerosene

Original Measurements:
N. L. Bliznyuk, A. P. Voronkov, V. S. Mislavskaya, and R. Ya. Mushii, Khim. Tekhnol. (Kiev) (**1**), 47–48 (1975).

Variables:
T/K=253–273 K

Prepared By:
A. Skrzecz and P. G. T. Fogg

Experimental Data

t/°C	T/K	V_r/cm^3 g^{-1}	H/Torr	H/Torr[b]
−20	253.1	2.60	33 700	298 00
−15	258.1	2.51	35 630[a]	
−10	263.1	2.34	38 960[a]	
−5	268.1	2.14	43 410[a]	
0	273.1	2.04	46 360	433 00
20	293.1	1.64	61 930	

[a]Calculated by the compilers.
[b]Reported in the paper as data obtained by static method and taken from Ref. 2.

Auxiliary Information

Method/Apparatus/Procedure:
The gas-chromatographic method, as described in Ref. 1, was used to measure specific retention volumes (V_r). The Henry's coefficients (H) were calculated by the compilers from the equation $V_r = RT/(MH)$ where M is molar mass of stationary phase, stated to be 180, R is gas constant, and T is temperature.

Source and Purity of Materials:
(1) Source not specified.
(2) Source not specified; boiling point range 190–250 °C.

Estimated Error:
No information.

References:
[1]G. A. Kurkchi and A. V. Iogansen, Zh. Fiz. Khim. **40**, 2928 (1969).
[2]V. G. Bova, and D. A. Kuznetzov, Tr. Mosk. Khim.-Tekhnol. Inst. **60**, 58 (1969).

Components:
(1) Ethyne; C_2H_2; [74-86-2]
(2) Kerosene KO-25

Original Measurements:
V. A. Granzhan and V. V. Kvasova, Zh. Prikl. Khim. **49** (4), 935 (1976); VINITI 2704-75, deposited 22nd Sept. 1975.

Variables:
T/K=233–273; P/kPa=27.4–109.3 kPa

Prepared By:
Yu. P. Yampolskii

Experimental Data

t/°C	T/K*	P/mm Hg	P/kPa*	x_1	α**
−40	233.2	205.5	27.39	0.0083	1.17
		338.5	45.13	0.0143	2.03
		584	77.86	0.0293	4.23
		791	105.45	0.0488	7.18
−20	253.2	214	28.53	0.0059	0.83
		349	46.53	0.0110	1.50
		545	72.66	0.0189	2.69
		819.5	109.26	0.0371	5.40
0	273.2	327.5	43.66	0.0066	0.92
		504.5	67.26	0.0119	1.69
		648.5	86.46	0.0168	2.40
		757	100.93	0.0241	3.46

*Calculated by the compiler.
**Volume of gas absorbed, reduced to 273.2 K and 101.3 kPa, divided by the volume of solvent.

Auxiliary Information

Method/Apparatus/Procedure:
No information was given on the method of determination of solubility of ethyne. The authors proposed a method of estimating the average molecular mass of the kerosene from the critical temperature of mixing with aniline.

Source and Purity of Materials:
ρ^{20}=0.8011 kg dm^{-3};
η_{20}=1.65 Pa s. Average molecular weight 153 (aniline point); 159 (cryoscopy),

Estimated Error:
No information.

Components:
(1) Ethyne; C_2H_2; [74-86-2]
(2) Heavy solvent

Original Measurements:
V. A. Kireev and M. A. Romanchuk, Zh. Obsch. Khim. **6**, 78–80 (1936).

Variables:
T/K=273; P/kPa=13.3–101.3

Prepared By:
A. Skrzecz and P. G. T. Fogg

Experimental Data

t/°C	T/K*	P/mm Hg	P/kPa*	V_1/V_2[a]
0	273.1	100	13.3	0.6
		200	26.7	1.0
		300	40.0	1.6
		400	53.3	2.1
		500	66.7	2.6
		600	80.0	3.1
		700	93.3	3.7
		760	101.3	4.0

[a]Ratio of volume of gas (STP) to volume of solvent.
*Calculated by a compiler.

