INTERNATIONAL UNION OF PURE AND APPLIED CHEMISTRY

ANALYTICAL CHEMISTRY DIVISION
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SOLUBILITY DATA SERIES

Volume 24

PROPANE, BUTANE AND 2-METHYLPROPANE

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Publisher at Pergamon Press

SOLUBILITY DATA SERIES

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A. S. KERTES

Volume 24

PROPANE, BUTANE AND 2-METHYLPROPANE

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PERGAMON PRESS
OXFORD · NEW YORK · TORONTO · SYDNEY · FRANKFURT
TOKYO · SAO PAULO · BEIJING

U.K.	Pergamon Press, Headington Hill Hall, Oxford OX3 0BW, England
U S A	Pergamon Press Inc, Maxwell House, Fairview Park, Elmsford, New York 10523, U S.A.
CANADA	Pergamon Press Canada, Suite 104, 150 Consumers Road, Willowdale, Ontario M2J 1P9, Canada
AUSTRALIA	Pergamon Press (Aust) Pty Ltd, P O Box 544, Potts Point, N.S W 2011, Australia
FEDERAL REPUBLIC OF GERMANY	Pergamon Press GmbH, Hammerweg 6, D-6242 Kronberg, Federal Republic of Germany
JAPAN	Pergamon Press, 8th Floor, Matsuoka Central Building, 1-7-1 Nishishinjuku, Shinjuku-ku, Tokyo 160, Japan
BRAZIL	Pergamon Editora Ltda, Rua Eça de Queiros, 346, CEP 04011, São Paulo, Brazil
PEOPLE'S REPUBLIC OF CHINA	Pergamon Press, Qianmen Hotel, Beijing, People's Republic of China

First edition 1986

British Library Cataloguing in Publication Data

Propane, butane and 2-methylpropane.—(Solubility data series, v. 24)
1 Paraffins—Solubility
I Hayduk, Walter II. Battino, Rubin III. Series
547' 41104542 QD305.H6

ISBN 0-08-029202-X

Printed in Great Britain by A. Wheaton & Co Ltd, Exeter

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Recd 26 July '80

SOLUBILITY DATA SERIES

INTERNATIONAL UNION OF PURE AND APPLIED CHEMISTRY
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FOREWORD

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

How to communicate and disseminate numerical data effectively in chemical science and technology has been a problem of serious and growing concern to IUPAC, the International Union of Pure and Applied Chemistry, for the last two decades. The steadily expanding volume of numerical information, the formulation of new interdisciplinary areas in which chemistry is a partner, and the links between these and existing traditional subdisciplines in chemistry, along with an increasing number of users, have been considered as urgent aspects of the information problem in general, and of the numerical data problem in particular.

Among the several numerical data projects initiated and operated by various IUPAC commissions, the *Solubility Data Project* is probably one of the most ambitious ones. It is concerned with preparing a comprehensive critical compilation of data on solubilities in all physical systems, of gases, liquids and solids. Both the basic and applied branches of almost all scientific disciplines require a knowledge of solubilities as a function of solvent, temperature and pressure. Solubility data are basic to the fundamental understanding of processes relevant to agronomy, biology, chemistry, geology and oceanography, medicine and pharmacology, and metallurgy and materials science. Knowledge of solubility is very frequently of great importance to such diverse practical applications as drug dosage and drug solubility in biological fluids, anesthesiology, corrosion by dissolution of metals, properties of glasses, ceramics, concretes and coatings, phase relations in the formation of minerals and alloys, the deposits of minerals and radioactive fission products from ocean waters, the composition of ground waters, and the requirements of oxygen and other gases in life support systems.

The widespread relevance of solubility data to many branches and disciplines of science, medicine, technology and engineering, and the difficulty of recovering solubility data from the literature, lead to the proliferation of published data in an ever increasing number of scientific and technical primary sources. The sheer volume of data has overcome the capacity of the classical secondary and tertiary services to respond effectively.

While the proportion of secondary services of the review article type is generally increasing due to the rapid growth of all forms of primary literature, the review articles become more limited in scope, more specialized. The disturbing phenomenon is that in some disciplines, certainly in chemistry, authors are reluctant to treat even those limited-in-scope reviews exhaustively. There is a trend to preselect the literature, sometimes under the pretext of reducing it to manageable size. The crucial problem with such preselection - as far as numerical data are concerned - is that there is no indication as to whether the material was excluded by design or by a less than thorough literature search. We are equally concerned that most current secondary sources, critical in character as they may be, give scant attention to numerical data.

On the other hand, tertiary sources - handbooks, reference books and other tabulated and graphical compilations - as they exist today are comprehensive but, as a rule, uncritical. They usually attempt to cover whole disciplines, and thus obviously are superficial in treatment. Since they command a wide market, we believe that their service to the advancement of science is at least questionable. Additionally, the change which is taking place in the generation of new and diversified numerical data, and the rate at which this is done, is not reflected in an increased third-level service. The emergence of new tertiary literature sources does not parallel the shift that has occurred in the primary literature.

With the status of current secondary and tertiary services being as briefly stated above, the innovative approach of the *Solubility Data Project* is that its compilation and critical evaluation work involve consolidation and reprocessing services when both activities are based on intellectual and scholarly reworking of information from primary sources. It comprises compact compilation, rationalization and simplification, and the fitting of isolated numerical data into a critically evaluated general framework.

The *Solubility Data Project* has developed a mechanism which involves a number of innovations in exploiting the literature fully, and which contains new elements of a more imaginative approach for transfer of reliable information from primary to secondary/tertiary sources. *The fundamental trend of the Solubility Data Project is toward integration of secondary and tertiary services with the objective of producing in-depth critical analysis and evaluation which are characteristic to secondary services, in a scope as broad as conventional tertiary services.*

Fundamental to the philosophy of the project is the recognition that the basic element of strength is the active participation of career scientists in it. Consolidating primary data, producing a truly critically-evaluated set of numerical data, and synthesizing data in a meaningful relationship are demands considered worthy of the efforts of top scientists. Career scientists, who themselves contribute to science by their involvement in active scientific research, are the backbone of the project. The scholarly work is commissioned to recognized authorities, involving a process of careful selection in the best tradition of IUPAC. This selection in turn is the key to the quality of the output. These top experts are expected to view their specific topics dispassionately, paying equal attention to their own contributions and to those of their peers. They digest literature data into a coherent story by weeding out what is wrong from what is believed to be right. To fulfill this task, the evaluator must cover *all* relevant open literature. No reference is excluded by design and every effort is made to detect every bit of relevant primary source. Poor quality or wrong data are mentioned and explicitly disqualified as such. In fact, it is only when the reliable data are presented alongside the unreliable data that proper justice can be done. The user is bound to have incomparably more confidence in a succinct evaluative commentary and a comprehensive review with a complete bibliography to both good and poor data.

It is the standard practice that the treatment of any given solute-solvent system consists of two essential parts: I. Critical Evaluation and Recommended Values, and II. Compiled Data Sheets.

The Critical Evaluation part gives the following information:

(i) a verbal text of evaluation which discusses the numerical solubility information appearing in the primary sources located in the literature. The evaluation text concerns primarily the quality of data after consideration of the purity of the materials and their characterization, the experimental method employed and the uncertainties in control of physical parameters, the reproducibility of the data, the agreement of the worker's results on accepted test systems with standard values, and finally, the fitting of data, with suitable statistical tests, to mathematical functions;
(ii) a set of recommended numerical data. Whenever possible, the set of recommended data includes weighted average and standard deviations, and a set of smoothing equations derived from the experimental data endorsed by the evaluator;
(iii) a graphical plot of recommended data.

The Compilation part consists of data sheets of the best experimental data in the primary literature. Generally speaking, such independent data sheets are given only to the best and endorsed data covering the known range of experimental parameters. Data sheets based on primary sources where the data are of a lower precision are given only when no better data are available. Experimental data with a precision poorer than considered acceptable are reproduced in the form of data sheets when they are the only known data for a particular system. Such data are considered to be still suitable for some applications, and their presence in the compilation should alert researchers to areas that need more work.

The typical data sheet carries the following information:

(i) components - definition of the system - their names, formulas and Chemical Abstracts registry numbers;
(ii) reference to the primary source where the numerical information is reported. In cases when the primary source is a less common periodical or a report document, published though of limited availability, abstract references are also given;
(iii) experimental variables;
(iv) identification of the compiler;
(v) experimental values as they appear in the primary source. Whenever available, the data may be given both in tabular and graphical form. If auxiliary information is available, the experimental data are converted also to SI units by the compiler.

Under the general heading of Auxiliary Information, the essential experimental details are summarized:

(vi) experimental method used for the generation of data;
(vii) type of apparatus and procedure employed;
(viii) source and purity of materials;
(ix) estimated error;
(x) references relevant to the generation of experimental data as cited in the primary source.

This new approach to numerical data presentation, formulated at the initiation of the project and perfected as experience has accumulated, has been strongly influenced by the diversity of background of those whom we are supposed to serve. We thus deemed it right to preface the evaluation/compilation sheets in each volume with a detailed discussion of the principles of the accurate determination of relevant solubility data and related thermodynamic information.

Finally, the role of education is more than corollary to the efforts we are seeking. The scientific standards advocated here are necessary to strengthen science and technology, and should be regarded as a major effort in the training and formation of the next generation of scientists and engineers. Specifically, we believe that there is going to be an impact of our project on scientific-communication practices. The quality of consolidation adopted by this program offers down-to-earth guidelines, concrete examples which are bound to make primary publication services more responsive than ever before to the needs of users. The self-regulatory message to scientists of the early 1970s to refrain from unnecessary publication has not achieved much. A good fraction of the literature is still cluttered with poor-quality articles. The Weinberg report (in 'Reader in Science Information', ed. J. Sherrod and A. Hodina, Microcard Editions Books, Indian Head, Inc., 1973, p. 292) states that 'admonition to authors to restrain themselves from premature, unnecessary publication can have little effect unless the climate of the entire technical and scholarly community encourages restraint...' We think that projects of this kind translate the climate into operational terms by exerting pressure on authors to avoid submitting low-grade material. The type of our output, we hope, will encourage attention to quality as authors will increasingly realize that their work will not be suited for permanent retrievability unless it meets the standards adopted in this project. It should help to dispel confusion in the minds of many authors of what represents a permanently useful bit of information of an archival value, and what does not.

If we succeed in that aim, even partially, we have then done our share in protecting the scientific community from unwanted and irrelevant, wrong numerical information.

A. S. Kertes

PREFACE

The three gases, propane, butane and 2-methylpropane are rather unusual gases and possess rather unusual solubility characteristics. First of all, at ambient conditions these gases are well below their critical temperatures and, in fact, are closer in temperature to their normal boiling points than they are to their critical temperatures. The normal boiling points, and critical temperatures are respectively: for propane 231, 370 K, for 2-methylpropane 261, 408 K, and for butane 273, 425 K. Secondly, their solubilities are extremely high in non-polar solvents but, in contrast, they are relatively low in highly polar solvents such as water. The term "high solubility" has usually been reserved for solubilities in which the quantity of dissolved gas at a gas partial pressure of 101.325 kPa exceeds about 5 mole percent. In fact, particularly for butane and 2-methylpropane at low temperatures, solubilities in excess of 50 mole percent and even 80 mole percent solute in the saturated solution have been observed. In these cases the solvent becomes the minor component in the saturated solution, and the Ostwald coefficient expressing the solubility may be in the order of 500 volumes of gas to one volume of solvent[1].

The solubilities of propane, butane and 2-methylpropane increase dramatically as the temperatures are reduced toward the respective boiling points of the liquefied gases. As a result, the temperature-solubility relation is more complex and is more difficult to represent mathematically than for most other gases. Further, as for vapor-liquid equilibria, the composition corresponding to pure gas is an extension of the solubility relation[1]. That is, if solubility experiments are performed at a constant total pressure of 101.325 kPa, then as the temperature is reduced toward the normal boiling point, the compositions of both the gas and liquid phases approach that of the pure gas. Thus the normal boiling point, corresponding to the composition of the pure liquefied gas can be considered as one point on the solubility curve for that particular gas in all solvents, provided that the solvents still exist as miscible liquids at the temperatures concerned. It is apparent that gas solubilities at 101.325 kPa cannot be measured for those solvents whose freezing point temperatures are higher than the normal boiling points of the liquefied gases.

For the treatment of solubility data corresponding to a gas partial pressure of 101.325 kPa, true gas molar volumes are required. Particularly for butane and 2-methylpropane, the deviation from ideality is as high as 5 percent. To aid in the work of reviewing solubility data, the second virial coefficients for the three gases as obtained from Dymond and Smith[2] were fitted by simple exponential functions and found to describe that data well. In the truncated form, the virial equation of state is:

$$PV / (RT) = 1 + B/V \qquad (1)$$

The equation which may be used to successfully correlate virial coefficient data for many gases and vapors has the following form:

$$B = a\,T^{b} \qquad (2)$$

When Equation (1) is used in estimating the gas molar volume, a quadratic equation for molar volume results:

$$V = C/2 + 0.5\,(C^2 + 4BC)^{0.5} \qquad (3)$$

$$C = RT/P \qquad (4)$$

The resulting constants for the three cases for use in Equation (2), the percentage deviations in B and V, as well as the temperature ranges for which the equations apply, are shown in Table 1. Whereas the maximum deviation in B is 2.9 percent, the maximum deviation of the molar volume is 0.11 percent. It is noted that the correlation for the virial coefficients breaks down near the Boyle temperature and is useful only in the temperature range in which the second virial coefficients are negative. There are two advantages in using the above correlation for the second virial coefficients: interpolation to any arbitrary temperature is simplified, and the equation for the second virial coefficients can be easily incorporated in a computational sequence whereas tabulated information cannot.

A consistency check of the solubility data for high pressures was devised. It involves plotting the mole fraction solubility versus the partial pressure of solute on log scales. On such a graph the solubility - partial pressure relation is often nearly linear; a slope of unity is obtained if Henry's law is obeyed. Solubilities obtained at high pressures can be extrapolated to atmospheric pressure so that a comparison with solubilities actually measured at atmospheric pressure can be readily made. Equally useful is an extrapolation of solubility data obtained at one temperature to the higher pressure corresponding to the vapor pressure of pure liquefied solute gas. Interpolation between solubility isotherms

Table 1: Calculation of Second Virial Coefficients and Gas Molar Volumes

For Propane: $B = -1.246\ (10^8)\ T^{-2.224}$ cm^3/mole

/K	B(ref.2)	B(calc.)	B, % Diff.	V(ref.2)	V(calc.)	V, % Diff.
240	-640	-634	1.0	19032	19039	0.04
300	-382	-386	1.0	24230	24226	0.02
350	-276	-274	0.8	28442	28444	0.01
400	-208	-203	2.2	32615	32619	0.01
500	-124	-123	0.1	40906	40906	-
550	- 97	-100	3.3	45036	45033	0.01

For Butane: $B = -7.985\ (10^8)\ T^{-2.436}$ cm^3/mole

250	-1170	-1151	1.7	19269	19269	0.11
300	-722	-738	2.2	23874	23857	0.07
360	-472	-473	0.3	29062	29061	-
400	-370	-366	1.0	32450	32454	0.1
500	-219	-213	2.9	40810	40816	0.02
560	-164	-161	1.6	45789	45792	0.01

For 2-Methylpropane: $B = -1.403\ (10^9)\ T^{-2.542}$ cm^3/mole

273.2	-900	-899	0.1	21475	21476	-
303.2	-687	-690	0.4	24170	24167	0.01
360.9	-441	-443	0.4	29170	29168	-
406.9	-326	-326	-	33058	33058	-
477.6	-218	-217	0.4	38973	38973	-
510.9	-184	-183	0.5	41740	41741	-

Gas molar volume, V, in cm^3/mole.

Gas constant taken as: $R = 82.06$ cm^3 atm/(mole K) also appears possible with reasonable accuracy. Refer to the section "Alkane solvents at high pressure" for an example of the solubility-pressure diagram based on data reported by Reamer and Sage[3] for the solubility of propane in decane.

When solubility data at 101.325 kPa pressure were available over a temperature range, the solubility was usually expressed as a function of temperature using an equation having one of the following forms:

$$\ell n\, x_1 = a + b / (T/K) \qquad (5)$$

$$\ell n\, x_1 = a + b\, \ell n\, (T/K) \qquad (6)$$

$$\ell n\, x_1 = a + b / (T/K) + c\, \ell n\, (T/K) \qquad (7)$$

The constants for the equations were determined by means of a regression analysis; then one of the equations was chosen on the basis of its being the best representation of the particular data. Smoothed values for mole fraction solubility as shown in some of the compiled sheets were obtained by means of the regression equation and may not be accurately extrapolated beyond the temperature range of the data on which the equation is based.

It is readily apparent from an examination of the pages of this volume, that in only a very few instances are data available indicating within narrow limits the solubility of any of the gases in a particular solvent. In many instances there is a wide discrepancy between data from two or more sources. In many other instances data are simply not available to draw any general conclusions. Perhaps a useful function of this compilation is to draw attention to the real shortage of accurate solubility data for propane, butane and 2-methylpropane in most solvents.

To permit maximum use of data as they become available, it is recommended that authors include an analysis of both the gas and liquid phases in future publications for solubilities of highly soluble gases. The vapor pressure of a volatile solvent containing a significant quantity of dissolved gas cannot usually be accurately determined by simple calculation. Nor can the true molar volume of gas saturated with solvent vapor be accurately calculated without auxiliary information. Finally, Henry's law cannot generally be expected to apply with good accuracy for gas solubilities as high as those for propane, butane and 2-methylpropane. If for any reason it is not possible to measure phase compositions, the raw data, at the actual conditions of measurement, should be included to permit useful comparisons by other workers who may be able to correct the data for phase non-idealities at a later date. When only the results, extrapolated to a gas partial pressure of 101.325 kPa, are reported, it becomes impossible to make any subsequent corrections to the data. The gas molar volumes and solvent vapor pressures and densities that were used in the calculations would also be most helpful.

As may also be apparent, there is a considerable delay between the time that data from the technical literature are initially compiled and subsequently evaluated, and the time the volume is published in its final form. Hence, some data appearing in the very recent literature have not been included in this volume. Included in this volume are data appearing in the technical literature to the end of 1983. It has not been possible to process data from some few papers which contain solubilities of propane, butane or 2-methylpropane gases appearing in 1984.

The contributions and assistance of Professors R. Battino, H.L. Clever and C.L. Young as Compilers and/or Evaluators as well as collaborators is most gratefully acknowledged. The assistance of compilers, Dr. E. S. Thomsen and Dr. E.S. Rudakov is also acknowledged. The support of the IUPAC Commission on Solubility Data is most appreciated; without their initiative, guidance, and continued encouragement this volume would not have been possible. The painstaking assistance of Dr. B.S. Minhas and Mr. C.-F. Wong and typists C. Lachaine and A. Mainville is also acknowledged and much appreciated.

Walter Hayduk

Ottawa, Canada
December, 1984

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THE SOLUBILITY OF GASES IN LIQUIDS

Introductory Information

C. L. Young, R. Battino, and H. L. Clever

INTRODUCTION

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

DEFINITION OF GAS SOLUBILITY

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

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

UNITS AND QUANTITIES

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

EVALUATION AND COMPILATION

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

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

Many high pressure solubility data have been published in a smoothed form. Such data are particularly difficult to evaluate, and unless specifically discussed by the authors, the estimated error on such values can only be regarded as an "informed guess".

Many of the high pressure solubility data have been obtained in a more general study of high pressure vapor-liquid equilibrium. In such cases a note is included to indicate that additional vapor-liquid equilibrium data are given in the source. Since the evaluation is for the compiled data, it is possible that the solubility data are given a classification which is better than that which would be given for the complete vapor-liquid data (or vice versa). For example, it is difficult to determine coexisting liquid and vapor compositions near the critical point of a mixture using some widely used experimental techniques which yield accurate high pressure solubility data. 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.

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

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

PURITY OF MATERIALS

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

APPARATUS AND PROCEDURES

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

METHODS OF EXPRESSING GAS SOLUBILITIES

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

The Mole Fraction, x(g)

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

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

$$= \frac{W(g)/M(g)}{\{W(g)/M(g)\} + \{W(l)/M(l)\}}$$

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

The Weight Per Cent Solubility, wt%

For a binary system this is given by

$$wt\% = 100\, W(g)/\{W(g) + W(l)\}$$

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

$$x(g) = \frac{\{wt\%/M(g)\}}{\{wt\%/M(g)\} + \{(100 - wt\%)/M(1)\}}$$

The Weight Solubility, C_w

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

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

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

The Moles Per Unit Volume Solubility, n

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

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

where $v^o(1)$ is the molar volume of the liquid component.

The Bunsen Coefficient, α

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

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

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

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

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

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

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

The Kuenen Coefficient, S

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

The Ostwald Coefficient, L

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

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

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

$$x(g) = \left[\frac{RT}{P(g)\ L\ v^{o}(l)} + 1\right]^{-1} .$$

where P is the partial pressure of gas. The mole fraction solubility will be at a partial pressure of P(g). (See the following paper by E. Wilhelm for a more rigorous definition of the Ostwald coefficient.)

The Absorption Coefficient, β

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

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

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

The Henry's Law Constant

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

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

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

$$P(g) = K_2 C(l) \qquad \text{or} \qquad C(g) = K_c C(l)$$

where K_2 and K_c are constants, C the concentration, and (l) and (g) refer to the liquid and gas phases. Unfortunately, K_H, K_2 and K_c are all sometimes referred to as Henry's Law constants. Henry's Law is a *limiting law* but can sometimes be used for converting solubility data from the experimental pressure to a partial gas pressure of 1 atmosphere, provided the mole fraction of the gas in the liquid is small, and that the difference in pressures is small. Great caution must be exercised in using Henry's Law.

The Mole Ratio, N

The mole ratio, N, is defined by

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

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

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

TABLE 1 Interconversion of parameters used for reporting solubility

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

$$C_w = \alpha/v_o\rho$$

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

$$L = C_w\ v_{t,gas}\ \rho$$

where v_o is the molal volume of the gas in $cm^3 mol^{-1}$ at 0°C, ρ the density of the solvent at the temperature of the measurement, ρ_{soln} the density of the solution at the temperature of the measurement, and $v_{t,gas}$ the molal volume of the gas ($cm^3 mol^{-1}$) at the temperature of the measurement.

SALT EFFECTS

Salt effect studies have been carried out for many years. The results are often reported as Sechenov (Setchenow) salt effect parameters. There appears to be no common agreement on the units of either the gas solubility, or the electrolyte concentration.

Many of the older papers report the salt effect parameter in a form equivalent to

$$k_{scc}/\text{mol dm}^{-3} = (1/(c_2/\text{mol dm}^{-3}))\ \log\ ((c_1^\circ/\text{mol dm}^{-3})/(c_1/\text{mol dm}^{-3}))$$

where the molar gas solubility ratio, c_1°/c_1, is identical to the Bunsen coefficient ratio, α°/α, or the Ostwald coefficient ratio, L°/L. One can designate the salt effect parameters calculated from the three gas solubility ratios as k_{scc}, $k_{sc\alpha}$, k_{scL}, respectively, but they are identical, and $k_{scc}/dm^3\ mol^{-1}$ describes all of them. The superzero refers to the solubility in the pure solvent.