Auxiliary Information

Method/Apparatus/Procedure:
The solvent was saturated with the gas at constant temperature and pressure until equilibrium was reached. After decreasing the pressure, the volume of the desorbed gas was measured. The method and apparatus was described in Ref. 1.

Source and Purity of Materials:
(1) Source not specified; taken from a standard cylinder, technical grade; used as received; ρ^{20}=1.0857 g dm^{-3}.
(2) Neftegaz; boiling point 150–250 °C; containing equal amounts of olefins, aromatic hydrocarbons, and naphthenes.

Estimated Error:
No information.

References:
[1]V. A. Kireev, S. I. Kaplan, and M. A. Romanchuk, Zh. Obshch. Khim. **5**, 444 (1935).

Components:
(1) Ethyne; C_2H_2; [74-86-2]
(2) Transformer oils
Tetracosane,2,6,10,15,19,23 hexamethyl, (*squalane*); $C_{30}H_{62}$; [111-01-3]

Original Measurements:
F. Simon and J. Lukács, Magy. Ásványolaj-Földgázkísérl. Intéz. Közl. **18**, 57–66 (1977).

Variables:
T/K= 293–333

Prepared By:
P. G. T. Fogg

Experimental Data

Oil	Correlation coefficient, $r^{\dagger}$	$A^{\dagger}$	$B^{\dagger}$	T/K	Bunsen coefficient, α*	x_1*
28.MVMT	0.9893	−1.8438	568.73	293.15	1.25	
		−1.8438	568.73	313.15	0.94	
		−1.8438	568.73	323.15	0.82	
		−1.8438	568.73	333.15	0.73	
28.MVMT használt	0.9995	−1.7453	531.72	293.15	1.17	
		−1.7453	531.72	313.15	0.90	
		−1.7453	531.72	323.15	0.79	
		−1.7453	531.72	333.15	0.71	
Györi II	0.9962	−1.7017	514.57	293.15	1.13	
		−1.7017	514.57	313.15	0.87	
		−1.7017	514.57	323.15	0.78	
		−1.7017	514.57	333.15	0.70	
IX.BIM	0.9818	−1.4586	436.55	293.15	1.07	
		−1.4586	436.55	313.15	0.86	
		−1.4586	436.55	323.15	0.78	
		−1.4586	436.55	333.15	0.71	
Squalane	0.9962	−1.6425	491.97	293.15	1.09	0.025
		−1.6425	491.97	313.15	0.85	0.020
		−1.6425	491.97	323.15	0.76	0.018
		−1.6425	491.97	333.15	0.68	0.016

†The authors gave values of the correlation coefficients r and constants A and B in the following equation for Bunsen coefficients: α, :$\log_{10}\alpha = A + B/(T/\mathrm{K})$.
*Calculated by the compiler.

Auxiliary Information

Method/Apparatus/Procedure:
A gas chromatographic method was used. Bunsen coefficients were calculated from retention times.

Source and Purity of Materials:
No information.

Estimated Error:
$\delta\alpha = \pm 0.04–0.06$;
$\delta T/\mathrm{K} = \pm 0.5$ (authors).

3.16. Rubbers and Other Polymers

Components:
(1) Ethyne; C_2H_2; [74-86-2]
(2) Rubbers and other polymers

Evaluator:
Peter G. T. Fogg, University of North London, London, United Kingdom.

Critical Evaluation

The solubility of ethyne in samples of natural and synthetic rubbers was measured by van Amerongen.[1] No other data are available for comparison.

Solubility in polystyrene was measured by Newitt and Weale.[2] No other data are available for comparison.

Solubility in poly(vinyltrimethyl silane) was measured by Volkov *et al.*[3] at 298 K and by Davydova *et al.*[4] at 295 K. There is poor agreement between the values of the solubility coefficient given in the two sources. A comparison between solubility coefficients for different gases in this polymer has been published by Yampolski.[5]

References:

[1]G. J. van Amerongen, J. Polym. Sci. **5**(3), 307–332 (1950).
[2]D. M. Newitt and K. E. Weale, J. Chem. Soc. 1541(1948).
[3]V. V. Volkov, N. S. Nametkin, and S. G. Durgaryan, Vysokomol, Soedin, Ser. A, **21**, 920 (1979).
[4]M. B. Davydova, Yu, P. Yampol'ski, S. G. Durgaryan, and N. K. Gladkova, Vyokomol. Soedin Ser. A **30**, 554 (1988); M. B. Davydova, Yu. P. Yampol'ski, and S. G. Durgaryan, Vyokomol. Soedin Ser. A **30**, 1430 (1988).
[5]Yu. P. Yampol'ski, J. Phys. Chem. Ref. Data **28**, 1313–1314 (1999).

Components:
(1) Ethyne; C_2H_2; [74-86-2]
(2) Natural and synthetic rubbers

Original Measurements:
G. J. van Amerongen, J. Polym. Sci. **5**(3), 307–332 (1950).

Variables:
T/K = 298, 323;
p_1 /kPa = 101.3

Prepared By:
P. G. T. Fogg

Experimental Data

Elastomer	t/°C	T/K	Solubility, S*
Natural rubber	25	298.15	1.62
	50	323.15	1.20
Perbunan (German)	25	298.15	2.48
	50	323.15	1.79
Butyl rubber	25	298.15	0.63
	50	323.15	0.54

*Volume of gas, corrected to 101.3 kPa and 273.15 K, dissolved by unit volume of elastomer at a partial pressure of gas of 101.3 kPa.

Auxiliary Information

Method/Apparatus/Procedure:
Apparatus and methods are described in Refs. 1 and 2. Values of the permeation coefficient, Q, and of the diffusion coefficient, D, were measured. Values of the solubility, S, were calculated from the relationship $Q = DS$.

Source and Purity of Materials:
(1) From a cylinder.
(2) Perbunan: 73% butadiene +27% acrylonitrile copolymer. Equivalent to American Perbunan 26. Butyl rubber: 98% isobutene +2% isoprene copolymer.

Estimated Error:
No information.

References:
[1]G. J. van Amerongen, J. Appl. Phys. **17**, 972 (1946).
[2]G. J. van Amerongen, Rubber Chem. Technol. **20**, 495 (1947).

Components:
(1) Ethyne; C_2H_2; [74-86-2]
(2) Polystyrene; $(C_8H_8)_n$; [9003-53-6]

Original Measurements:
D. M. Newitt and K. E. Weale, J. Chem. Soc. 1541 (1948).

Variables:
T/K = 433; p_1 /kPa = 4964–9370

Prepared By:
P. G. T. Fogg

Experimental Data

p_1 /atm	p_1 /kPa	Solubility C/cm^3(STP)/cm^3
49	4964	5.27
77.55	7856	8.05
92.5	9370	9.75

Auxiliary Information

Method/Apparatus/Procedure:
The pressure drop due to gas sorption was measured.

Source and Purity of Materials:
Polystyrene supplied by B. X. Plastics Ltd.

Estimated Error:
No information.

Components:
(1) Ethyne; C_2H_2 ; [74-86-2]
(2) Poly(vinyltrimethyl silane); $(C_5H_{12}Si)_n$; [25036-32-2]

Original Measurements:
V. V. Volkov, N. S. Nametkin, and S. G. Durgaryan, Vysokomol, Soedin, Ser. A. **21**, 920 (1979). Data quoted by Yu. P. Yampol'ski, J. Phys. Chem. Ref. Data **28**, 1315 (1999).

Variables:
T/K = 298

Prepared By:
P. G. T. Fogg

Experimental Data

T/K	Solubility coefficient, S/cm^3(STP)/cm^3 atm
298	0.033

Auxiliary Information

Method/Apparatus/Procedure:
Sorption was measured using a McBain balance with a quartz spring.

Source and Purity of Materials:
The polymer was synthesized in the presence of butyl lithium. The number average relative molecular mass was 416 000. The mass average relative molecular mass was 608 000.

Estimated Error:
No information.

Components:
(1) Ethyne; C_2H_2 ; [74-86-2]
(2) Poly(vinyltrimethyl silane); $(C_5H_{12}Si)_n$; [25036-32-2]

Original Measurements:
M. B. Davydova, Yu, P. Yampol'ski, S. G. Durgaryan, and N. K. Gladkova, Vyokomol. Soedin Ser. A **30**, 554 (1988); M. B. Davydova, Yu. P. Yampol'ski, and S. G. Durgaryan, Vyokomol. Soedin Ser. A. **30**, 1430 (1988); Data quoted by Yu. P. Yampol'ski, J. Phys. Chem. Ref. Data **28**, 1316 (1999).