Recent statistical mechanical theories favor a molal measure of the electrolyte and gas solubility. Some of the more recent salt effects are reported in the form

$$k_{smm}/\text{kg mol}^{-1} = (1/(m_2/\text{mol kg}^{-1})\ \log\ ((m_1^\circ/\text{mol kg}^{-1})/(m_1/\text{mol kg}^{-1})$$

In this equation the m_1°/m_1 ratio is identical to the Kuenen coefficient ratio, s_1°/s_1, or the solvomolality ratio referenced to water, A_{sm}°/A_{sm}. Thus the salt effect parameters k_{smm}, k_{sms}, and $k_{smA_{sm}}$ are well represented by the $k_{smm}/kg\ mol^{-1}$.

Some experimentalists and theoreticians prefer the gas solubility ratio as a mole fraction ratio, x_1°/x_1. It appears that most calculate the mole fraction on the basis of the total number of ions. The salt effect parameters

$$k_{scx}/\text{dm}^3\ \text{mol}^{-1} = (1/(c_2/\text{mol dm}^{-3}))\ \log\ (x_1^\circ/x_1)$$

and

$$k_{smx}/\text{kg mol}^{-1} = (1/(m_2/\text{mol kg}^{-1}))\ \log\ (x_1^\circ/x_1)$$

are both in the literature, but k_{scx} appears to be the more common.

The following conversions were worked out among the various forms of the salt effect parameter from standard definitions of molarity, molality, and mole fraction assuming the gas solubilities are small.

$$k_{smc} = (c_2/m_2)\ k_{scc} = (c_2/m_2)\ k_{scm} + F_{1m}$$

$$k_{scm} = k_{scc} - F_{1c} = (m_2/c_2)\ k_{smc} - F_{1c} = (m_2/c_2)\ k_{smm}$$

$$k_{scx} = (m_2/c_2)\ k_{smx} = (m_2/c_2)\ \mathrm{ksmm} + F_{2c}$$

$$k_{smm} = k_{smx} - F_{2m} = (c_2/m_2)\ k_{scx} - F_{2m}$$

$$k_{smx} = (c_2/m_2)\ k_{scx} = (c_2/m_2)\ k_{scc} + F_{3m}$$

$$k_{scc} = k_{scx} - F_{3c} = (m_2/c_2)\ k_{smx} - F_{3c}$$

where

$$F_{1m} = (1/m_2)\ \log\ [(\rho°/\rho)\ (1000 + m_2M_2)/1000]$$

$$F_{1c} = (m_2/c_2)\ F_{1m}$$

$$F_2m = (1/m_2)\ \log\ [(1000 + \nu m_3\ M_3)/1000]$$

$$F_{2c} = (m_2/c_2)\ F_{2m}$$

$$F_{3m} = (1/m_2)\ \log\ [(1000\rho + (\nu M_3 - M_2)\ c_2)/1000\rho°)$$

$$F_{3c} = (m_2/c_2)\ F_{3m}$$

The factors F_{1m}, F_{1c}, F_{2m}, F_{2c}, F_{3m}, and F_{3c} can easily be calculated from aqueous electrolyte data such as weight per cent and density as found in Volume III of the International Critical Tables. The values are small and change nearly linearly with both temperature and molality. The factors normally amount to no more than 10 to 20 per cent of the value of the salt effect parameter.

The symbols in the equations above are defined below:

Component	Molar Concentration $c/\mathrm{mol\ dm^{-3}}$	Molal Concentration $m/\mathrm{mol\ kg^{-1}}$	Mole Fraction x	Molecular Weight $M/\mathrm{g\ mol^{-1}}$
Nonelectrolyte	c_1^o, c_1	m_1^o, m_1	x_1^o, x_1	M_1
Electrolyte	c_2	m_2	x_2	M_2
Solvent	c_3	m_3	x_3	M_3

The superscript "°" refers to the nonelectrolyte solubility in the pure solvent. The pure solvent and solution densities are $\rho°/\mathrm{g\ cm^{-3}}$ and $\rho/\mathrm{g\ cm^{-3}}$, respectively. They should be the densities of gas saturated solvent (water) and salt solution, but the gas free densities will differ negligibly in the $\rho°/\rho$ ratio. The number of ions per formula of electrolyte is symbolized by ν.

The following table gives estimated errors in k_{scc} for various salt concentrations and a range of random errors in the gas solubility measurement

Error in $k_{scc}/\mathrm{dm^3\ mol^{-1}}$ [a]

$c_2/\mathrm{mol\ dm^{-3}}$	Random Error in gas solubility Measurement				
	±2%	±1%	±0.5%	±0.1%	±0.05%
1	±18%	±9%	±5%	±1.5%	±1%
0.1	±175%	±87%	±43%	±9%	±4%
0.05	±350%	±174%	±87%	±17%	±9%
0.01	±1750%	±870%	±435%	±87%	±43%

[a] Based on a k_{scc} value of 0.100.

AQUAMOLAL OR SOLVOMOLAL, A_{sm} or $m_i^{(s)}$

The term aquamolal was suggested by R. E. Kerwin (9). The unit was first used in connection with D_2O and $H_2O + D_2O$ mixtures. It has since been extended in use to other solvents. The unit represents the numbers of moles of solute per 55.51 moles of solvent. It is represented by $m_i^{(s)}/\mathrm{mol\ kg^{-1}} = (n_1 M_2/w_2)(w_2/M_0) = m_i(M_2/M_0)$ where an amount of n_i of solute i is dissolved in a mass w_2 of solvent of molar mass M_2; M_0 is the molar mass of a reference solvent and $m_i/\mathrm{mol\ kg^{-1}}$ is the conventional molality in the reference solvent. The reference solvent is normally water.

TEMPERATURE DEPENDENCE OF GAS SOLUBILITY

In a few cases it has been found possible to fit the mole fraction solubility at various temperatures using an equation of the form

$$\ln x = A + B / (T/100\mathrm{K}) + C \ln (T/100\mathrm{K}) + DT/100\mathrm{K}$$

It is then possible to write the thermodynamic functions $\Delta\bar{G}_1^\circ$, $\Delta\bar{H}_1^\circ$, $\Delta\bar{S}_1^\circ$ and $\Delta\bar{C}_{p_1}$ for the transfer of the gas from the vapor phase at 101,325 Pa partial pressure to the (hypothetical) solution phase of unit mole fraction as:

$$\Delta\bar{G}_1^\circ = -RAT - 100\ RB - RCT \ln (T/100) - RDT^2/100$$

$$\Delta\bar{S}_1^\circ = RA + RC \ln (T/100) + RC + 2\ RDT/100$$

$$\Delta\bar{H}_1^\circ = -100\ RB + RCT + RDT^2/100$$

$$\Delta\bar{C}_{p_1}^\circ = RC + 2\ RDT/100$$

In cases where there are solubilities at only a few temperatures it is convenient to use the simpler equations

$$\Delta\bar{G}_1^\circ = - RT \ln x = A + BT$$

in which case $A = \Delta\bar{H}_1^\circ$ and $-B = \Delta\bar{S}_1^\circ$

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Revised: April 1982 (R.B., H.L.C.)

COMPONENTS:

(1) Propane; C_3H_8; [74-98-6]

(2) Water; H_2O; [7732-18-5]

EVALUATOR:

Rubin Battino
Department of Chemistry
Wright State University
Dayton, Ohio 45435 U.S.A.

November, 1983

CRITICAL EVALUATION:

The solubility of *propane* in water has been reported in thirteen papers (1-13). The data from all of these papers were converted to mole fraction solubilities at 0.101325 MPa partial pressure of gas and fitted to both of the following equations:

$$\ln x_1 = A_0 + A_1/\mathrm{T} + A_2 \ln \mathrm{T} + A_3 \mathrm{T} + A_4 \mathrm{T}^2 \quad \text{where } \mathrm{T} = T/100\ \mathrm{K}. \tag{1}$$

$$\ln x_1 = B_0 + B_1/(T/\mathrm{K}) + B_2/(T/\mathrm{K})^2 + B_3/(T/\mathrm{K})^3 + B_4/(T/\mathrm{K})^4 \tag{2}$$

Three coefficients were found to be quite adequate to describe the temperature dependence for both equations. Equation (1) was selected for this evaluation. The fitting process was repeated several times deleting those points which differed from the smoothed function by two standard deviations or more. On the basis of this criterion and examination of the original papers, the results of references (7-13) were not used in determining the final smoothing equation. The two lowest temperature points from reference (1) were also discarded. The final smoothing equation for the temperature range 273-347 K is:

$$\ln x_1 = -102.044 + 144.345/\mathrm{T} + 39.4740 \ln \mathrm{T} \tag{3}$$

The standard deviation for Equation 3 is 0.012 in $\ln x_1$ or about 2% in x_1. For this equation 10 points from reference (1) were used, twelve from (2), two from (3), three from (4), one from (5), and two from reference (6). Smoothed mole fractions at 0.101325 MPa partial pressure of gas and Ostwald coefficients at 5 K intervals are given in Table 1.

The evaluator has made solubility measurements for this system in the temperature range from 278 to 323 K to a precision (standard deviation) for x_1 of ± 0.21%. Comparison of his unpublished results with the smoothed values in Table 1 show an agreement within 0.8% in the range 293 K to 323 K and also to values extrapolated to as high as 373 K. His values are, however, 2 to 6% higher in the temperature range from 273 to 288 K. He suggests caution in using the values in Table 1 for temperatures below 288 K.

Table 2 gives the thermodynamic functions for the transfer of the gas from the vapor phase at 0.101325 MPa partial pressure of gas to the (hypothetical) solution of unit mole fraction. With a three-term fitting equation $\Delta\bar{C}^\circ_{p_1}$ is independent of temperature, with the value 328 J mol^{-1} K^{-1}. Extrapolated values of ΔH_1° becomes positive at about 365 K.

Table 1. The solubility of propane in water at 0.101325 MPa partial pressure of gas.

T/K	$10^5 x_1$	L	T/K	$10^5 x_1$	L
273.15	7.236	0.09001	313.15	1.865	0.02640
278.15	5.727	0.07255	318.15	1.689	0.02424
283.15	4.627	0.05967	323.15	1.549	0.02253
288.15	3.813	0.05000	328.15	1.438	0.02119
293.15	3.200	0.04265	333.15	1.350	0.02014
298.15	2.732	0.03699	338.15	1.281	0.01935
303.15	2.370	0.03258	343.15	1.227	0.01876
308.15	2.088	0.02913	348.15	1.188	0.01836

COMPONENTS:

(1) Propane; C_3H_8; [74-98-6]

(2) Water; H_2O; [7732-18-5]

EVALUATOR:

Rubin Battino
Department of Chemistry
Wright State University
Dayton, Ohio 45435 U.S.A.

November, 1983

CRITICAL EVALUATION: ...continued

Table 2. Thermodynamic properties for the solubility of propane in water.

T/K	$\Delta\bar{G}_1^\circ$/ kJ mol^{-1}	$\Delta\bar{H}_1^\circ$/ kJ mol^{-1}	$\Delta\bar{S}_1^\circ$/ J mol^{-1} K^{-1}
273.15	21.65	-30.37	-190.4
278.15	22.59	-28.72	-184.5
283.15	23.50	-27.08	-178.6
288.15	24.38	-25.44	-172.9
293.15	25.23	-23.80	-167.2
298.15	26.05	-22.16	-161.7
303.15	26.84	-20.52	-156.2
308.15	27.61	-18.88	-150.9
313.15	28.35	-17.24	-145.6
318.15	29.07	-15.60	-140.4
323.15	29.76	-13.96	-135.3
328.15	30.42	-12.31	-130.2
333.15	31.06	-10.67	-125.3
338.15	31.67	- 9.03	-120.4
343.15	32.26	- 7.39	-115.6
348.15	32.83	- 5.75	-110.8

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COMPONENTS:

(1) Propane; C_3H_8; [74-98-6]

(2) Water; H_2O; [7732-18-5]

ORIGINAL MEASUREMENTS:

Wen, W.-Y.; Hung, J.H.

J. Phys. Chem. 1970, *74*, 170-180.

VARIABLES:

T/K: 278.15-308.15

P/kPa: 101.325 (1 atm)

PREPARED BY:

W. Hayduk

EXPERIMENTAL VALUES:

t/°C	T/K	Solubility[1] s/cm^3(STP)kg^{-1}	Mole Fraction[2] /10^5x_1	Ostwald Coefficient[2] L/cm^{3}cm^{-3}	Bunsen Coefficient[2] α/cm^3(STP)cm^{-3}
5	278.15	69.57 ± 0.11	5.709	0.0709	0.0695
15	288.15	45.75 ± 0.06	3.645	0.0482	0.0455
25	298.15	32.31 ± 0.08	2.640	0.0352	0.0320
35	308.15	23.91 ± 0.07	1.950	0.0268	0.0208

[1] Original data.

[2] Calculated by compiler assuming that authors considered gas to be ideal, and using real gas molar volumes:

$$x_1 = s\ T\ (18.016)[273.15(1000)V_t]^{-1};\ V_t/\text{cm}^3\text{mol}^{-1}\text{at } T.$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The apparatus was similar to that described by Ben-Naim and Baer (1). Teflon needle valves were used in place of stopcocks.

The apparatus consists of three main parts, a dissolution cell of 300 to 600 cm^3 capacity, a gas volume measuring column, and a manometer.

The solvent is degassed in the dissolution cell, the gas is introduced and dissolved while the liquid is kept stirred by a magnetic stirrer immersed in the water bath. Dissolution of the gas results in the change in the height of a column of mercury which is measured by a cathetometer.

SOURCE AND PURITY OF MATERIALS:

1. Matheson Co. Stated to be better than 99.9 per cent pure.
2. Distilled from an all-Pyrex apparatus. Specific conductivity 1.5 x 10^{-6} (ohm cm)$^{-1}$.

ESTIMATED ERROR:

δT/K = ±0.005

$\delta s_1/s_1$ = ±0.003

REFERENCES:

1. Ben-Naim, A.; Baer, S. *Trans. Faraday Soc.* 1963, *59*, 2735.

COMPONENTS:

(1) Propane; C_3H_8; [74-98-6]

(2) Water; H_2O; [7732-18-5]

ORIGINAL MEASUREMENTS:

Kresheck, G. C.; Schneider, H.; Scheraga, H. A.

J. Phys. Chem. 1965, *69*, 3132-44.

VARIABLES:

$T/K = 274.15 - 328.15$

$p_1/kPa = 101.325$

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

Temperature		Mol Fraction[a]	Molarity	Molality
$t/^{0}C$	T/K	10^5x_1	$10^3c_1/mol\ dm^{-3}$	$10^3m_1/mol\ kg^{-1}$
1	274.15	7.215, 7.242		
4	277.15	6.254, 6.216		
	277.15[b]	6.24 ± 0.02	3.46 ± 0.01	3.46 ± 0.01
10	283.15	4.729, 4.726		
15	288.15	3.861, 3.860		
20	293.15	3.234, 3.219		
25	298.15	2.748, 2.732		
	298.15[b]	2.74 ± 0.01	1.52 ± 0.01	1.53 ± 0.01
30	303.15	2.362, 2.362		
35	308.15	2.086, 2.073		
40	313.15	1.886		
45	318.15	1.676, 1.668		
50	323.15	1.526, 1.533		
	323.15[b]	1.53 ± 0.01	0.84 ± 0.01	0.85 ± 0.01
55	328.15	1.424, 1.409		

[a] The experimental values of the mole fraction solubility were provided by H. Schneider. The last figure is not significant.

[b] Smoothed values from the original paper.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

A known quantity of the gas was introduced from a gas buret into a calibrated volume which contained a weighed quantity of water. The water was stirred until equilibrium was attained (3 to 4 hours). The amount of gas in the vapor phase at equilibrium was determined from the propane partial pressure and volume of the vapor space. The volume was the difference in the empty vessel volume and the water volume. The amount of dissolved gas was obtained by difference.

Handbook values of water density were used. The gas volume was corrected for nonideality by use of a compressibility factor (1). At each temperature the solubility was measured at two partial pressures which ranged from 0.5 to 0.7 atm at 4 ^{0}C to .2 to 1.6 atm at 50 ^{0}C. All solubility data were normalized to a partial pressure of 1 atm.

SOURCE AND PURITY OF MATERIALS:

(1) Propane. Matheson Co., Inc. 99.92 mole per cent.

(2) Water. Laboratory distilled water was deionized prior to use.

ESTIMATED ERROR:

$\delta x_1/x_1 = \pm\ 0.005$

REFERENCES:

1. Silberberg, I. H.; Kuo, P. K.; McKetta, J. J. *Petrol. Engr.* 1954, *24*, C9.

COMPONENTS:

(1) Propane; C_3H_8; [74-98-6]

(2) Water; H_2O; [7732-18-5]

ORIGINAL MEASUREMENTS:

Umano, S.; Nakano, Y.

Kogyo Kagaku Zasshi 1958, *61*, 536-44.

VARIABLES:

T/K = 273.2 - 293.2
p_1/kPa = 8.19 - 100.53

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

Temperature $t/^\circ C$	T/K	Total Pressure p/atm	Propane Partial Pressure,p_1/atm	Mol Fraction $10^5 x_1$
0	273.2	0.1035	0.99747	0.4410
		0.3009	0.2948	1.5795
		0.4982	0.4922	3.1777
		0.6956	0.6896	4.6873
		0.9982	0.9922	6.7939
5	278.2	0.1048	0.09601	0.4755
		0.3022	0.2936	1.5059
		0.5008	0.4922	2.5663
		0.6969	0.6883	3.5123
		1.0008	0.9922	5.2597
10	283.2	0.1090	0.09690	0.3078
		0.3064	0.2943	1.1979
		0.5038	0.4916	2.0493
		0.7011	0.6880	3.0487
		1.0037	0.9916	4.2204
15	288.2	0.1060	0.08914	0.2686
		0.3033	0.2865	0.9077
		0.5007	0.4839	1.6691
		0.6974	0.6805	2.3853
		1.0000	0.9832	3.4902
20	293.2	0.1039	0.08087	0.1309
		0.3013	0.2782	0.8018
		0.4981	0.4751	1.3908
		0.6955	0.6724	1.9943
		0.9981	0.9750	3.0749

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The apparatus consists of a gas reservoir, a manometer-buret system, a thermostated mixing cell, and a solvent reservoir. The apparatus is constructed of glass and vinyl chloride tubing. A gasoline insoluble type stopcock grease is used.

The apparatus is evacuated, then filled with the solute gas to condition the surface, vinyl chloride tubing, and stockcock grease. The solvent is degassed by boiling under reduced pressure in the solvent reservoir. The solvent is transferred to the evacuated mixing cell, the gas added to the pressure of the measurement. The mixing cell is shaken until equilibrium is attained.

SOURCE AND PURITY OF MATERIALS:

(1) Propane. Oakford Gas and Appliance Co. Stated to be greater than 99 mol percent purity. The impurity is higher molecular weight hydrocarbons.

(2) Water.

ESTIMATED ERROR:

REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Propane; C_3H_8; [74-98-6] (2) Water; H_2O; [7732-18-5]	Barone, G.; Crescenzi, V.; Pispisa, B.; Quadrifoglio, F. *J. Macromol. Chem.* 1966, *1*, 761-771.

VARIABLES:	PREPARED BY:
T/K: 298.15 P/kPa: 101.325	W. Hayduk

EXPERIMENTAL VALUES:

T/K	Solubility[1] s/m mol dm^{-3}	Mole Fraction[2] $/10^5x_1$	Ostwald Coefficient[2] L/cm^{3}cm^{-3}	Bunsen Coefficient[2] α/cm^3(STP)cm^{-3}atm^{-1}
298.15	1.50	2.71	0.0361	0.0329

[1] Original data reported as millimoles of gas per liter water at gas partial pressure of 101.325 kPa.

[2] Calculated by compiler using a real gas molar volume.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

A method utilizing a gas chromatographic analysis of saturated water was used. A volume of 4 cm^3 of water was saturated at constant temperature in a 20-cm^3 gas-washing bottle by means of a sintered glass bubbler. The top was sealed with a rubber stopper through which a hypodermic needle was inserted as a vent. Equilibration was continued for 1 hr. Samples of 0.20 cm^3 were withdrawn by syringe and passed through a stripper where they were contacted with carrier gas, then through a $CaCl_2$ tube and finally to a gas chromatograph for analysis.

SOURCE AND PURITY OF MATERIALS:

1. Riviora, Turin, Italy. Specified as chromatographically pure.
2. Not specified.

ESTIMATED ERROR:

T/K = 0.02

$\delta s/s$ = 0.04 (authors)

REFERENCES:

COMPONENTS:

(1) Propane; C_3H_8; [74-98-6]

(2) Water; H_2O; [7732-18-5]

ORIGINAL MEASUREMENTS:

Morrison, T.J.; Billett, F.

J. Chem. Soc. 1952, 3819-3822.

VARIABLES:

T/K: 285.45-347.25

P/kPa: 101.325

PREPARED BY:

W. Hayduk

EXPERIMENTAL VALUES:

t/°C	T/K	Solubility[1] s/cm^3(STP)kg^{-1}	Mole Fraction[2] /10^5x_1	Ostwald Coefficient[2] L/cm^{3}cm^{-3}	Bunsen Coefficient[2] α/cm^3(STP)cm^{-3}
12.3	285.45	50.70	4.15	0.0529	0.0505
15.5	288.65	45.39	3.72	0.0479	0.0452
21.5	294.65	37.07	3.03	0.0399	0.0368
22.8	295.95	35.65	2.91	0.0385	0.0354
25.5	298.65	32.58	2.66	0.0355	0.0323
26.0	299.15	32.21	2.63	0.0352	0.0319
31.5	304.65	28.25	2.31	0.0314	0.0279
40.3	313.45	22.86	1.863	0.0260	0.0225
49.0	322.15	19.50	1.587	0.0227	0.0191
59.0	332.15	16.94	1.377	0.0203	0.0165
64.5	337.65	16.03	1.301	0.0194	0.0155
74.1	347.25	14.55	1.181	0.0180	0.0140

---

[1] Original data expressed as cm^3(STP) per 1000 g water at total pressure of 101.325 kPa(1 atm). Smoothing equation given by authors (ref. 1 below): $\log_{10}s = -99.629 + 5445/(T/\mathrm{K}) + 33.50 \log_{10}(T/\mathrm{K})$.

[2] Calculated by compiler assuming that authors considered gas to be ideal, and using real gas molar volumes:

$x_1 = sT(18.016)[273.15(1000)V_t]^{-1}$; V_t/cm^{3}mol^{-1}at T.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The equipment consisted of a solvent degassing system, an absorption spiral and a gas buret for measuring the gas volume. Degassed solvent was allowed to flow down the absorption spiral containing the gas, saturated with solvent vapor, at a total pressure of one atmosphere. The volume of gas absorbed was measured by means of the attached buret system. Details were previously described (2).

SOURCE AND PURITY OF MATERIALS:

1. Prepared from Grignard reagent. Purity not specified.
2. Degassed. No additional details given.

ESTIMATED ERROR:

δT/K = 0.02

$\delta s/s$ = 0.01 (compiler)

REFERENCES:

1. Morrison, T.J.
   J. Chem. Soc. 1952, 3814.
2. Morrison, T.J.
   J. Chem. Soc. 1948, 2033.

COMPONENTS:

(1) Propane; C_3H_8; [74-98-6]

(2) Water; H_2O; [7732-18-5]

ORIGINAL MEASUREMENTS:

Claussen, W.F.; Polglase, M.F.