Variables:
T/K = 295

Prepared By:
P. G. T. Fogg

Experimental Data

T/K	Solubility coefficient, S/cm^3(STP)/cm^3 atm
295	0.025

Auxiliary Information

Method/Apparatus/Procedure:
An inverse gas chromatographic method was used as described in Ref. 1.

Source and Purity of Materials:
The relative molecular mass was stated to be 600 000.

Estimated Error:
No information.

References:
[1]Yu. P. Yampol'ski, S. G. Durgaryan, and N. E. Kaliuzhnyi, Chrom. **286**, 97 (1984).

3.17. Biological Fluids

Components:
(1) Ethyne; C_2H_2; [74-86-2]
(2) Biological fluids

Evaluator:
Peter G. T. Fogg, University of North London, London, United Kingdom.

Critical Evaluation

Schoen[1] measured the solubility of ethyne in human blood at various temperatures in the range 282–312 K. The variation of the Bunsen coefficient with temperature is consistent. Grollman[2] and also Priestley and Schwartz[3] measured the solubility in whole blood and also aqueous solutions of components of blood. The Bunsen coefficient for normal human blood reported by Grollman at 310.65 K (0.740) is close to the values reported by Priestley at 310.2 K (0.751; 0.747) and by Schoen at the same temperature (0.739; 0.731). The differences between Bunsen coefficients for blood from different sources indicated by Grollman's data may be significant. However his method of measurement may not be reliable. Priestley's data for a different selection of mammalian blood show less variation. Grollman also published data for solubility per gram of water. Except in the case of distilled water these values are greater than values of Bunsen coefficients. These values of the solubility per gram of water are also higher than the value for water with the exception of the value for the sample of dog plasma. This indicates that in all cases, except that of the dog plasma, other components in addition to water contribute to the absorption.

Shkol'nikova[4] measured solubility in solutions of serum albumin. The data indicate that the albumin reduces the solubility of ethyne. This is probably due to solvation. The data do not fall into an entirely consistent pattern but are probably reliable enough to show general trends.

Data for the solubility in solutions of gelatin also measured by Shkol'nikova are more consistent. Gelatin also reduces the solubility of ethyne in water.

The solubility of ethyne in rat abdominal muscle was measured by Campos Carles *et al.*[5] The Bunsen coefficient given in the paper is higher than that in water. The high value for the solubility in rat abdominal muscle may be due to the lipid content. No other data for the system are available.

Campos Carlos *et al.* also measured the solubility in olive oil. The Bunsen coefficient at 310.15 K calculated from the solubility coefficient given by the author is 1.52 about twice the value for water at the same temperature. Solubility of a gas in olive oil is often taken to be approximately equal to the solubility in lipids. No other measurements of the solubility in olive oil are available for comparison.

References:

[1]R. Schoen, Z. Physiol. Chem. **127**, 243 (1923).
[2]A. Grollman, J. Biol. Chem. **82**, 317–325 (1929).
[3]J. G. Priestley and H. Schwarz, J. Physiol. **99**, 49–56 (1940).
[4]R. I. Shkol'nikova, Uch. Zap. Leningr. Gos. Univ. Ser. Khim. Nauk. **18**, 64–86 (1959); Chem. Abstr. **55**, 25443b (1961).
[5]A. Campos Carles, T. Kawashiro, and J. Pliper, Pflugers Arch. **359**, 209–218 (1975).

Components:
(1) Ethyne; C_2H_2; [74-86-2]
(2) Human blood

Original Measurements:
R. Schoen, Z. Physiol. Chem. **127**, 243 (1923).

Variables:
T/K = 282.7–312.0;
p_1 /kPa = 59.4–85.3

Prepared By:
P. G. T. Fogg

Experimental Data

t/°C	T/K	P_{total} /mm Hg	%C_2H_2 in gas	Vol. of C_2H_2 in 1 cm^3 of water*	Bunsen coefficient, α
9.5	282.7	757	80.7	1.052	1.305
10	283.2	745	64.9	0.847	1.302
15	288.2	760	89.5	1.017	1.136
15	288.2	760	74	0.843	1.14
37	310.2	756	70.6	0.521	0.739
37	310.2	758	58.8	0.427	0.731
38	311.2	757	84.5	0.609	0.72
39	312	760	86.9	0.598	0.703

*Volumes of gas were corrected to 273.15 K and 101.3 kPa and correspond to the solubility at the experimental partial pressure which was equal to the total pressure multiplied by the fraction of ethyne in the gas stream.

The author multiplied these volumes by 760/(p_1 /mm Hg) to obtain values of the Bunsen coefficient α.

Auxiliary Information

Method/Apparatus/Procedure:
Water was saturated with a mixture of air and ethyne in measured proportions at a total pressure equal to atmospheric pressure. The dissolved ethyne was estimated in a van Slyke apparatus by reaction with mercuric cyanide solution. Full experimental details were described by the author.

Source and Purity of Materials:
(1) Ethyne obtained from a cylinder. Traces of acetone were removed by storing the gas over water.
(2) Fresh human blood was obtained from a cubital vein.

Estimated Error:
No information.

Components:
(1) Ethyne; C_2H_2; [74-86-2]
(2) Animal and human blood

Original Measurements:
A. Grollman, J. Biol. Chem. **82**, 317–325 (1929).

Variables:
T/K = 310.65;
p_1 /kPa approximately 101 kPa

Prepared By:
P. G. T. Fogg

Experimental Data

Temperature = 37.5 °C = 310.65 K; Total pressure was probably barometric.

Liquid	Bunsen coefficient,* β	Solubility**/cm^3 g^{-1}
Distilled water	0.747	0.752
Whole dog blood	0.759	0.943
Dog plasma	0.69	0.751
Dog corpuscles	0.778	0.986
Whole human blood	0.74	0.916
Whole rabbit blood	0.703	0.812
Whole human blood in case of *polycythemia vera*	0.71	
Whole human blood in case of myeloid leukaemia (*anaemia* and *relative lipemia*)	0.735	0.881
Solution of 0.3 g of human blood lipids in 100 cm^3 of water	0.748	

*Volume of gas, reduced to 273.13 K and 101.3 kPa, dissolved by 1 cm^3 of solution under a total pressure of 101.3 kPa.
**Volume of gas, reduced to 273.13 K and 101.3 kPa, dissolved by liquid containing 1 g of water.

Auxiliary Information

Method/Apparatus/Procedure:
The techniques used were similar to those used by van Slyke.[1] A "bubbling" method was used for water and solutions containing no protein. The "tonometric" method described by Austin *et al.*[2] was used for other solutions. Absorbed acetylene was estimated by reaction with alkaline mercuric cyanide as described in Ref. 3. Water content was found by drying at 110 °C and determining the change in weight.

Source and Purity of Materials:
(1) No information.
(2) Rabbit and dog blood were obtained by use of a local anaesthetic.[4] Plasma obtained by centrifuging. Normal human blood obtained by vein puncture using heparin as an anticoagulant. Lipids were extracted from blood by petroleum ether and diethyl ether. Pathological specimens of human blood were from a hospital ward.

Estimated Error:
$\delta\beta/\beta = \pm 5\%$ (compiler).

References:
[1]D. D. van Slyke, J. Sendroy, Jr; A. B. Hastings, and J. M. Neill, J. Biol. Chem. **78**, 765 (1928).
[2]J. H. Austin, G. E. Cullen, A. B. Hastings, F. C. McLean, J. P. Peters, and D. D. van Slyke, J. Biol. Chem. **54**, 121 (1922).
[3]E. K. Marshall and A. Grollman, Amer. J. Physiol. **86**, 117 (1928).
[4]A. Grollman, J. Gen. Physiol. **11**, 495 (1928).

Components:
(1) Ethyne; C_2H_2; [74-86-2]
(2) Human and animal blood

Original Measurements:
J. G. Priestley and H. Schwarz, J. Physiol. **99**, 49–56 (1940).