J. Am. Chem. Soc. 1952, *74*, 4817-4819.

VARIABLES:

T/k: 292.95, 302.95

P/kPa: 101.325

PREPARED BY:

W. Hayduk

EXPERIMENTAL VALUES:

t^1/°C	T/K	Mole Fraction[2] $/10^5 x_1$	Ostwald Coefficient[2] $L/\text{cm}^3\text{cm}^{-3}$	Bunsen Coefficient[1] $\alpha/\text{cm}^3(\text{STP})\text{cm}^{-3}\text{atm}^{-1}$
19.8	292.95	3.25	0.0425	0.0395, 0.0395, 0.0397 0.0392, 0.0394, 0.0393 (0.03943)[3]
29.8	302.95	2.38	0.0322	0.0288, 0.0289 (0.02885)[3]

[1] Original data reported as the Bunsen coefficients.

[2] Calculated by compiler using the average value of the Bunsen coefficients and real gas molar volumes.

[3] Average value of Bunsen coefficients.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The gas solubility was determined by a micro combustion technique. It involved stripping the gas from a saturated water solution with oxygen, catalytically oxidizing the hydrocarbon and then adsorbing and weighing the carbon dioxide produced. Gas was bubbled through the water via a sintered glass disc until saturated. The train for analysis consisted of an oxygen tank, pressure regulators, mercury manometer, preheater, absorption tube containing ascarite and anhydrone, aerator, combustion tube containing copper oxide at 973 K, weighing tubes containing ascarite and anhydrone, and finally the Mariotte flask. Further details are given in the paper.

SOURCE AND PURITY OF MATERIALS:

1. Ohio Chemical Co., specified as 99 per cent pure.
2. Doubly distilled.

ESTIMATED ERROR:

$\delta T/\text{K} = 0.1$

$\delta\alpha/\alpha = 0.01$

(estimated by compiler)

REFERENCES:

COMPONENTS:

(1) Propane; C_3H_8; [74-98-6]

(2) Water; H_2O; [7732-18-5]

ORIGINAL MEASUREMENTS:

Yano, T.; Suetaka, T.;
Umehara, T.; Horiuchi, A.

Kagaku Kogaku 1974, *38*, 320-323.

VARIABLES:

T/K: 298.15

P/kPa: 101.325

PREPARED BY:

W. Hayduk

EXPERIMENTAL VALUES:

T/K	Solubility[1] s/mmol dm^{-3}	Mole Fraction[2] $/10^5 x_1$	Ostwald Coefficient[2] L/cm^{3}cm^{-3}	Bunsen Coefficient[2] α/cm^3(STP)cm^{-3}atm^{-1}
298.15	1.44	2.60	0.0347	0.0316

[1] Original data reported as 10^3(mol) dm^{-3} at a gas partial pressure of 101.325 kPa.

[2] Calculated by compiler using a real gas molar volume.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The method involved the measurement of the change in volume of a vapor-saturated gas in contact with stirred, initially deaerated water in an absorption flask. The pressure within the cell was adjusted to be essentially atmospheric pressure.

Details are given in ref. 1.

SOURCE AND PURITY OF MATERIALS:

1. Specified minimum purity of 99.5 per cent.
2. Distilled.

ESTIMATED ERROR:

$\delta s/s$ = 0.01 (authors)

REFERENCES:

1. Yano, T.; Suetaka, T.; Umehara, T.

   Nippon Kagaku Kaishi 1972, *11*, 2194.

COMPONENTS:

(1) Propane; C_3H_8; [74-98-6]

(2) Water; H_2O; [7732-18-5]

ORIGINAL MEASUREMENTS:

Wetlaufer, D.B.; Malik, S.D.; Stoller, L.; Coffin, R.L.

J. Am. Chem. Soc. 1964, *86*, 508-514.

VARIABLES:

T/K: 278.15-318-15

P/kPa: 101.325

PREPARED BY:

W. Hayduk, C.L. Young

EXPERIMENTAL VALUES:

T/K	Solubility[1] s/mmol dm^{-3}	Mole Fraction[2] $/10^5 x_1$	Ostwald Coefficient[2] L/cm^{3}cm^{-3}	Bunsen Coefficient[2] α/cm^3(STP)cm^{-3}atm^{-1}
278.15	3.14	5.66	0.0702	0.0689
298.15	1.47	2.66	0.0354	0.0322
318.15	0.95	1.73	0.0208	0.0244

[1] Original data reported as millimoles per litre at a gas partial pressure of 101.325 kPa.

[2] Calculated by compiler using real gas molar volumes.

[3] No correction was made for the amount of gas retained by the solvent during extraction, estimated by the authors to be 1-1.5 per cent; hence the results are expected to be too low by that amount.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

A modified Van Slyke-Neill manometric blood gas apparatus, fitted with a magnetic stirrer was used. The solvent was saturated with gas; then a sample was transferred to the Van Slyke extraction chamber for gas desorption and volume measurement.

SOURCE AND PURITY OF MATERIALS:

1. Matheson Co. Instrument grade. Minimum specified purity 99.5 per cent.
2. Distilled.

ESTIMATED ERROR:

$\delta T/\text{K} = 0.05$

$\delta s/s = 0.02$ (authors)[3]

REFERENCES:

COMPONENTS: (1) Propane; C_3H_8; [74-98-6] (2) Water; H_2O; [7732-18-5]	**ORIGINAL MEASUREMENTS:** McAuliffe, C. *J. Phys. Chem.* 1966, *70*, 1267-1275. *Nature*, 1963, *200*, 1092-1093.
VARIABLES: T/K: 298.15 P/kPa: 101.325	**PREPARED BY:** W. Hayduk

EXPERIMENTAL VALUES:

T/K	Solubility[1] s/g(10^6g water)$^{-1}$	Mole Fraction[2] $/10^5x_1$	Ostwald Coefficient[2] L/cm^{3}cm^{-3}	Bunsen Coefficient[2] α/cm^3(STP)cm^{-3}atm^{-1}
298.15	62.4	2.60	0.0346	0.0316

[1] Original data at 1 atm total pressure.

[2] Calculated by compiler correcting for vapor pressure of water.

The same data appear in both sources.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The equipment consisted of a gas reservoir, contacting bottle, stripping column and a gas chromatographic analyzer. A rubber balloon maintained at essentially atmospheric pressure served as the gas reservoir which was connected to a bottle partially filled with the water solvent. Equilibrium was established by hand shaking for 5 to 10 min after which the mixture was allowed to stand for phase separation. The solubility was determined by injection of the gas-saturated water solution into a stripping column supplied with helium. The quantity of gas was determined by a gas chromatograph equipped with a hydrogen-flame ionization detector.

SOURCE AND PURITY OF MATERIALS:

1. Phillips Petroleum Co. of minimum specified purity 99.0%.
2. Distilled.

ESTIMATED ERROR:

δT/K = 1.5

$\delta s/s$ = 0.04 (author)

REFERENCES:

COMPONENTS:

(1) Propane; C_3H_8; [74-98-6]

(2) Water; H_2O; [7732-18-5]

ORIGINAL MEASUREMENTS:

Wishnia, A.

J. Phys. Chem. 1963, *67*, 2079-2082.

VARIABLES:

T/K: 288.15-308.15

P/kPa: 101.325

PREPARED BY:

W. Hayduk

EXPERIMENTAL VALUES:

T/K	Solubility[1] s/mMol(kg)$^{-1}$	Mol Fraction[1] /10^5x_1
288.15	2.30	4.14
293.15	1.89	3.40
298.15	1.62	2.92
303.15	1.39	2.50
308.15	1.18	2.13

[1] Values read from a graph of (log) s versus T^{-1} by compiler and calculated as mol fraction. No numerical data given. Values are s and not log s as indicated on axis.

Solubilities of propane and butane in aqueous sodium dodecyl sulfate (SDS) solutions also given in graphical form but could not be read with sufficient accuracy to warrant listing here.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The solubility was determined at pressures from 0.15 to 0.7 atm and extrapolated to the comparable solubility for a gas partial pressure of 1 atm.

An all-glass apparatus was used which consisted of a calibrated liquid contactor, 10 cm^3 in volume and a 5-10 cm^3 gas storage tube. The water was deaerated in the contactor under vacuum. The pressure was measured with a manometer. The initial and final gas pressures and volumes, together with the compressibilities were used to compute the molal solubilities. At the sub-atmospheric pressures used, Henry's law was obeyed. The quantity of water charged was determined by weight.

Details of experimental method are given in (1).

SOURCE AND PURITY OF MATERIALS:

1. Phillips Petroleum, research grade. Purity not specified.
2. Deaerated.

ESTIMATED ERROR:

δT/K = 0.01 (author)

$\delta s/s$ = 0.08 (compiler)

REFERENCES:

1. Wishnia, A.

Proc. Natl. Acad. Sci., Biochem. 1962, *48*, 2200.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Propane; C_3H_8; [74-98-6] (2) Water; H_2O; [7732-18-5]	Namiot, A. Yu. *Zh. Strukt. Khim.* 1961, *2*, 408-17. **J. Struct. Chem. (Engl. Transl.)* 1961, *2*, 381-9.
VARIABLES:	**PREPARED BY:**
T/K = 273, 283 p_1/kPa = 101.3	H. L. Clever

EXPERIMENTAL VALUES:

Temperature		Henry's Constant	Mol Fraction at One Atm (Compiler)
$t/^{\circ}C$	T/K	K/atm	10^5x_1
0	273.15	13800	7.25
10	283.15	21400	4.67

Henry's constant, K/atm = $(p_1/\text{atm})/x_1$.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

No experimental details are given.

The paper does not make clear whether these are new experimental data or literature values.

The paper does contain literature values of the partial molar volume of the gas in water and other thermodynamic information.

SOURCE AND PURITY OF MATERIALS:

No experimental details are given.

ESTIMATED ERROR:

REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Propane; C_3H_8; [74-98-6] (2) Water; H_2O; [7732-18-5]	Rudakov, E.S.; Lutsyk, A.I. *Zh. Fiz. Khim.*, 1979, *53*, 1298-1300. *Russ. J. Phys. Chem.*, 1979, *53*, 731-733.
VARIABLES:	PREPARED BY:
T/K = 298.15	E.S. Rudakov W. Hayduk

EXPERIMENTAL VALUES:

T/K	Partition coefficient[1] $k/\mathrm{cm}_2^3\mathrm{cm}_1^{-3}$	Ostwald coefficient[2] $L/\mathrm{cm}^3\mathrm{cm}^{-3}$	Bunsen coefficient[2] $\alpha/\mathrm{cm}^3(\mathrm{STP})\mathrm{cm}^{-3}\mathrm{atm}^{-1}$	Mole fraction[2] 10^5x_1
298.15	29	0.0345	0.0314	2.58

[1] Original data

[2] Ostwald and Bunsen coefficients and mole fraction for 101.325 kPa calculated by compilers on basis that partition coefficient is equivalent to the inverse of the Ostwald coefficient and assuming that Henry's law applies.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Gas chromatographic method used to evaluate partition coefficients. Reactor containing gas and water mechanically shaken.
After phase separation a measured volume of gas introduced into carrier gas for analysis. An equal volume of solution placed into a gas stripping cell for complete stripping of the propane by the carrier gas. The ratio of areas under the propane peaks used to determine the solubility. Actual equilibrium pressure not specified.

SOURCE AND PURITY OF MATERIALS:

Sources and purities not specified.

ESTIMATED ERROR:

$\delta k/k = 0.10$

(authors)

REFERENCES:

COMPONENTS:

(1) Propane; C_3H_8; [74-98-6]

(2) Water, Benzene, Ethanol, Diethylether, Chloroform, Turpentine

ORIGINAL MEASUREMENTS:

Lebeau, P.

Compt. Rend. 1905, *140*, 1454-6 and 1572.

Bull. Soc. Chim. [3] 1905, *33*, 1137-9.

VARIABLES:

T/K = 290.8 - 294.8
p/kPa = 100.4 - 100.9

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

Temperature		Pressure[a]	Solubility
t/°C	T/K	p/mmHg	Volume propane/100 Volumes Solvent
Water; H_2O; [7732-18-5]			
17.8	291.0	753	6.5
Benzene; C_6H_6O; [71-43-2]			
21.5	294.7	757	1452
Ethanol; C_2H_6O; [64-17-5]			
16.6	290.8	754	790
1,1'-Oxybisethane or diethylether; $C_4H_{10}O$; [60-29-7]			
16.6	290.8	757	926
Chloroform or trichloromethane; $CHCl_3$; [67-66-3]			
21.6	294.8	757	1299
Oil of turpentine			
17.7	290.9	757	1587

[a] Not clear whether this is total pressure or propane partial pressure. It is probably total pressure.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Details not given.

The data are reported in both papers.

SOURCE AND PURITY OF MATERIALS:

(1) Propane. Prepared by author from carefully purified propyl iodide by reaction with sodium in liquid ammonia.
Melting point/°C = -195
Boiling point/°C = -44.5
Critical temperature/°C = 102.

(2) Solvents. No information.

ESTIMATED ERROR:

REFERENCES:

COMPONENTS:	EVALUATOR:
(1) n-Butane; C_4H_{10}; [106-97-8] (2) Water; H_2O; [7732-18-5]	Rubin Battino Department of Chemistry Wright State University Dayton, Ohio 45435 U.S.A. November, 1983

CRITICAL EVALUATION:

The solubility of n-butane in water at approximately atmospheric pressure has been reported in sixteen papers (1-16), but only the data from eight papers (1-8) were used for the final smoothing equation for this system. After the data from all of the papers were converted to mole fraction solubilities at 0.101325 MPa partial pressure, they were fitted by the following equation:

$$\ln x_1 = A_0 + A_1/T + A_2 \ln T + A_3 T + A_4 T^2 \quad \text{where } T = T/100\ \text{K}. \qquad (1)$$

Fitting to a polynomial in the reciprocal of the Kelvin temperature gave no significant improvement over equation (1) for the same number of terms. Furthermore, the use of more than three terms gave no significant reduction in the standard deviation of the fit. The fitting process was repeated several times, deleting in each instance those points which deviated by about two standard deviations or more from the smoothed line. Also, a knowledge of the original papers and experimental methods used were considered in making the decision about which points or whose work to delete. The smoothing equation which follows was based on four data points from reference (1), ten from (2), twelve from (3), two from (4), five from (5), five from (6), five from (7) (extrapolated to 0.101325 MPa), and two from reference (8).

$$\ln x_1 = -102.029 + 146.040/T + 38.7599 \ln T \qquad (2)$$

The standard deviation in $\ln x_1$ was 0.026 and in x_1 about 2.6%. The smoothed data were available for the range from 273 to 349 K.

Smoothed values obtained from Equation (2) for the mole fraction at 0.101325 MPa partial pressure of gas and the Ostwald coefficient are presented at 5 K intervals in Table 1. Also given in this table are the thermodynamic functions for the transfer of the gas from the vapor phase at 0.101325 MPa partial pressure of gas to the (hypothetical) solution of unit mole fraction. Taking appropriate derivatives of equation (2) gave a constant value of $\Delta\bar{C}^\circ_{p_1}$ of 322 J mol^{-1} K^{-1}.

Table 1. The solubility and thermodynamic properties for the solubility of n-butane in water at 0.101325 MPa partial pressure of gas.

T/K	$10^5 x_1$	L	$\Delta\bar{G}^\circ_1$/ kJ mol^{-1}	$\Delta\bar{H}^\circ_1$/ kJ mol^{-1}	$\Delta\bar{S}^\circ_1$/ J mol^{-1} K^{-1}
273.15	6.666	0.08293	21.84	-33.40	-202.2
278.15	5.150	0.06525	22.83	-31.79	-196.4
283.15	4.065	0.05241	23.80	-30.17	-190.6
288.15	3.274	0.04293	24.74	-28.56	-185.0
293.15	2.687	0.03581	25.65	-26.95	-179.4
298.15	2.244	0.03039	26.54	-25.34	-174.0
303.15	1.906	0.02621	27.39	-23.73	-168.6
308.15	1.645	0.02295	28.22	-22.12	-163.4
313.15	1.440	0.02038	29.03	-20.51	-158.2
318.15	1.278	0.01835	29.80	-18.89	-153.1
323.15	1.150	0.01673	30.56	-17.28	-148.0
328.15	1.047	0.01543	31.28	-15.67	-143.1
333.15	0.965	0.01440	31.99	-14.06	-138.2
338.15	0.899	0.01358	32.67	-12.45	-133.4
343.15	0.847	0.01294	33.32	-10.84	-128.7
348.15	0.805	0.01244	33.95	-9.23	-124.0
353.15	0.772	0.01207	34.56	-7.62	-119.4

COMPONENTS:	EVALUATOR:
(1) n-Butane; C_4H_{10}; [106-97-8] (2) Water; H_2O; [7732-18-5]	Rubin Battino Department of Chemistry Wright State University Dayton, Ohio 45435 U.S.A. November, 1983

CRITICAL EVALUATION: ...continued

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2. Kresheck, G.C.; Schneider, H.; Scheraga, H.A., *J. Phys. Chem.* 1965, *69*, 3132-44.
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4. Claussen, W.F.; Polglase, M.F., *J. Am. Chem. Soc.* 1952, *74*, 4817-9.
5. Ben-Naim, A.; Wilf, J.; Yaacobi, M., *J. Phys. Chem.* 1973, *77*, 95-102.
6. Rice, P.A.; Gale, R.P.; Barduhn, A.J., *J. Chem. Eng. Data* 1976, *21*, 204-6.
7. Umano, S.; Nakano, Y., *Kogyo Kagaku Zasshi* 1958, *61*, 536-44.
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10. Denton, W.H.; Smith, M.J.S.; Klaschka, J.T.; Forgan, R. et al., *Fourth Int. Symp. Fresh Water Sea* 1973, *3*, 291-311.
11. Namiot, A., Yu., *Zh. Strukt. Khim.* 1961, *2*, 408-17. *J. Struct. Chem. (Engl. Transl.)* 1961, *2*, 381-9.
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13. McAuliffe, C., *J. Phys. Chem.* 1966, *70*, 1267-75. *Nature*, 1963, *200*, 1092-3.
14. Wishnia, A., *Proc. Natl. Acad. Sci., Biochem.* 1962, *48*, 2200-4.
15. Rudakov, E.S.; Lutsyk, A.I., *Zh. Fiz. Khim.* 1979, *53*, 1298-1300. *Russ. J. Phys. Chem.* 1979, *53*, 731-3.
16. Lebeau, P., *Bull. Acad. Roy. Belg.* 1908, 300-4.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Butane; C_4H_{10}; [106-97-8] (2) Water; H_2O; [7732-18-5]	Wen, W.-Y.; Hung, J.H. *J. Phys. Chem.* 1970, *74*, 170-180.

VARIABLES:	PREPARED BY:
T/K: 278.15-308.15 P/kPa: 101.325 (1 atm)	W. Hayduk

EXPERIMENTAL VALUES:

t/°C	T/K	Solubility[1] s/cm^3(STP)kg^{-1}	Mole Fraction[2] $/10^5x_1$	Ostwald Coefficient[2] L/cm^{3}cm^{-3}	Bunsen Coefficient[2] α/cm^3(STP)cm^{-3}
5	278.15	62.00 ± 0.10	5.194	0.0631	0.0618
15	288.15	39.20 ± 0.05	3.267	0.0413	0.0388
25	298.15	26.34 ± 0.06	2.186	0.0287	0.0259
35	308.15	19.27 ± 0.06	1.594	0.0216	0.0189

[1] Original data.

[2] Calculated by compiler assuming authors considered gas to be ideal, and using real gas molar volumes:

$$x_1 = (18.016)\, sT[273.15(1000)V_t]^{-1};\ V_t/\mathrm{cm^3mol^{-1}} \text{ at } T.$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The apparatus was similar to that described by Ben-Naim and Baer (1). Teflon needle valves were used in place of stopcocks.

The apparatus consists of three main parts, a dissolution cell of 300 to 600 cm^3 capacity, a gas volume measuring column, and a manometer.

The solvent is degassed in the dissolution cell, the gas is introduced and dissolved while the liquid is kept stirred by a magentic stirrer immersed in the water bath. Dissolution of the gas results in the change in the height of a column of mercury which is measured by a cathetometer.

SOURCE AND PURITY OF MATERIALS:

1. Matheson Co. Stated to be better than 99.9 per cent pure.
2. Distilled from an all-Pyrex apparatus. Specific conductivity 1.5 x 10^{-6} (ohm cm)$^{-1}$.

ESTIMATED ERROR:

δT/K = ±0.005

$\delta s_1/s_1$ = ±0.003

REFERENCES:

1. Ben-Naim, A.; Baer, S. *Trans. Faraday Soc.* 1963, *59*, 2735.

COMPONENTS:

(1) Butane; C_4H_{10}; [106-97-8]

(2) Water; H_2O; [7732-18-5]

ORIGINAL MEASUREMENTS:

Moudgil, B. M.; Somasundaran, P.; Lin, L. J.

Rev. Sci. Instrum. 1974, *45*, 406-9.

VARIABLES:

T/K = 298.15

p_1/kPa = 101.325

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

Temperature		Solubility/	Mol Fraction	Ostwald Coefficient
$t/^{\circ}C$	T/K	cm^3(STP) kg^{-1}	$10^5 x_1$	$L/cm^3\ cm^{-3}$
25.0	298.15	26.00	2.090	0.02830

The mole fraction and Ostwald coefficient values were calculated by the compiler assuming ideal gas behavior.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The apparatus is based on the design of Ben Naim and Baer (1). The apparatus consists of an absorption cell, a gas measuring column and the pressure control system.

The pressure control system is automated.

SOURCE AND PURITY OF MATERIALS:

(1) Butane. Matheson Co., Inc. Stated to be 99.9 percent.

(2) Water. Triple distilled. Specific conductivity 1.5 x 10^{-6} Ω^{-1} cm^{-1}.

ESTIMATED ERROR: $\delta t/K = \pm 0.1$

$\delta p/kg\ cm^{-2} = \pm 0.1$

Maximum error in solubility is ± 0.4 percent (authors).

REFERENCES:

1. Ben Naim, A.; Baer, S. *Trans. Faraday Soc.* 1963, *59*, 2735.

COMPONENTS:

(1) Butane; C_4H_{10}; [106-97-8]

(2) Water; H_2O; [7732-18-5]

ORIGINAL MEASUREMENTS:

Kresheck, G. C.; Schneider, H.; Scheraga, H. A.

J. Phys. Chem. 1965, *69*, 3132-44.

VARIABLES:

T/K = 274.15 - 328.15

p_1/kPa = 101.325

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

Temperature		Mol Fraction[a]		Molarity	Molality
$t/^\circ C$	T/K	10^5x_1		10^3c_1/mol dm^{-3}	10^3m_1/mol kg^{-1}
1	274.15	6.919			
4	277.15	5.802,	5.773		
	277.15[b]	5.79 ± 0.01		3.21 ± 0.01	3.21 ± 0.01
10	283.15	4.328,	4.219		
15	288.15	3.379,	3.328		
20	293.15	2.740,	2.716		
25	298.15	2.282,	2.259		
	298.15[b]	2.27 ± 0.01		1.26 ± 0.01	1.26 ± 0.01
30	303.15	1.929			
35	308.15	1.672,	1.647		
40	313.15	1.452			
45	318.15	1.322,	1.352		
50	323.15	1.188			
	323.15[b]	1.19 ± 0.01		0.66 ± 0.01	0.66 ± 0.01
55	328.15	1.106,	1.084		

[a] The experimental values of the mole fraction solubility were provided by H. Schneider. The last figure is not significant.

[b] Smoothed values from the original paper.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

A known quantity of the gas was introduced from a gas buret into a calibrated volume which contained a weighed quantity of water. The water was stirred until equilibrium was attained (3 to 4 hours). The amount of gas in the vapor phase at equilibrium was determined from the partial pressure of the butane and the volume of the vapor space. The volume was the difference in the empty vessel volume and the water volume. The amount of dissolved gas was obtained by difference.

Handbook values of water density were used. The gas volume was corrected for non-ideal behavior by use of a compressibility factor (1). At each temperature the solubility was measured at two partial pressures which ranged from 0.5 to 0.7 atm at 4 °C to 1.2 to 1.6 atm at 50 °C. All solubility data were normalized to a partial pressure of 1 atm.

SOURCE AND PURITY OF MATERIALS:

(1) Butane. Matheson Co., Inc. 99.94 mole per cent.

(2) Water. Laboratory distilled water was deionized prior to use.

ESTIMATED ERROR:

$\delta x_1/x_1 = \pm 0.005$

REFERENCES:

1. Silberberg, I. H.; Kuo, P. K.; McKetta, J. J. *Petrol. Engr.* 1954, *24*, 9C.

COMPONENTS:

(1) Butane; C_4H_{10}; [106-97-8]

(2) Water; H_2O; [7732-18-5]

ORIGINAL MEASUREMENTS:

Morrison, T.J.; Billet, F.

J. Chem. Soc. 1952, 3819-3822.

VARIABLES:

T/K: 284.05-349.25

P/kPa: 101.325

PREPARED BY:

W. Hayduk

EXPERIMENTAL VALUES:

t/°C	T^2/K	Solubility[1] s/cm^3(STP) kg^{-1}	Mole Fraction[2] /$10^5 x_1$	Ostwald Coefficient[2] L/cm^{3}cm^{-3}	Bunsen Coefficient[2] α/cm^3(STP) cm^{-3}
10.9	284.05	43.85	3.66	0.0456	0.0436
14.1	297.25	38.28	3.04	0.0382	0.0361
20.0	293.15	30.83	2.56	0.0330	0.0305
25.0	298.15	25.88	2.15	0.0282	0.0255
30.1	303.25	22.18	1.84	0.0245	0.0218
35.0	308.15	19.41	1.605	0.0218	0.0190
40.1	313.25	16.98	1.402	0.0193	0.0166
45.0	318.15	15.14	1.248	0.0175	0.0147
49.9	323.05	13.77	1.134	0.0161	0.0133
58.0	331.15	11.99	0.985	0.0143	0.0115
65.4	338.55	10.86	0.891	0.0132	0.0104
66.0	339.95	10.72	0.881	0.0131	0.0103
70.8	343.95	10.16	0.831	0.0125	0.00967
76.1	349.25	9.71	0.795	0.0121	0.00922

[1] Original data expressed as cm^3(STP) per 1000 g water at a total pressure of 101.325 kPa(1 atm). Smoothing equation given by authors (ref. 1 below): $\log_{10}s = -109.258 + 5995/(T/\mathrm{K}) + 36.60 \log_{10}(T/\mathrm{K})$.

[2] Calculated by compiler assuming that authors considered gas to be ideal, and using real gas molar volumes:
$x_1 = 18.016sT[273.15(1000)\ V_t]^{-1}$; V_t/cm^{3}mol^{-1}at T.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The equipment consisted of a solvent degassing system, an absorption spiral and a gas buret for measuring the gas volume. Degassed solvent was allowed to flow down the absorption spiral containing the gas, saturated with solvent vapor, at a total pressure of one atmosphere. The volume of gas absorbed was measured by means of the attached buret system. Details were previously described (2).

SOURCE AND PURITY OF MATERIALS:

1. Prepared from Grignard reagent. Some supplied by Anglo-Iranian Oil Co., Specified as 99 per cent pure, giving same results.
2. Degassed. No additionnal details given.

ESTIMATED ERROR:

δT/K = 0.02

$\delta s/s$ = 0.01 (compiler)

REFERENCES:

1. Morrison, T.J.
   J. Chem. Soc. 1952, 3814.
2. Morrison, T.J.; Billet, F.
   J. Chem. Soc. 1948, 2033.

COMPONENTS:

(1) Butane; C_4H_{10}; [106-97-8]

(2) Water; H_2O; [7732-18-5]

ORIGINAL MEASUREMENTS:

Umano, S.; Nakano, Y.

Kogyo Kagaku Zasshi 1958, *61*, 536-44.

VARIABLES:

$T/K = 273 - 293$
$p_1/\text{kPa} = 99.29 - 101.01$

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

Temperature $t/^{0}C$	Temperature T/K	Total Pressure p/atm	Butane Partial Pressure p_1/atm	Mol Fraction $10^5 x_1$
0	273	1.0030	0.9969	6.793
5	278	1.0030	0.9944	4.925
10	283	1.0030	0.9908	3.952
15	288	1.0030	0.9865	3.353
20	293	1.0030	0.9799	2.776

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The apparatus consists of a gas supply, a manometer-buret system, a thermostated mixing cell, and a solvent cell. The apparatus is constructed of glass with vinyl tubing connectors. A gasoline insoluble type stopcock grease is used.

The apparatus is evacuated, then filled with gas to condition the glass surfaces, vinyl chloride tubing and stopcock grease. The solvent is degassed by boiling under reduced pressure in the solvent reservoir. The solvent is transferred to the evacuated mixing cell, the gas added to establish the pressure of the measurement. The mixing cell is shaken until equilibrium is attained.

SOURCE AND PURITY OF MATERIALS:

(1) Butane. Oakford Gas and Appliance Co. Stated to be greater than 99 mol percent purity. The impurity is higher molecular weight hydrocarbons.

(2) Water.

ESTIMATED ERROR:

$\delta T/K = 0.05$

$\delta x_1/x_1 = 0.01$ (compiler)

REFERENCES:

COMPONENTS:

(1) Butane; C_4H_8; [106-97-8]

(2) Water; H_2O; [7732-18-5]

ORIGINAL MEASUREMENTS:

Claussen, W.F.; Polglase, M.F.

J. Am. Chem. Soc. 1952, *74*, 4817-4819.

VARIABLES:

T/K: 292.95, 302.95

P/kPa: 101.325

PREPARED BY:

W. Hayduk

EXPERIMENTAL VALUES:

t^1/°C	T/K	Mole Fraction^2 /$10^5 x_1$	Ostwald Coefficient^2 L/cm^{3}cm^{-3}	Bunsen Coefficient^1 α/cm^3(STP)cm^{-3}atm^{-1}
19.8	292.95	2.75	0.0354	0.0321, 0.0333, 0.0330, 0.0326, 0.0325 (0.03270)^3
29.8	302.95	1.96	0.0262	0.0230, 0.0236, 0.0233, 0.0234, 0.0230 (0.02326)^3

[1] Original data reported as the Bunsen coefficients.

[2] Calculated by compiler using the average value of the Bunsen coefficients and real gas molar volumes.

[3] Average value of Bunsen coefficients.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The gas solubility was determined by a micro combustion technique. It involved stripping the gas from a saturated water solution with oxygen, catalytically oxidizing the hydrocarbon and then adsorbing and weighing the carbon dioxide produced. Gas was bubbled through the water via a sintered glass disc until saturated. The train for analysis consisted of an oxygen tank, pressure regulators, mercury manometer, preheater, absorption tube containing ascarite and anhydrone, aerator, combustion tube containing copper oxide at 973 K, weighing tubes containing ascarite and anhydrone, and finally the Mariotte flask. Further details are given in the paper.

SOURCE AND PURITY OF MATERIALS:

1. Ohio Chemical Co., specified as 99 per cent pure.
2. Doubly distilled.

ESTIMATED ERROR:

δT/K = 0.1

$\delta\alpha/\alpha$ = 0.01

(estimated by compiler)

REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Butane; C_4H_{10}; [106-97-8] (2) Water; H_2O; [7732-18-5]	Ben-Naim, A.; Wilf, J.; Yaacobbi, M. *J. Phys. Chem.* 1973, *77*, 95-102.
VARIABLES: T/K: 278.15-298.15 P/kPa: 101.325	PREPARED BY: W. Hayduk

EXPERIMENTAL VALUES:

t^1/°C	T^2/K	Ostwald Coefficient[1] L/cm^{3}cm^{-3}	Bunsen Coefficient[2] α/cm^3(STP) cm^{-3}	Mole Fraction[2] $/10^5 x_1$
5	278.15	0.0641	0.0628	5.27
10	283.15	0.0511	0.0490	4.12
15	288.15	0.0416	0.0391	3.29
20	293.15	0.0346	0.0319	2.69
25	298.15	0.0293	0.0265	2.23

[1] Original data.

[2] Calculated by compiler using real gas molar volumes.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The method of Ben-Naim and Baer (1) was modified to include the use of Teflon stopcocks. Degassed liquid initially in a volumetric container was forced by a stirrer-created vortex up side-arms and through tubes containing the gas, which was saturated with vapor.

The gas uptake at constant pressure was determined by means of a buret.

SOURCE AND PURITY OF MATERIALS:

1. Matheson Co. Minimum specified purity 99.95%.
2. Not specified.

ESTIMATED ERROR:

$\delta L/L = 0.01$ (compiler)

REFERENCES:

1. Ben-Naim, A.; Baer, S.
   Trans. Faraday Soc. 1963, *59*, 2735-2741.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Butane; C_4H_{10}; [106-97-8] (2) Water; H_2O; [7732-18-5]	Rice, P. A.; Gale, R. P.; Barduhn, A. J. *J. Chem. Eng. Data* 1976, *21*, 204-6.
VARIABLES: T/K = 276.15 - 292.15 p_1/kPa = 67.58, 101.325	PREPARED BY: H. L. Clever

EXPERIMENTAL VALUES:

Temperature		Partial Pressure	Butane Solubility	
$t/^\circ C$	T/K	p_1/atm	ppm	Mol Fraction $10^5 x_1$
3	276.15	1	182.4	5.65
6	279.15	1	152.4	4.72
9	282.15	1	134.5	4.17
14	287.15	1	109.6	3.40
19	292.15	1	91.9	2.85
19	292.15	0.667	61.3	1.90

The mole fraction values were calculated by the compiler.

The solubility values are the average of three to nine separate injections into the total carbon analyzer.

Smoothed Data: A least square regression of the ppm solubility data at one atm gives

$$\ln\,(\text{ppm}) = -222.3536 + 333.0672/(T/100\ \text{K}) + 105.281 \ln\,(T/100\ \text{K})$$

with a standard error about the regression line of 1.9 which ranges from 1.0 to 2.1 % of the experimental values.

ppm = parts per million by weight

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The solubility equilibrium was established in a one liter pyrex cell with a Plexiglass top with ports for sampling, pressure connection, vacuum line, and introduction of the gas.

About 700 cm^3 of solvent was placed in the cell, it was sealed, thermostated, and degassed by reducing the pressure to the vapor pressure of the solvent for about one hour.

Butane was added to the system and the system was stirred for 24 - 48 hours. It was assumed that equilibrium was established when no pressure change was observed in a four hour period. Saturation was approached from both a higher and a lower temperature. Samples of the liquid were taken in a microliter syringe. The samples were injected directly into a total carbon analyzer. Three to nine injections were made.

SOURCE AND PURITY OF MATERIALS:

(1) Butane. Source not given. Stated to be of 99.5 % instrument purity.

(2) Water. No information.

ESTIMATED ERROR:

δT/K = ± 0.02

δpmm/pmm = ± 0.01

$\delta x_1/x_1$ = ± 0.01

REFERENCES:

COMPONENTS: (1) Butane; C_4H_{10}; [106-97-8] (2) Water; H_2O; [7732-18-5]	ORIGINAL MEASUREMENTS: Namiot, A. Yu. *Zh. Strukt. Khim.* 1961, *2*, 408-17. **J. Struct. Chem. (Engl. Transl.)* 1961, *2*, 381-9.
VARIABLES: T/K = 283 p_1/kPa = 101.3	PREPARED BY: H. L. Clever

EXPERIMENTAL VALUES:

Temperature		Henry's Constant	Mol Fraction at One Atm (Compiler)
$t/^{\circ}C$	T/K	K/atm	$10^5 x_1$
10	283.15	27400	3.65

Henry's constant, $K/\text{atm} = (p_1/\text{atm})/x_1$.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

No experimental details are given.

The paper does not make clear whether this is a new experimental value or a literature value.

The paper does contain literature values of other thermodynamic information.

SOURCE AND PURITY OF MATERIALS:

No experimental details are given.

ESTIMATED ERROR:

REFERENCES:

COMPONENTS: (1) Butane; C_4H_{10}; [106-97-8] (2) Water; H_2O; [7732-18-5]	**ORIGINAL MEASUREMENTS:** Denton, W.H.; Smith, M.J.S.; Klaschka, J.T.; Forgan, R. *et al.* *Fourth Int. Symp. Fresh Water Sea* 1973, *3*, 291-311.
VARIABLES: *T*/K: 298.15 *P*/kPa: 0.101-101.325	**PREPARED BY:** W. Hayduk

EXPERIMENTAL VALUES:

T/K	Gas Partial Pressure[1] *P*/atm	Solubility[1] z/mol $(10^6\text{mol})^{-1}$	Mole Fraction[2] $/10^5 x_1$	Ostwald Coefficient[2] $L/\text{cm}^3\text{cm}^{-3}$	Bunsen Coefficient[2] α
298.15	1.00	21.0	2.10	0.0275	0.0249
	0.10	2.1			
	0.01	0.21			
	0.001	0.021			

[1] Results presented only on a log-log graph which was replotted by compiler for estimation of values shown here. Values show that Henry's law is obeyed; the slope of the graph is 1.

[2] Calculated by compiler using a real gas molar volume.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

A chromatographic technique for analysis of butane in water and aqueous sodium chloride solutions stated to be capable of detecting concentrations down to 0.001 mg dm^{-3} was used. Details not given.

SOURCE AND PURITY OF MATERIALS:

Sources and purities not specified.

ESTIMATED ERROR:

$\delta z/z = 0.02$ (authors)

REFERENCES:

COMPONENTS:

(1) Butane; C_4H_8; [106-97-8]

(2) Water; H_2O; [7732-18-5]

ORIGINAL MEASUREMENTS:

Wetlaufer, D.B.; Malik, S.K.; Stoller, L.; Coffin, R.L.

J. Am. Chem. Soc. 1964, *86*, 508-514.

VARIABLES:

T/K: 278.15-318.15

P/kPa: 101.325

PREPARED BY:

W. Hayduk, C.L. Young

EXPERIMENTAL VALUES:

T/K	Solubility[1] s/mmol dm^{-3}	Mole Fraction[2] $/10^5 x_1$	Ostwald Coefficient[2] L/cm^{3}cm^{-3}	Bunsen Coefficient[2] α/cm^3(STP)cm^{-3}atm^{-1}
278.15	2.85	5.14	0.0624	0.0611
298.15	1.16	2.10	0.0275	0.0249
318.15	0.69	1.26	0.0176	0.0148

[1] Original data reported as millimoles per litre at a gas partial pressure of 101.325 kPa.

[2] Calculated by compiler using real gas molar volumes.

[3] No correction was made for the amount of gas retained by the solvent during extraction, estimated by the authors to be 1-1.5 per cent; hence the results are expected to be too low by that amount.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

A modified Van Slyke-Neill manometric blood gas apparatus, fitted with a magnetic stirrer was used. The solvent was saturated with gas; then a sample was transferred to the Van Slyke extraction chamber for gas desorption and volume measurement.

SOURCE AND PURITY OF MATERIALS:

1. Matheson Co. C.P. grade of minimum specified purity 99.0 per cent.
2. Distilled.

ESTIMATED ERROR:

δT/K = 0.05

$\delta s/s$ = 0.02 (authors)[3]

REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Butane; C_4H_{10}; [106-97-8] (2) Water; H_2O; [7732-18-5]	McAuliffe, C. *J. Phys. Chem.* 1966, *70*, 1267-1275. *Nature*, 1963, *200*, 1092-1093.
VARIABLES:	**PREPARED BY:**
T/k: 298.15 *P*/kPa: 101.325	W. Hayduk

EXPERIMENTAL VALUES:

T/K	Solubility[1] s/g(10^{6}g water)$^{-1}$	Mole Fraction[2] $/10^5x_1$	Ostwald Coefficient[2] L/cm^{3}cm^{-3}	Bunsen Coefficient[2] α/cm^3(STP)cm^{-3}atm^{-1}
298.15	61.4	1.94	0.0255	0.0231

[1] Original data at 1 atm total pressure.

[2] Calculated by compiler correcting for vapor pressure of water.

The same data appear in both sources.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The equipment consisted of a gas reservoir, contacting bottle, stripping column and a gas chromatographic analyzer. A rubber balloon maintained at essentially atmospheric pressure served as the gas reservoir which was connected to a bottle partially filled with the water solvent. Equilibrium was established by hand shaking for 5 to 10 min after which the mixture was allowed to stand for phase separation. The solubility was determined by injection of the gas-saturated water solution into a stripping column supplied with helium. The quantity of gas was determined by a gas chromatograph equipped with a hydrogen-flame ionization detector.

SOURCE AND PURITY OF MATERIALS:

1. Phillips Petroleum Co. of minimum specified purity 99.0%.
2. Distilled.

ESTIMATED ERROR:

δT/K = 1.5
$\delta s/s$ = 0.04 (author)

REFERENCES:

COMPONENTS:

(1) Butane; C_4H_{10}; [106-97-8]

(2) Water; H_2O; [7732-18-5]

ORIGINAL MEASUREMENTS:

Barone, G.; Crescenzi, V.; Pispisa, B.; Quadrifoglio, F.

J. Macromol. Chem. 1966, *1*, 761-771.

VARIABLES:

T/K: 298.15

P/kPa: 101.325

PREPARED BY:

W. Hayduk

EXPERIMENTAL VALUES:

T/K	Solubility[1] s/mmol dm^{-3}	Mole Fraction[2] $/10^5x_1$	Ostwald Coefficient[2] L/cm^3cm^{-3}	Bunsen Coefficient[2] $\alpha/cm^3(STP)cm^{-3}atm^{-1}$
298.15	1.09	1.97	0.0258	0.0234

[1] Original data reported as millimoles of gas per litre water at gas partial pressure of 101.325 kPa.

[2] Calculated by compiler using a real gas molar volume.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

A method utilizing a gas chromatographic analysis of saturated water was used. A volume of 4 cm^3 of water was saturated at constant temperature in a 20-cm^3 gas-washing bottle by means of a sintered glass bubbler. The top was sealed with a rubber stopper through which a hypodermic needle was inserted as a vent. Equilibration was continued for 1 h. Samples of 0.20-cm^3 were withdrawn by syringe and passed through a stripper where they were contacted with carrier gas, then through a $CaCl_2$ tube and finally to a gas chromatograph for analysis.

SOURCE AND PURITY OF MATERIALS:

1. Riviora, Turin, Italy. Specified as chromatographically pure.
2. Not specified.

ESTIMATED ERROR:

T/K = 0.02

$\delta s/s$ = 0.04 (authors)

REFERENCES:

COMPONENTS:

(1) Butane; C_4H_{10}; [106-97-8]

(2) Water; H_2O; [7732-18-5]

ORIGINAL MEASUREMENTS:

Wishnia, A

Proc. Natl. Acad. Sci., Biochem. 1962, *48*, 2200-2204.

VARIABLES:

T/K: 283.15-308.15

P/kPa: 101.325

PREPARED BY:

W. Hayduk

EXPERIMENTAL VALUES:

t/°C	T/K	Solubility[1] s/mMol(kg)$^{-1}$	Mol Fraction[1] $/10^5x_1$
10	283.15	2.5	4.50
15	288.15	2.1	3.78
20	293.15	1.7	3.06
25	298.15	1.4	2.52
30	303.15	1.2	2.16
35	308.15	1.1	1.98

[1] Values read from graph of s versus t by compiler and calculated as mol fraction. No numerical data given.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The solubility was determined at pressures from 0.15 to 0.70 atm and extrapolated to a gas partial pressure of 1 atm using Henry's law.

An all-glass apparatus was used which consisted of a calibrated liquid contactor, 10 cm^3 in volume and a 5-10 cm^3 gas storage tube. The water was deaerated in the contactor under vacuum. The pressure was measured with a manometer. The initial and final gas pressures and volumes, together with the compressibilities were used to compute the molal solubilities. The quantity of solvent charged was determined by weight.

SOURCE AND PURITY OF MATERIALS:

1. Phillips petroleum, research grade. Purity not specified.
2. Deaerated.

ESTIMATED ERROR:

δT/K = 0.01 (author)

$\delta s/s$ = 0.08 (compiler)

REFERENCES:

COMPONENTS:

(1) Butane; C_4H_8; [106-97-8]

(2) Water; H_2O; [7732-18-5]

ORIGINAL MEASUREMENTS:

Rudakov, E.S.; Lutsyk, A.I.

Zh. Fiz. Khim., 1979, *53*, 1298-1300.

Russ. J. Phys. Chem., 1979, *53*, 731-733.

VARIABLES:

T/K: 298.15, 363.15

PREPARED BY:

E.S. Rudakov, W. Hayduk

EXPERIMENTAL VALUES:

T/K	Partition coefficient[1] k/cm$_2^3$cm$_1^{-3}$	Ostwald coefficient[2] L/cm^{3}cm^{-3}	Bunsen coefficient[2] α/cm^3(STP)cm^{-3}atm^{-1}	Mole fraction[2] 10^5x_1
298.15	37	0.0270	0.0244	2.05
363.15	223	0.00448	0.00328	0.29

[1] Original data.

[2] Ostwald and Bunsen coefficients and mole fraction for 101.325 kPa calculated by compilers on basis that partition coefficient is equivalent to the inverse of the Ostwald coefficient and assuming that Henry's law applies.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Gas chromatographic method used to evaluate partition coefficients. Reactor containing gas and water mechanically shaken.
After phase separation a measured volume of gas introduced into carrier gas for analysis. An equal volume of solution placed into a gas stripping cell for complete stripping of the butane by the carrier gas. The ratio of areas under the butane peaks used to determine the solubility. Actual equilibrium pressure not specified.

SOURCE AND PURITY OF MATERIALS:

Sources and purities not specified.

ESTIMATED ERROR:

$\delta k/k = 0.10$

(authors)

REFERENCES:

COMPONENTS:

(1) Butane; C_4H_{10}; [106-97-8]

(2) Water; H_2O; [7732-18-5]
Ethanol; C_2H_6O; [64-17-5]
Diethyl ether; $C_4H_{10}O$; [60-29-7]
Chloroform; $CHCl_3$; [67-66-3]

ORIGINAL MEASUREMENTS:

Lebeau, P.