Variables:
T/K = 293.2, 310.15

Prepared By:
P. G. T. Fogg

Experimental Data

Liquid	t/°C	T/K	Bunsen coefficient, α
Water	20	293.15	1.03
Blood—human			
H.S.	37	310.15	0.751
J.G.P.	37	310.15	0.747
Blood—animal			
Cat	37	310.15	0.744
Ox no. 1	37	310.15	0.749
Ox no. 2. Whole blood	37	310.15	0.739
66.7% corpuscles 33.3% serum	37	310.15	0.737
33.3% corpuscles 66.7% serum	37	310.15	0.7357

Auxiliary Information

Method/Apparatus/Procedure:
A modified van Slyke method was used to find the ethyne dissolved in blood in contact with a known pressure of ethyne.

Source and Purity of Materials:
No information.

Estimated Error:
No information.

Components:
(1) Ethyne; C_2H_2; [74-86-2]
(2) Serum albumin
(3) Water; H_2O; [7732-18-5]

Original Measurements:
R. I. Shkol'nikova, Uch. Zap. Leningr. Gos. Univ. Ser. Khim. Nauk. **18**, 64–86 (1959); Chem. Abstr. **55**, 25443b (1961).

Variables:
T/K = 283.15–313.15;
P/kPa = 101.325 (1 atm)
Serum Albumin/mass % = 0.575–1.99

Prepared By:
H. L. Clever and A. L. Cramer

Experimental Data

	Bunsen coefficient; 10α			
T/K	0.575 mass %	1.15 mass %	1.68 mass %	1.99 mass %
283.15	11.990	10.520	10.500	10.480
288.15	9.959	9.840	9.640	9.522
293.15	8.530	8.070	8.110	—
298.15	8.380	7.980	7.740	7.691
303.15	8.241	7.990	7.500	7.460
308.15	7.854	7.612	7.280	6.830
313.15	6.530	6.380	6.340	5.330

	Ostwald coefficient; $10L$			
T/K	0.575 mass %	1.15 mass %	1.68 mass %	1.99 mass %
283.15	12.43	10.91	10.88	10.87
288.15	10.5	10.38	10.17	10.12
293.15	9.153	8.661	8.595	—
298.15	9.148	8.711	8.449	8.395
303.15	9.138	8.646	8.303	8.259
308.15	8.861	8.585	8.213	7.706
313.15	7.483	7.311	7.266	6.337

The enthalpies of solution of ethyne calculated from the temperature coefficient of the Bunsen coefficient, are 3450 cal mol^{-1} in water, and 2440, 2140, 2130, and 3280 cal mol^{-1} for 0.575, 1.15, 1.68, and 1.99 wt % serum albumin solutions, respectively. The solubility of ethyne in water is not given in the paper.

Auxiliary Information

Method/Apparatus/Procedure:
Modifications of the apparatus and procedure of Lannung[1] were used.

Source and Purity of Materials:
No information.

Estimated Error:
No information.

References:
[1]A. Lannung, J. Am. Chem. Soc. **52**, 68 (1930).

Components:
(1) Ethyne; C_2H_2; [74-86-2]
(2) Gelatin
(3) Water; H_2O; [7732-18-5]

Original Measurements:
R. I. Shkol'nikova, Uch. Zap. Leningr. Gos. Univ. Ser. Khim. Nauk. **18**, 64–86 (1959); Chem. Abstr. **55**, 25443b (1961).

Variables:
T/K = 283.15–313.15;
P/kPa = 101.325 (1 atm)
Gelatin/mass % = 1–10.

Prepared By:
H. L. Clever and A. L. Cramer

Experimental Data

	Gelatin, 1 mass %		Gelatin, 5 mass %		Gelatin, 10 mass %	
T/K	$10^3\alpha$*	10^3L**	$10^3\alpha$	10^3L	$10^3\alpha$	10^3L
283.15	963.0	998.4	881.9	914.0	860.8	892.3
288.15	895.0	944.2	806.1	824.2	801.3	845.0
293.15	807.0	866.0	766.0	822.0	733.0	786.7
298.15	749.0	817.6	700.6	764.8	675.0	736.8
303.15	—	—	633.0	702.5	613.0	680.3
308.15	—	—	547.0	617.4	517.0	583.4
313.15	—	—	456.9	523.8	419.0	480.4

The enthalpies of solution from the temperature coefficient of the Bunsen coefficient are 3450 cal mol^{-1} in water, and 3010, 4790, and 5100 cal mol^{-1} for the 1, 5, and 10 mass % gelatin solutions, respectively. The solubility of ethyne in water is not given in the paper.