Bull. Acad. Roy. Belg. 1908, 300-4.

VARIABLES:

T/K = 290, 291
p/kPa = 102.9 -104.8

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

Temperature t/°C	T/K	Pressure[a] p/mmHg	Solubility Volume Butane/Volume Solvent
Water			
17	290	772	0.15
Ethanol			
17	290	775	18.83
Diethylether or 1,1'-oxybisethane			
18	291	773	29.8
Chloroform or trichloromethane			
17	290	786	32.5

[a] Not clear whether this is total pressure or butane partial pressure. It is probably the total pressure.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Details not given.

SOURCE AND PURITY OF MATERIALS:

(1) Butane. Prepared by author by the reaction of sodium in liquid ammonia on butyl iodide. The normal boiling point is 0.5 °C, and the critical temperature is 151-2 °C.

(2) Solvents. No information.

ESTIMATED ERROR:

REFERENCES:

COMPONENTS:

(1) 2-Methylpropane (isobutane); C_4H_{10}; [75-28-5]

(2) Water; H_2O; [7732-18-5]

EVALUATOR:

Rubin Battino
Department of Chemistry
Wright State University
Dayton, Ohio 45435 U.S.A.

November, 1983

CRITICAL EVALUATION:

Four papers reported data for this system (1-4). The early work by Lebeau (4) reports an extraordinarily large value and was rejected. McAuliffe's work (3) has proven to be usually significantly low for all of the systems he measured and his single value was also rejected. This left three points from reference (1) and one from reference (2) in the temperature range 278 to 318 K. These four points were smoothed to give the following equation:

$$\ln x_1 = -129.714 + 183.044/\mathrm{T} + 53.4651 \ln \mathrm{T} \quad \text{where } \mathrm{T} = T/100 \text{ K}.$$

The standard deviation of the fit was 0.034 in ln x_1 or about 2.8% in x_1. For this limited range smoothed values at 5 K intervals are given below for the mole fraction solubility at 0.101325 MPa partial pressure of gas (x_1), the Ostwald coefficient (L), and the thermodynamic functions for the transfer of the gas from the vapor phase at 0.101325 MPa partial pressure of gas to the (hypothetical) solution of unit mole fraction. It was found that $\Delta \bar{C}^\circ_{p_1}$ was constant at 463 J mol^{-1} K^{-1}.

T/K	$10^5 x_1$	L	$\Delta \bar{G}_1^\circ$/ kJ mol^{-1}	$\Delta \bar{H}_1^\circ$/ kJ mol^{-1}	$\Delta \bar{S}_1^\circ$/ J mol^{-1} K^{-1}
278.15	3.589	0.04547	23.67	-30.86	-196.0
283.15	2.859	0.03687	24.63	-28.68	-188.3
288.15	2.333	0.03059	25.55	-26.49	-180.6
293.15	1.947	0.02595	26.44	-24.31	-173.1
298.15	1.659	0.02247	27.28	-22.13	-165.7
303.15	1.443	0.01983	28.09	-19.95	-158.5
308.15	1.278	0.01783	28.87	-17.77	-151.4
313.15	1.151	0.01630	29.61	-15.59	-144.3
318.15	1.055	0.01514	30.31	-13.41	-137.4

References

1. Wetlaufer, D.B.; Malik, S.K.; Stoller, L.; Coffin, R.L., *J. Am. Chem. Soc.* 1964, *86*, 508-14.

2. Rudakov, E.S.; Lutsyk, A.I., *Zh. Fiz. Khim.* 1979, *53*, 1298-1300; *Russ. J. Phys. Chem.* 1979, *53*, 731-3.

3. McAuliffe, C., *J. Phys. Chem.* 1966, *70*, 1267-75; *Nature* 1963, *200*, 1092-3.

4. Lebeau, P., *Bull. Acad. Roy. Belg.* 1908, 300-4.

COMPONENTS: (1) 2-Methylpropane (isobutane); C_4H_{10}; [75-28-5] (2) Water; H_2O; [7732-18-5]	**ORIGINAL MEASUREMENTS:** Wetlaufer, D.B.; Malik, S.K.; Stoller, L.; Coffin, R.L. *J. Am. Chem. Soc.* 1964, *86*, 508-514.
VARIABLES: T/K: 278.15-318.15 P/kPa: 101.325	**PREPARED BY:** W. Hayduk, C.L. Young

EXPERIMENTAL VALUES:

T/K	Solubility[1] s/mmol dm^{-3}	Mole Fraction[2] $/10^5 x_1$	Ostwald Coefficient[2] L/cm^{3}cm^{-3}	Bunsen Coefficient[2] α/cm^3(STP)cm^{-3}atm^{-1}
278.15	1.99	3.59	0.0436	0.0427
298.15	0.94	1.70	0.0223	0.0202
318.15	0.58	1.055	0.0148	0.0125

[1] Original data reported as millimoles per litre at a gas partial pressure of 101.325 kPa.

[2] Calculated by compilers using a real gas molar volume.

[3] No correction was made for the amount of gas retained by the solvent during extraction, estimated by the authors to be 1-1.5 per cent; hence the results are expected to be too low by that amount.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

A modified Van Slyke-Neill manometric blood gas apparatus, fitted with a magnetic stirrer was used. The solvent was saturated with gas; then a sample was transferred to the Van Slyke extraction chamber for gas desorption and volume measurement.

SOURCE AND PURITY OF MATERIALS:

1. Matheson Co. Instrument grade. Minimum specified purity 99.5 per cent.
2. Distilled.

ESTIMATED ERROR:

$\delta T/\text{K} = 0.05$

$\delta s/s = 0.02$ (authors)[3]

REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) 2-Methylpropane (isobutane); C_4H_{10}; [75-28-5] (2) Water; H_2O; [7732-18-5]	McAuliffe, C. *J. Phys. Chem.* 1966, *70*, 1267-1275. *Nature*, 1963, *200*, 1092-1093.
VARIABLES:	**PREPARED BY:**
T/K: 298.15 P/kPa: 101.325	W. Hayduk

EXPERIMENTAL VALUES:

T/K	Solubility[1] s/g(10^6g water)$^{-1}$	Mole Fraction[2] $/10^5 x_1$	Ostwald Coefficient[2] L/cm^{3}cm^{-3}	Bunsen Coefficient[2] α/cm^3(STP)cm^{-3}atm^{-1}
298.15	48.9	1.52	0.0199	0.0181

[1] Original data at 1 atm total pressure.

[2] Calculated by compiler correcting for vapor pressure of water.

The same data appear in both sources.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The equipment consisted of a gas reservoir, contacting bottle, stripping column and a gas chromatographic analyzer. A rubber balloon maintained at essentially atmospheric pressure served as the gas reservoir which was connected to a bottle partially filled with the water solvent. Equilibrium was established by hand shaking for 5 to 10 min after which the mixture was allowed to stand for phase separation. The solubility was determined by injection of the gas-saturated water solution into a stripping column supplied with helium. The quantity of gas was determined by a gas chromatograph equipped with a hydrogen-flame ionization detector.

SOURCE AND PURITY OF MATERIALS:

1. Phillips Petroleum Co. of minimum specified purity 99.0%.
2. Distilled.

ESTIMATED ERROR:

δT/K = 1.5

$\delta s/s$ = 0.04 (author)

REFERENCES:

COMPONENTS:

(1) 2-Methylpropane (isobutane); C_4H_{10}; [75-28-5]

(2) Water; H_2O; [7732-18-5]

ORIGINAL MEASUREMENTS:

Rudakov, E.S.; Lutsyk, A.I.

Zh. Fiz. Khim., 1979, *53*, 1298-1300.

Russ. J. Phys. Chem., 1979, *53*, 731-733.

VARIABLES:

T/K = 298.15

PREPARED BY:

E.S. Rudakov
W. Hayduk

EXPERIMENTAL VALUES:

T/K	Partition coefficient[1] $k/\mathrm{cm}_2^3\mathrm{cm}_1^{-3}$	Ostwald coefficient[2] $L/\mathrm{cm}^3\mathrm{cm}^{-3}$	Bunsen coefficient[2] $\alpha/\mathrm{cm}^3(\mathrm{STP})\mathrm{cm}^{-3}\mathrm{atm}^{-1}$	Mole fraction[2] 10^5x_1
298.15	47	0.0213	0.0193	1.62

[1] Original data.

[2] Ostwald and Bunsen coefficients and mole fraction for 101.325 kPa calculated by compilers on basis that partition coefficient is equivalent to the inverse of the Ostwald coefficient and assuming that Henry's law applies.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Gas chromatographic method used to evaluate partition coefficients. Reactor containing gas and water mechanically shaken.
After phase separation a measured volume of gas introduced into carrier gas for analysis. An equal volume of solution placed into a gas stripping cell for complete stripping of the isobutane by the carrier gas. The ratio of areas under the isobutane peaks used to determine the solubility. Actual equilibrium pressure not specified.

SOURCE AND PURITY OF MATERIALS:

Sources and purities not specified.

ESTIMATED ERROR:

$\delta k/k = 0.10$
(authors)

REFERENCES:

COMPONENTS:

(1) 2-Methylpropane or isobutane; C_4H_{10}; [75-28-5]

(2) Water; H_2O; [7732-18-5]
Ethanol; C_2H_6O; [64-17-5]
Diethylether; $C_4H_{10}O$; [60-29-7]
Chloroform; $CHCl_3$; [67-66-3]

ORIGINAL MEASUREMENTS:

Lebeau, P.

Bull. Acad. Roy. Belg. 1908, 300-4.

VARIABLES:

T/K = 290, 291
p/kPa = 102.9 - 104.8

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

Temperature		Pressure[a]	Solubility
$t/^{0}C$	T/K	p/mmHg	Volume Isobutane/Volume Solvent
Water			
17	290	772	0.13
Ethanol			
17	290	775	13.2
Diethylether or 1,1'-oxybisethane			
18	291	773	27.9
Chloroform or trichloromethane			
17	290	786	39.5

[a] Not clear whether this is total pressure or isobutane partial pressure. It is probably the total pressure.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Details not given.

SOURCE AND PURITY OF MATERIALS:

(1) Isobutane. Prepared by the author by the reaction of sodium or calcium in liquid ammonia on isobutyl chloride. The normal boiling point is -10.5 ^{0}C and the critical temperature is 134-5 ^{0}C.

(2) Solvents. No information.

ESTIMATED ERROR:

REFERENCES:

COMPONENTS: (1) Propane; C_3H_8; [74-98-6] (2) Water; H_2O; [7732-18-5], at high pressure	EVALUATOR: Colin L. Young, Department of Physical Chemistry, University of Melbourne, Parkville, Vic. 3052, Australia. December 1983

CRITICAL EVALUATION:

There have been five studies of this system at high pressures. The extensive study of De Loos *et al.* (1) was mainly concerned with the phenomenon of gas-gas immiscibility and although it is thought to be reliable the data are not strictly gas solubility. The data of De Loos *et al.* (1) are broadly consistent with data for other hydrocarbons + water mixtures. Sanchez and Coll (2) determined the phase behavior of this system in the region 200-400 °C and 20-300 MPa. Their data are not strictly gas solubility and are not in agreement with those of De Loos *et al.* (1).

The limited data of Wehe and McKetta (3) at 160 °F (344.3 K) are in excellent agreement with the smoothed values these workers obtained using the experimental data of Kobayashi and Katz (4). The data of Azarnoosh and McKetta (5) are also in reasonable agreement with the data of Wehe and McKetta (3). Of these three latter sets of data those of Azarnoosh and McKetta (5) are by far the most extensive and are classified as tentative. The degree of overlap of the three sets of data is too limited to enable a set of data to be recommended.

References

1. De Loos, Th. W.; Wijen, A. J. M.; Diepen, G. A. M.
J. Chem. Thermodyn. 1980, *12*, 193.

2. Sanchez, M.; Coll, R.
An. Quim. 1978, *74*, 132.

3. Wehe, A. H.; McKetta, J. J.
Anal. Chem. 1961, *33*, 291.

4. Kobayashi, R.; Katz, D. L.
Ind. Eng. Chem. 1953, *45*, 440.

5. Azarnoosh, A.; McKetta, J. J.
Pet. Ref. 1958, *37*, 275.

COMPONENTS:

(1) Propane; C_3H_8; [74-98-6]

(2) Water; H_2O; [7732-18-5]

ORIGINAL MEASUREMENTS:

Azarnoosh, A.; McKetta, J.J.

Pet. Ref. 1958, *37*, 275-278.

VARIABLES:

T/K: 288.7-410.9

P/kPa: 99-3409

PREPARED BY:

W. Hayduk

EXPERIMENTAL VALUES:

t[1]/°F	T[2]/K	Total Pressure[1] /psia	Partial Pressure[2] P_1/kPa	Mol Fraction[1] /10^5x_1
60	288.7	(0.256)[3]		
		(14.952)[4]	101.325	(5.58)[4]
		14.7	99.56	5.89
		20.2	137.5	7.70
		49.8	341.5	19.05
		62.7	430.4	22.44
		84.3	579.3	24.96
		100.5	691.0	25.98
100	310.9	(0.949)[3]		
		(15.645)[4]	101.325	(1.62)[4]
		21.7	143.0	2.34
		33.7	225.7	3.88
100	310.9	52.5	355.3	6.23

continued...

[1] Original data.

[2] Calculated by compiler using vapor pressure data given by authors.

[3] Vapor pressure of water as given by authors.

[4] Solubility for partial pressure of 101.325 kPa extrapolated by compiler.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

A method is used in which water and propane are charged into an equilibration cell. After rocking for several hours, a sample of the aqueous solution is passed into an analysis train. The analysis consists of refluxing the water solution and collecting the evolved gas in an evacuated flask of known volume as well as pressure and temperature. This process is repeated until all the gas is removed. The quantity of water is determined by weight. Corrections are applied for the vapor pressure of water in the collection flask and for water collected in the cold trap connected to the gas collection flask.

SOURCE AND PURITY OF MATERIALS:

1. Phillips Petroleum Co. Certified purity of 99.9 mol per cent.
2. Distilled and deaerated.

ESTIMATED ERROR:

$\delta P/P = 0.01$

$\delta x_1/x_1 = 0.02$ (compiler)

REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Propane; C_3H_8; [74-98-6] (2) Water; H_2O; [7732-18-5]	Azarnoosh, A.; McKetta, J.J. *Pet. Ref.* 1958, *37*, 275-278.
VARIABLES: T/K: 288.7-410.9 P/kPa: 99-3409	**PREPARED BY:** W. Hayduk

EXPERIMENTAL VALUES:

t[1]/°F	T/K	Total Pressure[1] /psia	Partial Pressure[2] P_1/kPa	Mol Fraction[1] /10^5x_1
100	310.9	52.5	355.3	6.23
		70.5	479.4	7.70
		84.2	573.8	10.26
		96.7	660.0	10.50
		114.7	784.1	12.44
		116.7	797.9	12.56
		120.2	822.0	13.62
		122.0	834.4	14.04
		131.7	901.2	14.30
		131.7	901.2	14.76
		139.7	956.4	15.03
		140.2	959.8	15.41
		142.7	977.1	15.67
		151.7	1039.1	16.87
		160.2	1097.7	16.91
160	344.3	(4.74)[3]		
		(19.44)[4]	101.325	(0.99)[4]
		30.7	178.9	1.75
		39.2	237.5	2.25
		40.2	246.5	2.50
		55.2	347.8	3.48
		60.2	383.3	4.02
		80.7	523.6	5.20
		107.7	709.7	7.42
		122.7	813.1	8.12
		144.7	964.7	9.05
		167.7	1123	10.65
		186.7	1254	12.10
		200.7	1351	12.96
		232.7	1571	14.17
		242.2	1637	15.06
		244.0	1649	15.00
		244.7	1654	15.07
		270.7	1833	16.08
		283.7	1923	17.30
		305.7	2074	18.45
		344.7	2343	20.00
		370.4	2520	21.04
		385.2	2622	21.50
220	377.6	(17.19)[3]		
		(31.89)[4]	101.325	(0.78)[4]
		37.2	137.9	1.200
		75.2	399.9	4.004
		131.7	789.3	7.610
		131.7	789.3	7.55
		181.2	1130	11.00
		195.7	1230	11.69
		217.2	1379	13.10
		258.7	1665	15.12
		273.7	1768	16.80
		290.7	1885	16.02

continued...

COMPONENTS:

(1) Propane; C_3H_8; [74-98-6]

(2) Water; H_2O; [7732-18-5]

ORIGINAL MEASUREMENTS:

Azarnoosh, A.; McKetta, J.J.

Pet. Ref. 1958, *37*, 275-278.

VARIABLES:

T/K: 288.7-401.9

P/kPa: 99 - 3409

PREPARED BY:

W. Hayduk

EXPERIMENTAL VALUES:

t[1]/°F	T[2]/K	Total Pressure[1] /psia	Partial Pressure[2] P_1/kPa	Mol Fraction[1] /$10^5 x_1$
220	377.6	305.7	1989	17.75
		310.7	2023	17.66
		314.0	2046	18.00
		355.7	2333	20.38
		408.7	2699	21.95
		425.7	2816	23.85
		447.2	3309	24.06
		497.2	3409	26.50
		511.7		27.00
280	410.9	(49.20)[3]		
		(63.90)[4]	101.325	(1.53)[4]
		75.3	179.9	2.72
		125.4	525.2	6.04
		315.6	1836	19.65
		390.2	2350	23.60
		431.0	2632	27.24
		487.3	3020	29.20
		498.7	3098	31.30

continued...

[1] Original data.

[2] Calculated by compiler using vapor pressure data given by authors.

[3] Vapor pressure of water as given by authors.

[4] Solubility for partial pressure of 101.325 kPa extrapolated by compiler.

COMPONENTS:

(1) Propane; C_3H_8; [74-98-6]

(2) Water; H_2O; [7732-18-5]

ORIGINAL MEASUREMENTS:

Azarnoosh, A.; McKetta, J.J.

Pet. Ref. 1958, *37*, 275-278.

VARIABLES:

T/K: 288.7-410.9

P/kPa: 99-3409

PREPARED BY:

W. Hayduk

EXPERIMENTAL VALUES:

Smoothed data were presented by authors as follows:

Total Pressure[1] /psia	T/K	Partial Pressure[2] p_1/kPa	Mol Fraction[1] $/10^5x_1$	T/K	Partial Pressure[2] p_1/kPa	Mol Fraction[1] $/10^5x_1$
	288.7	(1.765)[3]		299.8	(3.50)[3]	
14.7	(60°F)	99.6	5.7	(80°F)	97.9	2.45
20		136.1	7.5		134.4	3.38
40		274.0	14.95		272.3	6.65
60		411.9	22.15		410.2	10.05
80		549.8	24.50		548.1	13.40
100		687.7	25.9		686.0	16.60
108.5		746.3	(26.4)[4]		-	-
146.0		-	-		1003	(21.9)[4]
	310.9	(6.54)[3]		327.6	(15.32)[3]	
14.7	(100°F)	94.8	1.52	(130°F)	86.0	1.08
20		131.4	2.15		122.6	1.55
40		269.2	4.51		260.5	3.18
60		407.1	6.85		398.4	4.84
80		545.0	9.20		536.3	6.45
100		682.9	11.51		674.1	8.09
150		1028	16.62		1019	12.09
191.5		1314	(20.3)[4]		-	-
200		-	-		1364	15.48
250		-	-		1708	18.54
275		-	-		1881	(20.0)[4]
	344.3	(32.68)[3]		360.9	(64.40)[3]	
14.7	(160°F)	68.7	0.80	(190°F)	37.0	0.40
20		105.2	1.15		73.5	0.78
40		243.1	2.60		211.4	2.14
60		381.0	4.02		349.3	3.54
80		518.9	5.40		487.2	4.89
100		656.8	6.77		625.1	6.19
150		1002	10.03		969.8	9.29
200		1346	13.04		1315	12.12
250		1691	15.68		1659	14.83
300		2036	18.03		2004	17.31
350		2380	20.02		2349	19.58
389		2649	(21.2)[4]		-	-
	360.9					
400		2693	21.37			
450		3038	22.98			
500		3383	24.20			
538		3645	(25.0)[4]			
	377.6	(118.5)[3]		394.3	(205.7)[3]	
20	(220°F)	19.37	0.30	(250°F)	-	-
40		157.3	1.80		70.12	1.05
60		295.2	3.21		208.0	2.64
80		433.1	4.53		345.9	4.04
100		571.0	5.81		483.8	5.32
150		915.7	8.88		828.5	8.62
200		1260	11.99		1173	11.88

continued...

COMPONENTS:

(1) Propane; C_3H_8; [74-98-6]

(2) Water; H_2O; [7732-18-5]

ORIGINAL MEASUREMENTS:

Azarnoosh, A.; McKetta, J.J.

Pet. Ref. 1958, *37*, 275-278.

VARIABLES:

T/K: 288.7-410.9

P/kPa: 99-3409

PREPARED BY:

W. Hayduk

EXPERIMENTAL VALUES: (concluded)

Total Pressure[1] /psia	T/K	Partial Pressure[2] p_1/kPa	Mol Fraction[1] /$10^5 x_1$	T/K	Partial Pressure[2] p_1/kPa	Mcl Fraction[1] /$10^5 x_1$
250	377.6	1605	14.89	394.3	1518	15.19
300	(220°F)	1950	17.42	(250°F)	1863	17.94
350		2295	19.73		2207	20.58
400		2639	21.92		2552	22.90
450		2984	23.96		2897	24.38
500		3329	26.04		3242	28.72
	410.9	(339.2)[3]				
60	(280°F)	74.46	1.19			
80		212.4	2.98			
100		350.3	4.51			
150		695.0	8.01			
200		1040	11.84			
250		1384	15.37			
300		1729	18.59			
350		2074	21.42			
400		2419	24.67			
450		2763	27.42			
500		3108	31.22			

[1] Original smoothed values.

[2] Calculated by compiler based on vapor pressure data given by authors.

[3] Vapor pressures as given by authors but converted to kPa.

[4] Incidence of two liquid phases.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Propane; C_3H_8; [74-98-6] (2) Water; H_2O; [7732-18-5]	Wehe, A.H.; McKetta, J.J. *Anal. Chem.* 1961, *33*, 291-293.
VARIABLES:	**PREPARED BY:**
T/K: 344.3 (160°F) P/kPa: 514.3-1247	W. Hayduk

EXPERIMENTAL VALUES:

Gas Partial Pressure, P /psia[1]	Gas Partial Pressure, P /kPa[2]	Mol Fraction[1] 10^5x_1
74.6	514.3	5.49
112.2	773.6	8.06
120.3	829.4	8.20
128.8	888.0	8.69
136.7	942.5	9.69
148.9	1027	10.1
165.0	1138	11.1
180.9	1247	12.3

[1] Original data.

[2] Calculated by compiler.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Water and propane were equilibrated in a cell at high pressure and constant temperature. A sample of the saturated aqueous solution was passed into a low pressure Orsat gas buret for gas release under controled conditions of temperature and pressure. At the low pressure used in the gas buret (usually < 200 mm mercury), Henry's law, and the ideal gas law, were assumed to describe the gas solubility, and volumetric properties, respectively. From a material balance and pressure-volume relationship, as well as the vapor pressure and volume of water in the gas buret, the hydrocarbon content of the original aqueous sample was calculated.

SOURCE AND PURITY OF MATERIALS:

1. Source and purity not given.
2. Treatment not specified.

ESTIMATED ERROR:

$\delta P/P = 0.01$ (compiler)

$\delta x_1/x_1 = 0.05$ (authors)

REFERENCES:

COMPONENTS:

(1) Propane; C_3H_8; [74-98-6]

(2) Water; H_2O; [7732-18-5]

ORIGINAL MEASUREMENTS:

Kobayashi, R.; Katz, D.L.

Ind. Eng. Chem. 1953, *45*, 440-446.

VARIABLES:

T/K: 310.9-422.0

P/kPa: 490-3332

PREPARED BY:

W. Hayduk

EXPERIMENTAL VALUES:

t^1/°F	T/K	Total Pressure[1] /psia	Partial Pressure[2] P_1/kPa	Mol Fraction[1] $/10^5x_1$
100	310.9	72	490	8.63
		117	800	15.52
133	329.3	188	1280	14.99
170	349.8	181	1207	11.46
		307	2075	17.63
190	360.9	131	839	7.96
		224	1480	13.30
		359	2411	19.60
205.7	369.7	230	1497	12.61
		400	2669	21.62
		478	3207	24.49
230	383.2	222	1387	13.01
		504	3332	26.33
260	399.8	170	928	10.01
		332	2045	19.64
		511	3279	28.92
300	422.0	265	1365	16.66
		471	2785	30.31

[1] Original data, excluding that involving a second liquid (propane) phase.

[2] Calculated by compiler.
Equilibrium data for three-phase systems also given in source.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

A high pressure cell containing propane and water was mechanically agitated for at least two hours to established equilibrium. Mercury was injected into the cell while the samples were taken. The analysis train consisted of a low pressure adsorption system for water vapor using magnesium perchlorate drying agent. The increase in gas pressure in a calibrated bottle was used to determine the amount of gas disolved. Real gas corrections were applied in determining the number of moles of propane.

Data were also given for the pressure at which a propane-rich liquid phase had just formed, defining the limit of the three-phase system.

See next page.

SOURCE AND PURITY OF MATERIALS:

1. Phillips Petroleum Co. Specified as 99 mol per cent minimum purity.
2. Distilled and degassed.

ESTIMATED ERROR:

T/K = 0.3

$\delta P/P$ = 0.01

$\delta x_1/x_1$ = 0.03 (compiler)

REFERENCES:

COMPONENTS:

(1) Propane; C_3H_8; [74-98-6]

(2) Water; H_2O; [7732-18-5]

ORIGINAL MEASUREMENTS:

Kobayashi, R.; Katz, D. L.

Ind. Eng. Chem.

1953, *45*, 440-446.

VARIABLES:

T/K: 278.9-369.5

P_1/MPa: 0.566-4.269

PREPARED BY:

W. Hayduk; C.L. Young

EXPERIMENTAL VALUES:

T/°F	T/K	Total Pressure P/psi	Partial Pressure p_1/MPa	Mole fraction of propane in liquid, $x_{C_3H_8}$
42.3	278.87	82.2	0.566	0.000366
53.9	285.32	101	0.695	0.0002913
78.1	298.76	142	0.976	0.0002208
79.1	299.31	143	0.979	0.0002208
100.2	311.04	191	1.310	0.0002045
100.6	311.26	191	1.310	0.0002001
132.9	329.21	284	1.941	0.0002046
137.7	331.87	300	2.050	0.0002003
154.2	341.04	366	2.495	0.0002063
160.3	344.42	391	2.663	0.0002107
172.2	351.04	446	3.032	0.0002298
179.7	355.21	482	3.272	0.0002360
189.6	360.71	538	3.645	0.0002495
191.1	361.54	543	3.678	0.0002489
201.7	367.43	608	4.109	0.0002638
205.4	369.48	632	4.269	0.0002726

Solubility given at pressure at which propane-rich liquid phase just forms, defining limit of three-phase region.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

High pressure cell with glass windows fitted with stirrer. System exhibits liquid-liquid-vapor equilibrium and cell fitted with sampling ports for the three phases. Liquid phase composition analysed by absorbing water on magnesium perchlorate and estimating gas volumetrically. Data on other phases in source.

SOURCE AND PURITY OF MATERIALS:

1. Phillips Petroleum sample, purity 99 mole per cent or better.
2. Distilled and degassed.

ESTIMATED ERROR:

δT/K = ±0.15; δP/MPa = ±0.01 (up to 1.0 MPa); ±0.05 (above 1.0 MPa); $\delta x_{C_3H_8}$ = $\pm 10^{-6}$ (estimated by compilers).

REFERENCES:

COMPONENTS:	EVALUATOR:
(1) Butane; C_4H_{10}; [106-97-8] (2) Water; H_2O; [7732-18-5], at high pressure	Colin L. Young, Department of Physical Chemistry, University of Melbourne, Parkville, Vic. 3052, Australia. December 1983

CRITICAL EVALUATION:

There are four studies of this system at high temperatures and pressures. The data of Tsiklis and Maslennikova (1) are rejected since they are restricted to the critical region and are in serious disagreement with the data of Danniel *et al.* (2). Furthermore they appear to be anomalous when the data for alkane + water systems are considered. Therefore the data of Tsiklis and Maslennikova (1) are rejected. The limited data of Danniel *et al.* (2) are classified as tentative on the basis that they appear consistent with data in the critical region of other workers for alkane + water mixtures.

There are significant discrepancies between the data of Reamer *et al.* (3) and Le Breton and McKetta (4). The latter data are probably the more reliable and are classified as tentative. The temperature range studied in references (1) and (2) does not overlap with the range studied in references (3) and (4).

References

1. Tsiklis, D. S.; Maslennikova, V. Ya.
Dokl. Akad. Nauk. S.S.S.R. 1964, *157*, 426.

2. Danniel, A.; Tödheide, K.; Franck, E. U.
Chem.-Ing.-Tech. 1967, *39*, 816.

3. Reamer, H. H.; Sage, B. H.; Lacey, W. N.
Ind. Eng. Chem. 1952, *44*, 609.

4. Le Breton, J. C.; McKetta, J. J.
Hydroc. Proc. Pet. Ref. 1964, *43* (6), 136.

COMPONENTS:

(1) Butane; C_4H_{10}; [106-97-8]

(2) Water; H_2O; [7732-18-5]

ORIGINAL MEASUREMENTS:

Le Breton, J.G.; McKetta, J.J.

Hydroc. Proc. Pet. Ref. 1964, *43*, 136-138.

VARIABLES:

T/K: 310.9-410.9

P/kPa: 129.3-3044

PREPARED BY:

W. Hayduk

EXPERIMENTAL VALUES:

t^1/°F	T^2/K	Total Pressure[1] /psia	Partial Pressure[2] P/kPa	Mol Fraction[1] /10^5x_1
100	310.9	19.7	129.3	1.73
		23.7	156.9	1.92
		29.7	198.2	2.78
		34.7	232.7	2.92
		41.2	277.5	3.76
		52.2	353.4	(4.61)[3]
160	344.3	38.7	234.1	1.60
		44.7	275.5	1.89
		47.7	296.2	2.00
		58.7	372.0	2.58
		73.7	475.5	3.21
		85.7	558.2	3.86
		96.7	634.0	4.23
		108.7	716.8	4.93
		125.2	830.5	(5.49)[3]

continued...

[1] Original data.

[2] Calculated by compiler using vapor pressure data given by authors.

[3] Average of several determinations made at pressure of appearance of second liquid phase.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Water and butane were equilibrated in a cell at high pressure and constant temperature. A sample of the aqueous solution was passed into a low pressure Orsat gas buret for gas release under controlled conditions of temperature and pressure. At the pressure used (usually < 200 mm mercury) Henry's law, and the ideal gas law were assumed to describe the solubility, and gas volumetric properties, respectively. From a material balance as well as the vapor pressure and volume of water in the gas buret, the butane content of the original aqueous sample was calculated. Details in (1,2).

Data also reported for the three-phase system.

SOURCE AND PURITY OF MATERIALS:

1. Phillips Petroleum Co. Certified purity of 99.9 mol per cent.
2. Distilled and deaerated.

ESTIMATED ERROR:

$\delta P/P$ = 0.01 (compiler)

$\delta x_1/x_1$ = 0.05 (authors)

REFERENCES:

1. Azarnoosh, A.; McKetta, J.J. *Pet. Ref.* 1958, *37*, 275.
2. Wehe, A.H.; McKetta, J.J. *Anal. Chem.* 1961, *33*, 291.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Butane; C_4H_{10}; [106-97-8] (2) Water; H_2O; [7732-18-5]	Le Breton, J.G.; McKetta, J.J. *Hydroc. Proc. Pet. Ref.* 1964, *43*, 136-138.
VARIABLES: T/K: 310.9-410.9 P/kPa: 129.3-3044	PREPARED BY: W. Hayduk

EXPERIMENTAL VALUES:

t^1/°F	T^2/K	Total Pressure^1 /psia	Partial Pressure^2 P/kPa	Mol Fraction^1 $/10^5x_1$
220	377.6	68.7	355.1	2.24
		82.7	451.7	2.81
		102.7	589.6	3.84
		119.7	706.8	4.49
		126.7	755.0	4.84
		140.7	851.6	5.39
		147.7	899.8	6.32
		180.7	1127	7.24
		212.7	1348	8.02
		227.7	1451	8.26
		259.7	1672	(8.76)^3
280	410.9	89.7	279.2	2.19
		129.7	550.0	4.23
		164.7	796.3	6.29
		194.7	1003	7.64
		226.7	1224	9.17
		264.7	1486	11.01
		299.7	1727	12.26
		329.7	1934	13.31
		360.7	2148	14.40
		401.7	2430	15.70
		430.7	2630	16.415
		450.7	2768	16.86
		490.7	3044	(17.71)^3

continued...

[1] Original data.

[2] Calculated by compiler using vapor pressures of water given by authors.

[3] Average of two or more determinations made at the pressure of the appearance of the second liquid phase.

Data were also reported for the system involving two liquid (butane-rich, water-rich) phases.

COMPONENTS:

(1) Butane; C_4H_{10}; [106-97-8]

(2) Water; H_2O; [7732-18-5]

ORIGINAL MEASUREMENTS:

Le Breton, J.G.; McKetta, J.J.

Hydroc. Proc. Pet. Ref. 1964, *43*, 136-138.

VARIABLES:

T/K: 310.9-410.9

P/kPa: 129.3-3044

PREPARED BY:

W. Hayduk

EXPERIMENTAL VALUES: (concluded)

Smoothed values were presented by authors as follows:

Total Pressure[1] /psia	T/K	Partial Pressure[2] P_1/kPa	Mol Fraction[1] $/10^5 x_1$
(0.9492)[3]	310.9		
20	(100°F)	131.3	1.75
40		269.2	3.45
52.2		353.4	(4.40)[4]
(4.741)[3]	344.3		
20	(160°F)	105.2	0.75
40		243.1	1.60
60		381.9	2.55
80		518.9	3.45
100		656.8	4.40
125.2		830.5	(5.50)[4]
(17.186)[3]	377.6		
20	(220°F)	19.4	0.15
40		157.3	1.00
60		295.2	1.85
80		433.1	2.75
100		571.0	3.60
200		1260	7.65
259		1672	(9.10)[4]
(49.203)[3]	410.9		
80	(280°F)	212.3	1.60
100		350.2	2.70
200		1040	9.70
300		1729	12.25
400		2419	15.65
490.7		3044	(17.80)[4]

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[1] Original smoothed values.

[2] Calculated by compiler using authors' vapor pressure for water.

[3] Authors' vapor pressure for water.

[4] Incidence of two liquid phases.

COMPONENTS:

(1) Butane; C_4H_{10}; [106-97-8]

(2) Water; H_2O; [7732-18-5]

ORIGINAL MEASUREMENTS:

Danneil, A.; Todheide, K., and Franck, E.U.

Chem. Ing-Tech. 1967, *13*, 816-821.

VARIABLES:

T/K: 628.15, 637.15

P/*M*Pa: 25.5-112.5

PREPARED BY:

W. Hayduk

EXPERIMENTAL VALUES:

t^1/°C	*T*/K	Pressure[1] *P*/bar	Pressure[2] *P*/MPa	Mol Fraction Butane:[1] in liquid/x_1	in vapour/y_1
355	628.15	255	25.5	0.025	0.124
		295	29.5	0.048	0.105
		510	51.0	0.055	-
		520	52.0	-	0.188
		590	59.0	0.043	0.287
		725	72.5	0.036	-
		735	73.5	-	0.356
364	637.15	690	69.0	0.077	0.256
		830	83.0	0.041	0.318
		1090	109.0	-	0.417
		1125	112.5	0.041	-

[1] Original data.

[2] Total pressure calculated by compiler.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Static bomb with magnetically operated stirrer. Pressure measured with Bourdon gauge. Temperature measured with NiCr-Ni thermocouple. Samples of vapour and liquid analysed by stripping out hydrocarbon with carbon dioxide and estimating volumetrically. Water estimated gravimetrically.

SOURCE AND PURITY OF MATERIALS:

1. Purity specified as 95.5 mol per cent.
2. Triply distilled.

ESTIMATED ERROR:

δT/K = 0.7; δP/bar = ±1%

δx_1 = 0.005; δy_1 = 0.012 (authors)

REFERENCES:

COMPONENTS:

(1) Butane; C_4H_{10}; [106-97-8]

(2) Water; H_2O; [7732-18-5]

ORIGINAL MEASUREMENTS:

Reamer, H. H.; Sage, B. H.;
Lacey, W. N.
Ind. Eng. Chem.
1952, *44*, 609-615.

VARIABLES:

T/K: 310.9-410.9
P/MPa: 0.355-3.735

PREPARED BY:

W. Hayduk; C.L. Young

EXPERIMENTAL VALUES:

T/K	T/°F	Total Pressure p/psi	Gas Partial Pressure P/MPa	Mole fractions		
				$10^5 x_{C_4H_{10}}$ [a]	$x'_{C_4H_{10}}$ [b]	$y_{C_4H_{10}}$
310.9	100	52.45	0.355	6.2	0.9995	0.9833
344.3	160	125.4	0.832	8.7	0.9979	0.9662
377.6	220	259.3	1.669	14.0	0.9915	0.9459
410.9	280	590.9	3.735	22.0	0.9732	0.9292

[a] Mole fraction in water-rich liquid layer.

[b] Mole fraction in hydrocarbon-rich liquid layer.

These data are at the limit of the three-phase region; at slightly lower pressures there are only two phases, gas and water.

Mole fraction of water rather than those of butane were given in the original.

Total pressure given in psia; gas partial pressure calculated in MPa by compilers.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Static equilibrium cell. Pressure measured with pressure balance and temperature measured with platinum resistance thermometer. Mixture confined to cell, the volume of which could be varied by mercury injection or withdrawal. Equilibrium established and samples withdrawn at constant pressure. Water content of sample determined by absorption in calcium chloride. Butane estimated volumetrically. Additional three-phase data in source and ref. (1) but no additional gas solubility data.

SOURCE AND PURITY OF MATERIALS:

No details given.

ESTIMATED ERROR:

δT/K = ±0.05; δP/MPa = ±0.007; $\delta x_{C_4H_{10}}$ = ±5%, $\delta x'_{C_4H_{10}}$, $\delta y_{C_4H_{10}}$ = ±1% (estimated by compilers).

REFERENCES:

1. Reamer, H. H.; Olds, R. H.; Sage, B. H.; Lacey, W. N. *Ind. Eng. Chem.* 1944, *36*, 381.

COMPONENTS:

(1) Propane; C_3H_8; [74-98-6]
and
(1) n-Butane; C_4H_{10}; [106-97-8]

(2) Water-d_2; D_2O; [7789-20-0]

EVALUATOR:

Rubin Battino
Department of Chemistry
Wright State University
Dayton, Ohio 45435 U.S.A.

November, 1983

CRITICAL EVALUATION:

The propane/D_2O and n-butane/D_2O systems were both studied by Kresheck et al. (1) and the n-butane/D_2O system was also studied by Ben-Naim et al. (2). The propane/D_2O data were smoothed to give:

$$\ln x_1 = -117.403 + 167.481/\mathrm{T} + 46.4577 \ln \mathrm{T} \quad \text{where } \mathrm{T} = T/100\ \mathrm{K} \qquad (1)$$

The standard deviation in ln x_1 was 0.0029 or about 0.3% in x_1. In smoothing the n-butane/D_2O data the two highest points from reference (2) were rejected. The resulting smoothing equation is:

$$\ln x_1 = -134.697 + 193.517/\mathrm{T} + 54.1240 \ln \mathrm{T} \quad \text{where } \mathrm{T} = T/100\ \mathrm{K}. \qquad (2)$$

The standard deviation was 0.014 in ln x_1 or about 1.4% in x_1. Smoothed data at 5 K intervals are given in the table below. The mole fractions are at 0.101325 MPa partial pressure of gas. The thermodynamic functions are for the transfer of the gas from the vapor phase at 0.101325 MPa partial pressure of gas to the (hypothetical) solution of unit mole fraction. The value of $\Delta\bar{C}_{p_1}^{\circ}$ was constant at 386 J mol^{-1} K^{-1} for propane /D_2O and 450 J mol^{-1} K^{-1} for n-butane/D_2O. If required, values of $\Delta\bar{G}_1^{\circ} = -RT \ln x_1$ can be calculated from the smoothed mole fractions.

T/K	Propane $10^5 x_1$	n-Butane $10^5 x_1$	Propane $\Delta\bar{H}_1^{\circ}$/ kJ mol^{-1}	n-Butane $\Delta\bar{H}_1^{\circ}$/ kJ mol^{-1}	Propane $\Delta\bar{S}_1^{\circ}$/ J mol^{-1} K^{-1}	n-Butane $\Delta\bar{S}_1^{\circ}$/ J mol^{-1} K^{-1}
273.15	8.229	7.579	-33.74	-37.98	-201.7	-217.7
278.15	6.348	5.796	-31.81	-35.73	-194.7	-209.6
283.15	5.016	4.450	-29.88	-33.48	-187.8	-201.5
288.15	4.053	3.506	-27.95	-31.23	-181.1	-193.7
293.15	3.345	2.829	-26.02	-28.98	-174.4	-185.9
298.15	2.815	2.336	-24.08	-26.73	-167.9	-178.3
303.15	2.414	1.970	-22.15	-24.48	-161.5	-170.8
308.15	2.106	1.695	-20.22	-22.23	-155.2	-163.5
313.15	1.868	1.486	-18.29	-19.98	-148.9	-156.2
318.15	1.682	1.326	-16.36	-17.73	-142.8	-149.1
323.15	1.537	1.203	-14.43	-15.48	-136.8	-142.1
328.15	–	1.109	–	-13.23	–	-135.2

References

1. Kresheck, G.C.; Schneider, H.; Scheraga, H.A., *J. Phys. Chem.*, 1965, *69*, 3132-44.

2. Ben-Naim, A.; Wilf, J.; Yaacobi, M., *J. Phys. Chem.*, 1973, *77*, 95-102.

COMPONENTS:

(1) Propane; C_3H_8; [74-98-6]

(2) Water-d2; D_2O; [7789-20-0]

ORIGINAL MEASUREMENTS:

Kresheck, G. C.; Schneider, H.
Scheraga, H. A.

J. Phys. Chem. 1965, *69*, 3132-44.

VARIABLES:

$T/K = 277.15 - 323.15$
$p_1/kPa = 101.325$

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

Temperature $t/^0C$	T/K	Mol Fraction[a] 10^5x_1	Molarity $10^3c_1/mol\ dm^{-3}$	Molality $10^3m_1/mol\ kg^{-1}$
4	277.15	6.610, 6.744		
	277.15[b]	6.68 ± 0.07	3.68 ± 0.03	3.33 ± 0.03
10	283.15	5.021		
15	288.15	4.053, 4.064		
20	293.15	3.333		
25	298.15	2.819, 2.834		
	298.15[b]	2.83 ± 0.01	1.56 ± 0.01	1.41 ± 0.01
30	303.15	2.409		
35	308.15	2.096, 2.109		
40	313.15	1.871		
45	318.15	1.685, 1.691		
50	323.15	1.530, 1.537		
	323.15[b]	1.54 ± 0.01	0.84 ± 0.00	0.76 ± 0.00

[a] The experimental values of the mole fraction solubility were provided by H. Schneider. The last digit in each figure is not significant.

[b] Smoothed values from the original paper.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

A known quantity of the gas was introduced from a gas buret into a calibrated volume which contained a weighed quantity of water. The water was stirred until equilibrium was attained (3 to 4 hours). The amount of gas in the vapor phase at equilibrium was determined from the partial pressure of the propane and volume of the vapor space. The volume was the difference in the empty vessel volume and the water volume. The amount of dissolved gas was obtained by difference.

The D_2O density values used were based on literature data (1). The gas volume was corrected for non-ideal behavior by use of a compressibility factor (2). At each temperature the solubility was usually measured at two partial pressures which ranged from 0.5 to 0.7 atm at 4 °C and 1.2 to 1.6 atm at 50 °C. All solubility data were normalized to a partial pressure of 1 atm.

SOURCE AND PURITY OF MATERIALS:

(1) Propane. Matheson Co., Inc. 99.92 mole per cent.

(2) Water-d2. US Atomic Energy Commission. 99.7 mol per cent D_2O.

ESTIMATED ERROR:

$\delta x_1/x_1 = \pm 0.005$

REFERENCES:

1. Steckel, F.; Szapiro, S. *Trans. Faraday Soc.* 1963, *59*, 331.

2. Silberberg, I. H.; Kuo, P. K.; McKetta, J. J. *Petrol. Engr.* 1954, *24*, C9.

COMPONENTS:

(1) Butane; C_4H_{10}; [106-97-8]

(2) Deuterium oxide (heavy water); D_2O; [7789-20-0]

ORIGINAL MEASUREMENTS:

Ben-Naim, A.; Wilf, J.;

Yaacobi, M.

J. Phys. Chem. 1973, *77*, 95-102.

VARIABLES:

T/K: 278.15-298.15

P/kPa: 101.325

PREPARED BY:

W. Hayduk

EXPERIMENTAL VALUES:

t^1/°C	T^2/K	Ostwald Coefficient^1 L/cm^{3}cm^{-3}	Bunsen Coefficient^2 α/cm^3(STP)cm^{-3}	Mole Fraction^2 /10^5x_1
5	278.15	0.0689	0.0675	5.70
10	283.15	0.0539	0.0517	4.36
15	288.15	0.0430	0.0404	3.41
20	293.15	0.0350	0.0323	2.73
25	298.15	0.0289	0.0262	2.21

[1] Original data.

[2] Calculated by compiler using real gas molar volumes.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The method of Ben-Naim and Baer (1) was modified to include the use of Teflon stopcocks. Degassed liquid initially in a volumetric container was forced by a stirrer-created vortex up side-arms and through tubes containing the gas, which was saturated with vapor.

The gas uptake at constant pressure was determined by means of a buret.