Auxiliary Information

Method/Apparatus/Procedure:
Modifications of the apparatus and procedure of Lannung[1] were used.

Source and Purity of Materials:
No information.

Estimated Error:
No information.

References:
[1]A. Lannung, J. Am. Chem. Soc. **52**, 68 (1930).

Components:
(1) Ethyne; C_2H_2; [74-86-2]
(2) Rat abdominal muscle

Original Measurements:
A. Campos Carles, T. Kawashiro, and J. Pliper, Pflugers Arch. **359**, 209–218 (1975).

Variables:
T/K = 310.15

Prepared By:
H. L. Clever

Experimental Data

Temperature t/°C	Temperature T/K	Solubility coefficient /μmol dm^{-3} mm Hg^{-1} Experiment	Solubility coefficient /μmol dm^{-3} mm Hg^{-1} Corrected	Bunsen coefficient α/cm^3(STP)cm^{-3} atm^{-1}
37	310.15	47.5 ± 0.9	55.5	0.945

The solubility coefficient is the mean of 15 measurements. Correction factors were applied for the unextracted gas and the gas lost during transfer between chambers.

In another paper[1] the authors report diffusion coefficients of C_2H_2 in rat skeletal muscle at 37 °C. Krogh's diffusion constant, 10^9K/mmol min^{-1} cm^{-1} mm Hg^{-1} = 41.2 ± 0.9.

Diffusion coefficient, 10^6D/cm^2 s^{-1} = 12.4.

Auxiliary Information

Method/Apparatus/Procedure:
The acetylene, saturated with water vapor, was led through an equilibration chamber for 2 h at a rate of 8 ml m^{-1}. The muscle sample rested on a screen in the chamber so that it was exposed to the gas on all sides. After equilibration the muscle sample was transferred to an extraction chamber filled with room air for the same length of time as the gas equilibration. The gas in the chamber was forced into a gas chromatograph by mercury entering the chamber.

Source and Purity of Materials:
(1) Acetylene. Source not given. Stated to have a purity of 98.5%.
(2) Rat abdominal muscle. A flat muscle sheet of about 1.6 g, 21.4 mm thick, and 10 cm surface area was excised from rats weighing 250–430 g.

References:
T. Kawashiro, A. Campos Carles, S. F. Perry, and J. Pliper, Pflugers Arch. **359**, 219 (1975).

Components:
(1) Ethyne; C_2H_2; [74-86-2]
(2) Olive oil

Original Measurements:
A. Campos Carles, T. Kawashiro, and J. Pliper, Pflugers Arch. **359**, 209–218 (1975).

Variables:
T/K = 310.15

Prepared By:
H. L. Clever

Experimental Data

Temperature t/°C	Temperature T/K	Solubility coefficient /μmol dm^{-3} mm Hg^{-1}	Mol fraction x_1
37	310.15	90.4 ± 3.8	0.0634

The compiler calculated the mole fraction solubility at 101.325 kPa (760 mm Hg) partial pressure of acetylene.

An olive oil molecular weight of 884 and density of 0.8979 g cm^{-3} was used.

See R. Battino, F. D. Evans, and W. F. Danforth, J. Am. Oil Chem. Soc. **45**, 830 (1968).

Auxiliary Information

Method/Apparatus/Procedure:
The authors used a tonometer and extraction apparatus as described by Farhi[1,2] and a gas chromatograph. The solubility value is the mean of seven determinations.

Source and Purity of Materials:
(1) Acetylene. Source not given. Stated to have a purity of 98.5%.

References:
[1]L. E. Farhi, J. Appl. Physiol. **20**, 1098 (1965).
[2]L. E. Farhi, A. W. T. Edwards, and T. Homma, J. Appl. Physiol. **18**, 97 (1963).

4. Solvent Index

Page numbers preceded by E refer to evaluation texts whereas those not preceded by E refer to compilation tables.

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