SOURCE AND PURITY OF MATERIALS:

1. Matheson Co. Minimum specified 99.95%.
2. Darmstadt Co. Minimum sepcified purity 99.95%.

ESTIMATED ERROR:

$\delta L/L$ = 0.01 (compiler)

REFERENCES:

1. Ben-Naim, A.; Baer, S.
Trans. Faraday Soc. 1963, *59*, 2735-2741.

COMPONENTS:

(1) Butane; C_4H_{10}; [106-97-8]

(2) Water-d_2; D_2O; [7789-20-0]

ORIGINAL MEASUREMENTS:

Kresheck, G. C.; Schneider, H.; Scheraga, H. A.

J. Phys. Chem. 1965, *69*, 3132-44.

VARIABLES:

T/K = 277.15 - 328.15
p_1/kPa = 101.325

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

Temperature		Mol Fraction[a]	Molarity	Molality
$t/^\circ$C	T/K	10^5x_1	10^3c_1/mol dm^{-3}	10^3m_1/mol kg^{-1}
4	277.15	6.267, 6.236, 6.196		
	277.15[b]	6.25 ± 0.03	3.44 ± 0.02	3.12 ± 0.02
7	280.15	5.280		
10	283.15	4.528, 4.497		
15	288.15	3.531, 3.490, 3.544		
20	293.15	2.815		
25	298.15	2.359, 2.318, 2.362		
	298.15[b]	2.35 ± 0.02	1.29 ± 0.01	1.17 ± 0.01
30	303.15	1.984, 1.980		
35	308.15	1.708, 1.683		
40	313.15	1.495, 1.506		
45	318.15	1.322, 1.322		
50	323.15	1.204, 1.211		
	323.15[b]	1.21 ± 0.01	0.66 ± 0.01	0.63 ± 0.01
55	328.15	1.099		

[a] The experimental values of the mole fraction solubility were provided by H. Schneider. The last digit in each number is not significant.

[b] Smoothed values from the original paper.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

A known quantity of the gas was introduced from a gas buret into a calibrated volume which contained a weighed quantity of water. The water was stirred until equilibrium was attained (3 to 4 hours). The amount of gas in the vapor phase at equilibrium was determined from the partial pressure of the butane and the volume of the vapor space. The volume was the difference in the empty vessel volume and the water volume. The amount of dissolved gas was obtained by difference.

The D_2O density values used were based on literature data (1). The gas volume was corrected for non-ideal behavior by use of a compressibility factor (2). At each temperature the solubility was measured at one to three partial pressures which ranged from 0.5 to 0.7 atm at 4 °C and 1.2 to 1.6 atm at 50 °C. All solubility values were normalized to a butane partial pressure of one atm.

SOURCE AND PURITY OF MATERIALS:

(1) Butane. Matheson Co., Inc. 99.94 mol per cent.

(2) Water-d_2. US Atomic Energy Commission. 99.7 mol per cent D_2O.

ESTIMATED ERROR:

$\delta x_1/x_1 = \pm 0.005$

REFERENCES:

1. Steckel, F.; Szapiro, S. *Trans. Faraday Soc.* 1963, *59*, 331.
2. Silberberg, I. H.; Kuo, P. K.; McKetta, J. J. *Petrol. Engr.* 1954, *24*, 9C.

COMPONENTS:	EVALUATOR:
(1) Propane; C_3H_8; [74-98-6] Butane; C_4H_{10}; [106-97-8] 2-Methylpropane; C_4H_{10}; [75-28-5] (2) Electrolyte (3) Water; H_2O; [7732-18-5]	H. Lawrence Clever Chemistry Department Emory University Atlanta, GA 30322 USA 1984, January

CRITICAL EVALUATION:

An Evaluation of the Solubility of Propane, Butane, and 2-Methylpropane in Aqueous Electrolyte Solutions

This section contains an evaluation of the solubility of propane, butane, and 2-methylpropane in aqueous solutions of electrolytes including synthetic sea salt and several micelle forming electrolytes. One solution of a nonelectrolyte, urea, is included. Solubility data are reported by more than one laboratory for only two propane (aqueous NaCl and urea) and two butane (aqueous NaCl and $(C_2H_5)_4NBr$) containing systems. There are not enough data available from independent sources on the solubility of the gases in any one electrolyte system over common ranges of electrolyte concentration and temperature to recommend solubility values. For many of the systems, the data are meager and sometimes of poor quality. Most of the available data are classed as tentative.

For most of the systems the solubility data have been converted to a form of the Sechenov (Setchenow) salt effect parameter at a gas partial pressure of 101.325 kPa in order to have a common basis of comparing the systems. Most of the available solubility data on these gases can be put in the form of the Sechenov constant as

$$k_{smm}/\text{kg mol}^{-1} = (1/(m_2/\text{mol kg}^{-1}))\log((m_1{}^{\circ}{,}sat/\text{mol kg}^{-1})/(m_1{,}sat/\text{mol kg}^{-1}))$$

where m_2 represents the electrolyte molality and $m_1{}^{\circ}{}_{,sat}$ and $m_{1,sat}$ represent the molal gas solubility in pure water and electrolyte solution, respectively.

Other forms of the Sechenov salt effect parameter will be used as well. They include

$$k_{scc}/\text{dm}^3\text{mol}^{-1} = (1/(c_2/\text{mol dm}^{-3}))\log(c^{\circ}_{1,sat}/c_{1,sat})$$

$$k_{smx}/\text{kg mol}^{-1} = (1/(m_2/\text{mol kg}^{-1}))\log(x^{\circ}_{1,sat}/x_{1,sat})$$

A complete discussion of the conversions among these and other forms of the salt effect parameter can be found in volume 10 of the *Solubility Data Series* (12a,b).

There are other modifications of the salt effect parameter in use. The use of a natural logarithm instead of the base ten logarithm is becoming popular. The use of electrolyte ionic strength instead of a molal or molar concentration allows a direct comparison of the salt effect among electrolytes of different charge type (1-1, 1-2, etc). Both of these modifications have their advantages, but we have not chosen to use them here.

The systems evaluated are given in the order of the standard arrangement for inorganic compounds used by the U. S. National Bureau of Standards publications. The number is the standard order number for the electrolyte cation.

The general policy in evaluating salt effects on gas solubility has been to convert all salt effect data into Sechenov salt effect parameters of the form of k_{scc}/dm^3 mol^{-1} or k_{smm}/kg mol^{-1} for purposes of comparison. Most of the data on the propane, butane, and 2-methylpropane gases is already in the k_{smm} form. Thus that is the form used in this evaluation for most of the systems. When available, the author's solubility value in pure water is used in the $m_1°/m_1$ ratio in the belief that some of the author's systematic errors may cancel in the ratio. In general one can place more confidence in the salt effect parameter determined at electrolyte concentrations of one molal or more than values determined in dilute electrolyte solutions where small error in solubility may result in large errors in the salt effect parameter.

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

Butane + Hydrochloric acid [7647-01-0] + Water

Yano, Suetaka, Umehara, and Horiuchi (8) report the solubility of propane at HCl concentrations of 0, 0.250, 0.500, and 1.000 mol dm^{-3} at 298.2 K. Morrison and Billett (1) report salt effect parameters at four temperatures based on the molal solubility of butane in water and one molal HCl solution.

The salt effect parameters are given below.

T/K	Gas	HCl m_2 or c_2	k_{scc}/dm^{3}mol^{-1}	k_{smm}/kg mol^{-1}	k_{smx}/kg mol^{-1}	Ref.
285.75	Butane	1(m_2)		0.080	0.095	1
298.2	Propane	0.25(c_2)	0.164			8
		0.50(c_2)	0.123			
		1 (c_2)	0.125	0.114	0.129	
303.15	Butane	1(m_2)		0.049	0.064	1
322.55	Butane	1(m_2)		0.031	0.046	1
344.85	Butane	1(m_2)		0.028	0.043	1

The propane salt effect parameter in 0.25 *M* HCl is doubtful, and implies the solubility value is in error by being too small. The other values are classed as tentative, but it is worth noting that the salt effect parameters for the propane system are larger than normally observed for other gases in hydrochloric acid solution.

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

Butane + Sulfuric acid [7664-93-9] + Water

2-methylpropane + Sulfuric acid [7664-93-9] + Water

Rudakov and Lutsyk (11) report solubility data on these systems at 298.15 and 363.15 K in solutions up to 98.3 weight percent acid. Rudakov has provided some supplementary data not in the original publication. The evaluator has calculated k_{smc}/kg mol^{-1} and k_{smx}/kg mol^{-1} salt effect parameter values from the solubility values on the data sheets. The k_{smm} value can be approximated by subtracting 0.015 from the k_{smx} values. Unfortunately no value is given for the solubility of propane in water at 363 K so no salt effect parameters were calculated for the propane system at that temperature. The results follow the trend noted for other gases in aqueous sulfuric acid of salting-out at small acid concentration and

COMPONENTS:	EVALUATOR:
(1) Propane; C_3H_8; [74-98-6] Butane; C_4H_{10}; [106-97-8] 2-Methylpropane; C_4H_{10}; [75-28-5] (2) Electrolyte (3) Water; H_2O; [7732-18-5]	H. Lawrence Clever Chemistry Department Emory University Atlanta, GA 30322 USA 1984, January

CRITICAL EVALUATION:

salting in at large acid concentrations. It would be desirable to have additional data at small and intermediate acid concentrations. The values are classed as tentative. Salt effect parameters are not normally calculated for solutions as concentrated as these, but the results do indicate a similar behavior for the three gases in sulfuric acid solution.

T/K	H_2SO_4	Propane		Butane		2-Methylpropane	
	m_2/mol kg^{-1}	k_{smc}	k_{smx}	k_{smc}	k_{smx}	k_{smc}	k_{smx}
298.15	15.5	0.020	0.013	0.020	0.013	0.016	0.008
	40.8	0.011	0.006	0.008	0.002	0.007	0.002
	64.8	-	-	-	-	0.000	-0.004
	136	-0.002	-0.005	-0.003	-0.006	-0.004	-0.006
	182	-	-	-	-	-0.004	-0.006
	212	-	-	-	-	-0.003	-0.005
	590	-	-	-	-	-0.002	-0.003
363.15	91.8	-[a]	-[a]	-0.008	-0.011	No Data	
	136	-[a]	-[a]	-0.007	-0.009	at this	
	190	-[a]	-[a]			temperature	
	433	-[a]	-[a]				

[a] No solubility value in water to use in the calculation.

18 Propane + Ammonium bromide [12124-97-9] + Water

Wen and Hung (5) report the solubility of propane in aqueous ammonium bromide at five concentrations at four temperatures. Propane is salted out at all concentrations and temperatures studied. The evaluator has calculated k_{smm}/kg mol^{-1} salt effect parameters which are presented below.

NH_4Br	k_{smm}/kg mol^{-1}			
m_2/mol kg^{-1}	278.15 K	288.15 K	298.15 K	308.15 K
0.1 (authors)	0.095	0.086	0.076	0.066
0.105-0.107[a]	0.089	0.104	0.089	0.072
0.210-9.224[a]	0.071	0.087	0.067	0.053
0.407-0.428[a]	0.093	0.088	0.084	0.053
0.631-0.707[a]	0.089	0.088	0.075	0.063
0.850-0.942[a]	0.144	0.083	0.078	0.063
Av.	0.097	0.090	0.079	0.059

[a] The exact concentration at each temperature is given on the data sheets.

The authors give salt effect parameter values stated to be for 0.10*m* NH_4Br solution. They are compared with the individual values at the five concentrations and the average of the individual values. The averages parallel, but do not agree exactly with the authors values. Neither do linear regressions of the values to 0.1 *m* value agree. However, considering the uncertainty in the solubility values the k_{smm} values are all within the expected uncertainty. A similar range of values will be seen in the authors values for the gases in other electrolyte solutions.

23(1) Propane + 1-Dodecanamine hydrochloride [929-73-7] + Water

Lin and Metzer (6) measured the solubility of propane at 298.15 K in 1×10^{-8} to 1×10^{-3} mol dm^{-3} solutions of 1-dodecanamine hydrochloride. They do not report a solubility value in water but they quote water solubility values from the literature including the value of Wen and Hung (5). The solubility values show salting in at 1×10^{-8} *M*, salting out from about 1×10^{-7} to 5×10^{-5} *M* and salting in again at all larger salt concentrations. The electrolyte forms micelles, but all solubility measurements were made below the critical micelle concentration (cmc) of about 1.3×10^{-2} *M* in air. The cmc is 7.5×10^{-3} *M* when saturated with propane. Salt effect parameters are not appropriate for the system and were not calculated. The salting-in at 1×10^{-8} *M* 1-dodecanamine hydrochloride followed by a region of salting out has not been reported before. Confirmation of the observation is needed.

23(2) Propane + Guanidine hydrochloride [50-01-1] + Water

Butane + Guanidine hydrochloride [50-01-1] + Water

2-Methylpropane + Guanidine hydrochloride [50-01-1] + Water

Wetlaufer, Malik, Stoller and Coffin (4) measured the solubilities of the three gases in water and in 4.87 molar guanidine hydrochloride at temperatures of 278.2, 293.2, and 318.2 K. The salt effect parameters calculated from their data are below. The data are classed as tentative.

T/K	Guanidine Hydrochloride	k_{scc}/dm^3 mol^{-1}		
	c_2/mol dm^{-3}	Propane	Butane	2-Methylpropane
278.2	4.87	0.019	-0.001	0.0
293.2	4.87	-0.004	-0.025	-0.022
318.2	4.87	-0.013	-0.038	-0.031

23(3) Propane + Tetramethylammonium bromide [64-20-0] + Water

Butane + Tetramethylammonium bromide [64-20-0] + Water

Wen and Hung (5) report the solubility of propane in aqueous tetramethylammonium bromide at two concentrations and four temperatures and the solubility of butane at one concentration and four temperatures. The two gases are salted-in at all concentrations and temperatures studied. The salt effect parameters are summarized below.

$(CH_3)_4NBr$	k_{smm}/kg mol^{-1}			
m_2/mol kg^{-1}	278.15 K	288.15 K	298.15 K	308.15 K
Propane				
0.10 (authors)	-0.029	-0.039	-0.059	-0.091
0.165	-0.033	-0.033		-0.083
0.325-01328[a]			-0.051	-0.084
0.885			-0.051	
Butane				
0.10 (authors)	-0.049	-0.064	-0.074	-0.100
0.850	-0.056	-0.061	-0.071	-0.093

[a] The exact concentration at each temperature is given on the data sheet.

COMPONENTS:	EVALUATOR:
(1) Propane; C_3H_8; [74-98-6] Butane; C_4H_{10}; [106-97-8] 2-Methylpropane; C_4H_{10}; [75-28-5] (2) Electrolyte (3) Water; H_2O; [7732-18-5]	H. Lawrence Clever Chemistry Department Emory University Atlanta, GA 30322 USA 1984, January

CRITICAL EVALUATION:

The author's values stated to be for 0.10 *m* electrolyte were apparently smoothed in some way not explained in the paper. The values are within experimental error of the values calculated from the solubility data in the paper by the evaluator. The data are classed as tentative.

23(4) Propane + Tetraethylammonium bromide [71-91-0] + Water

Butane + Tetraethylammonium bromide [71-91-0] + Water

Wen and Hung (5) report the solubility of propane in water and at two aqueous solution concentrations of tetraethylammonium bromide at four temperatures and the solubility of butane in water and at one concentration of the electrolyte of four temperatures. Morrison and Johnstone (2) report a salt effect parameter for butane based on solubility measurements in water and one molal electrolyte at 298.15 K. Both gases salt-in under all conditions studied.

The authors' smoothed salt effect parameter values for 0.1 *m* solution and values calculated from data in their paper are given below. The Morrison and Johnstone value is in brackets, [ ].

$(C_2H_3)_4NBr$	k_{smm}/kg mol^{-1}			
m_2/mol kg^{-1}	278.15 K	288.15 K	298.15 K	308.15 K
Propane				
0.10 (authors)	-0.096	-0.125	-0.158	-0.207
0.154-0.171[a]	-0.111	-0.130	-0.115	-0.203
0.425	-0.098	-0.128	-0.132	-0.179
Butane				
0.10 (authors)	-0.149	-0.152	-0.168	-0.226
0.405	-0.142	-0.145	-0.159	-0.210
1.0			[-0.122][b]	

[a] The exact concentration at each temperature is given on the data sheet.

[b] Morrison and Johnstone (2), all other values from Wen and Hung (5).

The salt effect parameter values for butane + tetraethylammonium bromide + water from the two papers agree poorly. Both values are classed as tentative with a preference for the Wen and Hung value because their work represents a more extensive study.

23(5) Propane + Tetrapropylammonium bromide [1941-30-6] + Water

Butane + Tetrapropylammonium bromide [1941-30-6] + Water

Wen and Hung (5) report the solubility of propane in water and in up to eight concentrations of aqueous tetrapropylammonium bromide solution at four temperatures. They report the solubility of butane at only one electrolyte concentration at the four temperatures. The authors smoothed values of the salt effect parameter and the values calculated by the evaluator from the solubility data in the paper are given in the following table.

$(C_3H_8)_4NBr$	k_{smm}/mol kg^{-1}			
m_2/mol kg^{-1}	278.15 K	288.15 K	298.15 K	308.15 K
Propane				
0.10 (authors)	-0.080	-0.130	-0.187	-0.273
0.102-0.110[a]	-0.085	-0.126	-0.188	-0.279
0.210	-0.092	-0.124	-	-
0.267-0.271[a]	-0.085	-0.129	-0.160	-0.237
0.410-0.420[a]	-0.071	-0.125	-0.151	-
0.436	-0.070	-	-	-
0.457-0.465[a]	-	-0.116	-	-0.237
0.492	-0.053	-	-	-
0.609-0.784[a]	-0.033	-0.094	-0.152	-0.208
0.963	-0.023			
1.050-1.070[a]	-	-0.073	-0.126	-
Butane				
0.10 (authors)	-0.120	-0.165	-0.227	-0.307
0.405	-0.116	-0.157	-0.212	-0.281

[a] The exact concentration at each temperature is given on the data sheet.

Wen and Hung state that the salt effect parameters decrease in magnitude as the electrolyte concentration increases. This is most clearly seen in the data of the propane + tetrapropylNbromide + water system. We believe this system was used by them as a model system to extrapolate salt effect parameters to obtain the 0.10 molal values they give in the paper. The exact nature of their smoothing procedure is not given in the paper.

23(6) Propane + Tetrabutylammonium bromide [1643-19-2] + Water

Butane + Tetrabutylammonium bromide [1643-19-2] + Water

Wen and Hung (5) report the solubility of propane in water and in aqueous solutions at two concentrations of tetrabutylammonium bromide at four temperatures. They report the solubility of butane in water and at only one electrolyte solution. The salt effect parameters given by them for 0.10 *m* solution and those calculated by the compiler from solubility data in the paper are given below. All systems salt-in under the conditions studied. All values are classed as tentative.

COMPONENTS:	EVALUATOR:
(1) Propane; C_3H_8; [74-98-6] Butane; C_4H_{10}; [106-97-8] 2-Methylpropane; C_4H_{10}; [75-28-5] (2) Electrolyte (3) Water; H_2O; [7732-18-5]	H. Lawrence Clever Chemistry Department Emory University Atlanta, GA 30322 USA 1984, January

CRITICAL EVALUATION:

$(C_4H_9)_4NBr$	k_{smm}/mol kg^{-1}			
m_2/mol kg^{-1}	278.15 K	288.15 K	298.15 K	308.15 K
Propane				
0.10 (authors)	-0.066	-0.146	-0.248	-0.386
0.165-0.193[a]	-0.082	-0.150	-	-0.360
0.300-0.310[a]	-0.064	-0.139	-0.203	-0.336
0.624	-	-	-0.203	-
Butane				
0.10 (authors)	-0.104	-0.180	-0.286	-0.435
0.310	-0.101	-0.173	-0.269	-0.395

[a] The exact concentration at each temperature is given on the data sheet.

25(7) Propane + Tetraethanol amine bromide [4328-04-5] + Water

Wen and Hung (5) report the solubility of propane in water and in aqueous solutions of tetraethanolammonium bromide at one or two concentrations at four temperatures.

The salt effect parameters for the system are given below. The authors smoothed values for use with 0.10 *m* solutions are included. The gas is slightly salted-in. The values are classed as tentative.

$(C_2H_4OH)_4NBr$	k_{smm}/mol kg^{-1}			
m_2/mol kg^{-1}	278.15 K	288.15 K	298.15 K	308.15 K
0.10 (authors)	0.0	-0.025	-0.061	-0.113
0.153-0.160[a]	-0.014	-0.023	-0.028	-0.101
0.508	-	-	-0.042	-

[a] The exact concentration at each temperature is given on the data sheet.

76 Butane + Lanthanam chloride [10099-58-8] + Water

Morrison and Billett (1) report the solubility of butane in water and a salt effect parameter value based on an unreported solubility measurement in a one equivalent per kg electrolyte solution. Lanthanum chloride salts out. The salt effect parameters on a molal basis are given below. They are classed as tentative.

T/K	k_{smm}/kg mol^{-1}[a]	k_{smx}/kg mol^{-1}
285.75	0.546	0.576
303.15	0.462	0.492
322.55	0.462	0.492
344.85	0.420	0.450

[a] These are the values from the paper multiplied by 3 to convert from kg eq^{-1} to kg mol^{-1}.

96 Butane + Barium chloride [10361-37-2] + Water

Morrison and Billett (1) report the solubility of butane in water and a salt effect parameter value based on an unreported solubility measurement in a one equivalent per kg electrolyte solution. Barium chloride salts out. The salt effect parameter on a molal basis at four temperatures is given below. The values are classed as tentative.

T/K	k_{smm}/kg mol^{-1}[a]	k_{smx}/kg mol^{-1}
285.75	0.500	0.523
303.15	0.420	0.443
322.55	0.360	0.383
344.85	0.330	0.353

[a] These are values from the paper multiplied by 2 to convert from kg eq^{-1} to kg mol^{-1}.

98 Propane + Lithium chloride [7447-41-8] + Water

Butane + Lithium chloride [7447-41-8] + Water

Morrison and Billett (1) report the solubility of the gases in water and a salt effect parameter based on an unreported solubility measurement in the one molal electrolyte solution. The gases are salted out. The salt effect parameters at four temperatures are given below. The values a are classed as tentative.

T/K	Propane		Butane	
	k_{smm}/mol kg^{-1}	k_{smx}/mol kg^{-1}	k_{smm}/mol kg^{-1}	k_{smx}/mol kg^{-1}
285.75	0.175	0.190	0.198	0.213
303.15	0.152	0.167	0.171	0.186
322.55	0.138	0.153	0.155	0.170
344.85	0.138	0.153	0.150	0.165

99(1) Propane + Sodium chloride [7647-14-5] + Water

Butane + Sodium chloride [7647-14-5] + Water

The solubility of propane in aqueous sodium chloride solutions was measured by Morrison and Billett (1), Umano and Nakano (3), and Yano, Suetaka, Umehara and Horiuchi (8). The Morrison and Billett measurements were made in water and one molal solution at four temperatures between 285.75 and 344.85 K. The measurements of Umano and Nakano were made as a

COMPONENTS:

(1) Propane; C_3H_8; [74-98-6]
Butane; C_4H_{10}; [106-97-8]
2-Methylpropane; C_4H_{10}; [75-28-5]

(2) Electrolyte

(3) Water; H_2O; [7732-18-5]

EVALUATOR:

H. Lawrence Clever
Chemistry Department
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Atlanta, GA 30322 USA

1984, January

CRITICAL EVALUATION:

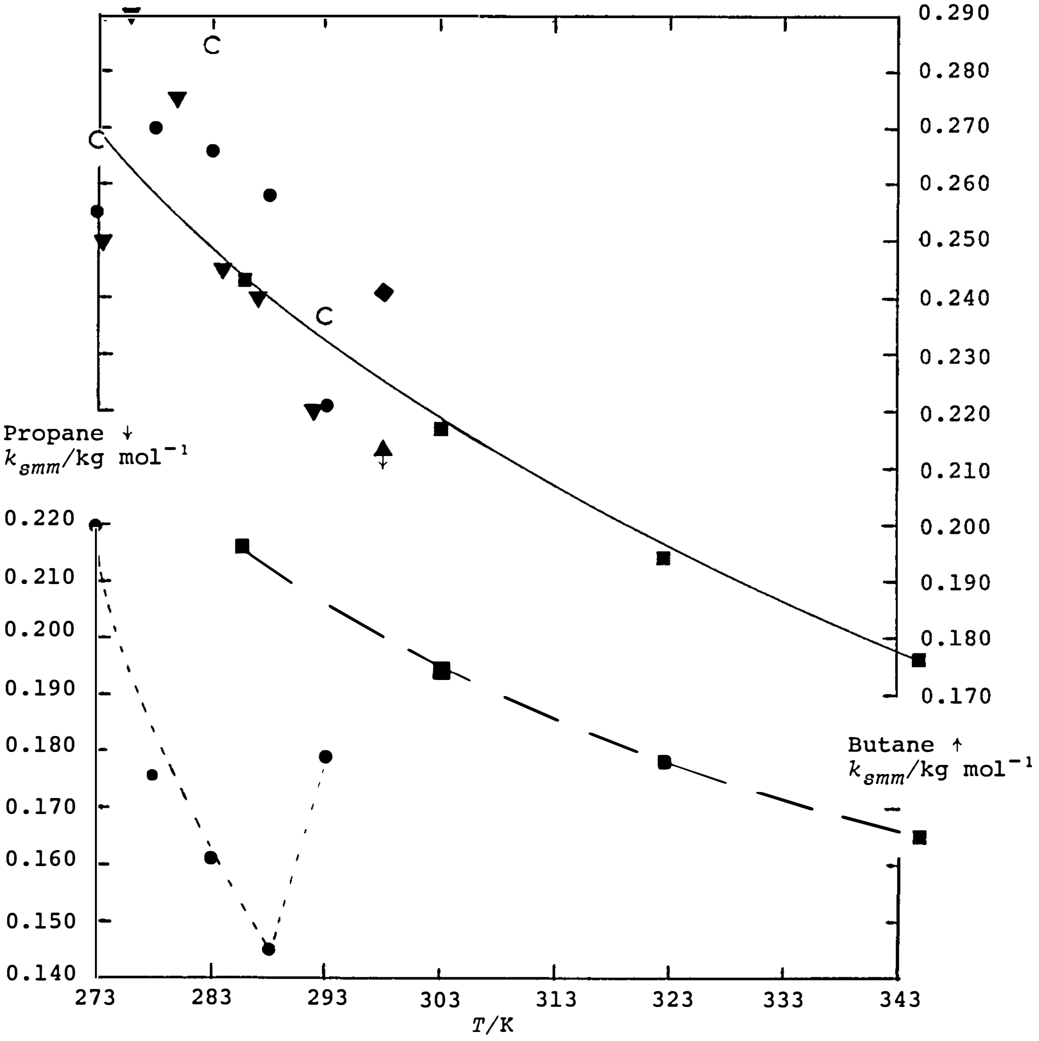

Fig 1. Salt effect parameter in one molal aqueous sodium chloride.

- ● Umano; Nakano (3)
- ■ Morrison; Billett (1)
- ▲ Yano; Suetaka; Umehara; Horiuchi (8)
- ▼ Rice; Gale; Barduhn (9)
- ◆ Denton; Smith; Klaschka; Forgan (7)
- C From solubility values calculated from equation of Rice *et al.* (9)

T/K	Sodium Chloride		Propane		Butane		Ref
	m_2/ mol kg^{-1}	c_2/ mol dm^{-3}	k_{smm}/ kg mol^{-1}	k_{scc}/ dm^3 mol^{-1}	k_{smm}/ kg mol^{-1}	k_{scc}/ dm^3 mol^{-1}	
273.2	0.522		0.233		-		3
	0.861		-		0.272		
	1.048		0.220		-		
	1.903		-		0.238		
	2.213		0.192		-		
	3.347		0.199		-		
	3.371		-		0.224		
	4.224		-		0.201		
	5.315		0.186		-		
273.45	1.288		-		0.23		9
273.65	0.621		-		0.27		9
276.15	0.621		-		0.31		9
	1.288		-		0.25		
278.2	0.522		0.176		-		3
	0.861		-		0.293		
	1.048		0.176		-		
	1.903		-		0.246		
	2.213		0.174		-		
	3.347		0.190		-		
	3.371		-		0.217		
	4.224		-		0.201		
	5.315		0.192		-		
280.15	0.621		-		0.30		9
	1.288		-		0.25		
283.2	0.522		0.121		-		3
	0.861		-		0.289		
	1.048		0.161		-		
	1.903		-		0.242		
	2.213		0.162		-		
	3.347		0.171		-		
	3.371		-		0.201		
	4.224		-		0.193		
	5.315		0.182		-		
284.15	0.621		-		0.24		9
	1.288		-		0.25		
285.75	1.00		0.216		0.243		1
287.15	1.288		-		0.24		9
288.15	0.621		-		0.22		9
288.2	0.522		0.110		-		3
	0.861		-		0.272		
	1.048		0.145		-		
	1.903		-		0.243		
	2.213		0.168		-		
	3.347		0.166		-		
	3.371		-		0.203		
	4.224		-		0.192		
	5.315		0.175		-		
292.15	0.621		-		0.23		9
	1.288		-		0.21		
293.2	0.522		0.184		-		3
	0.861		-		0.242		
	1.048		0.179		-		
	1.903		-		0.200		
	2.213		0.143		-		
	3.347		0.161		-		
	3.371		-		0.191		
	4.224		-		0.175		
	5.315		0.171		-		
298.15		0.250	0.116	0.125	-		8
		0.60	-	-	0.187	0.197	7
		0.750	0.234	0.246	-	-	8
		1.00	0.233	0.248	-	-	
		1.20	-	-	0.284	0.299	7
		1.50	0.229	0.244	-	-	8
		1.88	-	-	0.249	0.267	7
303.15	1.00		0.194		0.217		1
322.55	1.00		0.178		0.194		1
344.85	1.00		0.165		0.176		1

COMPONENTS:	EVALUATOR:
(1) Propane; C_3H_8; [74-98-6] Butane; C_4H_{10}; [106-97-8] 2-Methylpropane; C_4H_{10}; [75-28-5] (2) Electrolyte (3) Water; H_2O; [7732-18-5]	H. Lawrence Clever Chemistry Department Emory University Atlanta, GA 30322 USA 1984, January

CRITICAL EVALUATION:

function of propane partial pressure up to near 101 kPa (1 atm) at five sodium chloride concentrations between 0.522 and 5.315 molal at five degree intervals from 268.2 to 298.2 K. The evaluator has calculated salt effect parameter values from the 101 kPa propane partial pressure data only at temperatures of 273.2 to 293.2 K. There was no water solubility value at 268.2 and 298.2 K. Yano *et al.* measured the solubility of propane at four sodium chloride concentrations between 0.250 and 1.500 molar at 298.2 K.

The salt effect parameters as $k_{smm}/\text{kg mol}^{-1}$ from these references are given in the preceeding table. The agreement in the salt effect parameters from the three laboratories is poor (see Fig. 1). Although all of the data are classed as tentative, we have a preference for the data of Morrison and Billett partly because they are a self-consistent set of values over a 60 degree temperature interval.

The solubility of butane in aqueous sodium chloride solutions was measured by Morrison and Billett (1), Umano and Nakano (3), Denton, Smith, Klaschka and Forgan (7), and Rice, Gale and Barduhn (9). The Morrison and Billett measurements were made in water and one molal solution at four temperatures between 285.75 and 344.85 K. The measurements of Umano and Nakano were made as a function of sodium chloride concentration and temperature. Denton *et al.* measured the butane solubility in water and three sodium chloride solutions ranging from 0.50 to 1.88 molar at 298.15 K. Rice *et al.* measured the butane solubility in water and 0.621 and 1.288 molal sodium chloride at eight temperatures between 273.45 and 292.15 K.

The salt effect parameters are given in the table and in Fig. 1. The agreement of values from the four references is only fair at best. The figure shows values estimated for 1 *m* sodium chloride solutions. The values from Umano and Nakano are the average of values for 0.861 and 1.903 molal solutions. The values from Rice *et al.* are the average of values at 0.621 and 1.288 molal solutions and the value from Denton *et al.* is the average of the three values. All of the values are classed as tentative, however, as with the propane + aqueous sodium chloride, we suggest use of the values from the work of Morrison and Billett for a self-consistent set of data over a 60 degree temperature interval.

Rice, Gale and Barduhn (9) give an equation for Henry's constant (parts per million by weight butane/butane partial pressure, atm) as a function of weight percent NaCl and temperature over the 273 to 293 K interval which correlates their data and the data of Umano and Nakano (3). Salt effect parameters calculated from the results of their equation are shown on Fig. 1 at 273, 283 and 293 K. They show a maximum in k_{smm} as does the salt effect parameters calculated from the data in the two papers. This behavior seems unlikely to the evaluator. It is suspected there may be errors in the solubility data near 273.2 because the temperature is so near to the normal boiling point of butane of 272.7 K, which could make control of the butane partial pressure difficult.

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

Yano, Suetaka, Umehara and Horiuchi (8) measured the solubility of propane in water and in 0.50 and 1.00 molar sodium bromide solutions at 298.2 K. Both solutions give a salt effect parameter $k_{scc}/\text{dm}^3\ \text{mol}^{-1}=0.218$. In comparison with salt effect parameters of propane with other 1-1 electrolytes the value appears to be larger than expected. It is classed as tentative but the value should be used with caution.

99(3) Propane + Sodium carbonate [497-19-8] + Water

Yano, Suetaka, Umehara and Horiuchi (8) measured the solubility of propane in water and in 0.50 and 1.00 molar sodium carbonate solutions at 298.2 K. The salt effect parameters (k_{scc}/dm^3 mol^{-1}) calculated from the data are 0.721 and 0.680 for the 0.5 and 1.0 mol dm^{-3} solutions, respectively. The values are classed as tentative.

99(4) Butane + Sodium oleate [143-19-1] + Water

Zimmels and Metzer (10) measured the solubility of butane in aqueous sodium oleate solutions of 5 x 10^{-5} to 80 x 10^{-5} mol dm^{-3} at 299.2 K at several butane partial pressures up to 98 kPa (733 mmHg). They do not report a solubility of butane in water. A salting-out effect is indicated by the data. The data are classed as tentative. No salt effect parameters were calculated. The solubility of propane and butane at 319.2 K as a function of sodium oleate concentration from 10^{-6} to 10^{-3} *M* is shown on a small graph. The solubility shows maximums and minimums as the sodium oleate concentration increases with a particularly pronounced minimum at 5 x 10^{-5} *M* sodium oleate. Lin and Metzer (6) observed a similar minimum in the propane + 1-dodecanamine + water system discussed earlier in the evaluation. Studies to confirm these effects would be desirable.

100(1) Propane + Potassium chloride [7447-40-7] + Water

Butane + Potassium chloride [7447-40-7] + Water

Yano, Suetaka, Umehara and Horiuchi (8) measured the solubility of propane in water and in four concentrations of aqueous potassium chloride up to 1.50 molar at 298.2 K. Morrison and Billett (1) measured the solubility of butane in water and 1.0 molal potassium chloride solution at four temperatures between 285.75 and 344.85 K. The salt effect parameters are given in the following table. They are classed as tentative except the value in 0.250 *M* KCl which is doubtful.

T/K	Potassium Chloride		Propane		Butane
	m_2/mol kg^{-1}	c_2/mol dm^{-3}	k_{scc}/dm^3 mol^{-1}	k_{smm}/kg mol^{-3}	k_{smm}/kg mol^{-1}
285.75	1.0				0.200
298.2		0.250	0.112	0.099	
		0.500	0.203	0.187	
		1.000	0.207	0.187	
		1.500	0.222	0.199	
303.15	1.0				0.182
322.55	1.0				0.164
344.85	1.0				0.144

Values of k_{smx}/kg mol^{-1} can be obtained by adding 0.015 to the k_{smm} values.

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

Butane + Potassium bromide [7758-02-3] + Water

Yano, Suetaka, Umehara and Horiuchi (8) measured the solubility of propane in water and in 0.500 molar potassium bromide solution at 298.2 K. Morrison and Johnstone (2) measured the solubility of butane in water and 1.0 molal potassium bromide solution. The salt effect parameters from both sets of data are classed as tentative, however, it should be noted that the salt effect parameter is usually larger for butane than for propane for a given electrolyte. That is not true here, thus the data should be used with caution.

COMPONENTS:	EVALUATOR:
(1) Propane; C_3H_8; [74-98-6] Butane; C_4H_{10}; [106-97-8] 2-Methylpropane; C_4H_{10}; [75-28-5] (2) Electrolyte (3) Water; H_2O; [7732-18-5]	H. Lawrence Clever Chemistry Department Emory University Atlanta, GA 30322 USA 1984, January

CRITICAL EVALUATION:

T/K	Potassium Bromide		Propane		Butane
	m_2/mol kg^{-1}	c_2/mol dm^{-3}	k_{scc}/dm^3 mol^{-1}	k_{smm}/kg mol^{-1}	k_{smm}/kg mol^{-1}
298.2		0.500	0.226	0.205	
	1.0				0.174

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

Butane + Potassium iodide [7681-11-0] + Water

Morrison and Billett (1) measured the solubility of both gases in water and in 1.0 molal potassium iodide solutions at four temperatures between 285.75 and 344.85 K. The salt effect parameters are in the following table. They are classed as tentative. Again, note that the propane salt effect parameters are larger than those for butane.

T/K	Potassium Iodide	k_{smm}/mol kg^{-1}	
	m_2/mol kg^{-1}	Propane	Butane
285.75	1.0	0.121	0.109
303.15	1.0	0.103	0.098
322.55	1.0	0.085	0.080
344.85	1.0	0.067	0.059

The k_{smx}/kg mol^{-1} value may be obtained by adding 0.015 to the k_{smm}/kg mol^{-1} values.

Butane + sea salt (synthetic) + Water

Rice, Gale and Barduhn (9) measured the solubility of butane in water and in a synthetic sea salt containing 24,067 ppm NaCl, 5,107 ppm $MgCl_2$, 4.016 ppm Na_2SO_4, 1,130 ppm $CaCl_2$, and 680 ppm KCl (ppm = parts per million by weight). Salt effect parameters were not calculated. The results differ negligibly from results in 3.5 weight percent sodium chloride solution according to the authors. The data are classed as tentative.

Propane + Urea [57-13-6] + Water

Butane + Urea [57-13-6] + Water

2-Methylpropane + Urea [57-13-6] + Water

Urea is not an electrolyte, but the Sechenov equation is often used with nonelectrolyte solutions as well as electrolyte solution so it seems appropriate to include the gas aqueous urea systems here.

Wetlaufer, Malik, Stoller, and Coffin (4) measured the solubility of all three gases in water and in 6.96 molar aqueous urea solutions at temperatures of 278.2, 293.2, and 318.2 K. Wen and Hung (5) measured the solubility of propane in water and in 0.495 molal aqueous urea solution at 10 degree intervals between 278.15 and 308.15 K.

The propane Sechenov parameters are compared below. Included are the values Wen and Hung recommended for 0.1 molal solutions and the values calculated by the evaluator from the solubility data in their paper. Both the results of Wen and Hung and of Wetlaufer *et al.* show salting out at 278 K and salting in at the higher temperatures. Wen and Hung worked with molal concentrations and Wetlaufer *et al.* worked with molar concentrations of urea. At 0.495 *m* (0.482 *M*) $k_{scc} = 1.03\ k_{smm} + 0.019$ and at 6.96 *M* (10.10 *m*) $k_{scc} = 1.45\ k_{smm} + 0.023$.

T/K	Urea		Propane	
	m_2/mol kg^{-1}	c_2/mol dm^{-3}	k_{smm}/kg mol^{-1}	k_{scc}/dm^3 mol^{-1}
278.15	0.10 (authors)		0.005	
	0.495		0.006	
278.2		6.96	(-0.006)	0.014
288.15	0.10 (authors)		-0.009	
	0.495		-0.002	
293.2		6.96	(-0.017)	-0.001
298.15	0.10 (authors)		-0.020	
	0.495		-0.009	
308.15	0.10 (authors)		-0.030	
	0.495		-0.029	
318.2	(10.1)	6.96	(-0.023)	-0.010

The salt effect parameters values of Wetlaufer, Malik, Stoller and Coffin (4) for butane and 2-methylpropane in aqueous 6.96 molar urea are given below. The propane values are repeated for comparison.

T/K	Urea	k_{scc}/dm^3 mol^{-1}		
	c_2/mol dm^{-3}	Propane	Butane	2-Methylpropane
278.2	6.96	+0.014	+0.005	+0.002
293.2	6.96	-0.001	-0.013	-0.011
318.2	6.96	-0.010	-0.022	-0.020

REFERENCES

1. Morrison, T. J.; Billett, F. *J. Chem. Soc.* 1952, 3819.
2. Morrison, T. J.; Johnstone, N. B. B. *J. Chem. Soc.* 1955, 3655.
3. Umano, S.; Nakano, Y. *Kogyo Kagaku Zasshi* 1958, *61*, 536.
4. Wetlaufer, D. B.; Malik, S. K.; Stoller, L.; Coffin, R. L. *J. Am. Chem. Soc.* 1964, *86*, 508.
5. Wen, W.-Y.; Hung, J. H. *J. Phys. Chem.* 1970, *74*, 170.
6. Lin, I. J.; Metzer, A. *J. Phys. Chem.* 1971, *75*, 3000.
7. Denton, W. H.; Smith, M. J. S.; Klaschka, J. T.; Forgan, R. *et al.* *Fourth Int. Symp. Fresh Water Sea* 1973, *3*, 291.
8. Yano, T.; Suetaka, T.; Umehara, T.; Horiuchi, A. *Kagaku Kogaku* 1974, *38*, 320.

COMPONENTS:	EVALUATOR:
(1) Propane; C_3H_8; [74-98-6] Butane; C_4H_{10}; [106-97-8] 2-Methylpropane; C_4H_{10}; [75-28-5] (2) Electrolyte (3) Water; H_2O; [7732-18-5]	H. Lawrence Clever Chemistry Department Emory University Atlanta, GA 30322 USA 1984, January

CRITICAL EVALUATION:

9. Rice, P. A.; Gale, R. P.; Barduhn, A. J. *J. Chem. Eng. Data* 1976, *21*, 204.

10. Zimmels, Y.; Metzer, A. *J. Coll. Interface Sci.* 1976, *57*, 75.

11. Rudakov, E. S.; Lutsyk, A. I. *Zh. Fiz, Khim.*, 1979, *53*, 1298; *Russ. J. Phys. Chem.*, 1979, *53*, 731.

12. Clever, H. L. (a) *Nitrogen and Air*, Solubility Series, Volume 10, R. Battino, Editor, Pergamon Press Ltd., Oxford and New York, 1982, pp xxix-xliii and 45-56; (b) *J. Chem. Eng. Data* 1983, *28*, 340.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Propane; C_3H_8; [74-98-6] (2) Hydrochloric acid; HCl; [7647-01-0] (3) Water; H_2O; [7732-18-5]	Yano, T.; Suetaka, T.; Umehara, T.; Horiuchi, A. *Kagaku Kogaku* <u>1974</u>, *38*, 320-323.
VARIABLES: T/K: 298.2 c_2/mol L^{-1}: 0-1.0 P/kPa: 101.325	PREPARED BY: C. L. Young

EXPERIMENTAL VALUES:

T/K = 298.2

Concentration of electrolyte c_2/mol L^{-1}	Solubility[a] of propane /mmol L^{-1}
0.000	1.44
0.250	1.31
0.500	1.25
1.000	1.08

[a] At 1 atmosphere pressure.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

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

SOURCE AND PURITY OF MATERIALS:

1. High purity sample, purity better than 99.5 mole per cent.
2. Special grade.
3. Distilled.

ESTIMATED ERROR:

$\delta s/s = 0.01$ (compiler)

REFERENCES:

1. Yano, T.; Suetaka, T.; Umehara, T.
   Nippon Kagaku Kaishi
   <u>1972</u>, *11*, 2194.

COMPONENTS:

(1) Butane; C_4H_{10}; [106-97-8]

(2) Hydrochloric Acid; HCl; [7647-01-0]

(3) Water; H_2O; [7732-18-5]

ORIGINAL MEASUREMENTS:

Morrison, T. J.; Billett, F.

J. Chem. Soc. 1952, 3819 - 3822.

VARIABLES:

T/K: 285.75 - 344.85

p/kPa: 101.325 (1 atm)

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

Temperature			Salt Effect Parameters	
t/°C	T/K	1/(T/K)	$(1/m_2)\log(S°/S)$[1]	$(1/m_2)\log(x°/x)$
12.6	285.75	0.0035	0.080	0.095
30.0	303.15	0.0033	0.049	0.064
49.4	322.55	0.0031	0.031	0.046
71.7	344.85	0.0029	0.028	0.043

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

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

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

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

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

SOURCE AND PURITY OF MATERIALS:

(1) Butane. Prepared from Grignard reagent. A second sample, Anglo-Iranian Oil Co. stated to be 99 per cent pure, gave the same result.

(2) Hydrochloric Acid. "AnalaR" material.

(3) Water. No information given.

ESTIMATED ERROR:

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

REFERENCES:

1. Morrison, T. J.; Billett, F. *J. Chem. Soc.* 1948, 2033.

COMPONENTS: (1) Propane; C_3H_8; [74-98-6] (2) Sulfuric acid; H_2SO_4; [7664-93-9] (3) Water; H_2O; [7732-18-5]	**ORIGINAL MEASUREMENTS:** Rudakov, E.S.; Lutsyk, A.I. *Zh. Fiz. Khim.*, 1979, *53*, 1298-1300. *Russ. J. Phys. Chem.*, 1979, *53*, 731-733.
VARIABLES: T/K: 298.15, 363.15 H_2SO_4/wt.%: 0 - 97.7	**PREPARED BY:** E.S. Rudakov, W. Hayduk

EXPERIMENTAL VALUES:

T/K	Solvent wt. % H_2SO_4[1]	Partition Coefficient[1] $k/\mathrm{cm}^3\,\mathrm{cm}_1^{-3}$	Ostwald Coefficient[2] $L/\mathrm{cm}^3\,\mathrm{cm}^{-3}$	Bunsen Coefficient[2] $\alpha/\mathrm{cm}^3(\mathrm{STP})\,\mathrm{cm}^{-3}\,\mathrm{atm}^{-1}$	Mole Fraction[2] $10^5 x_1$
298.15	0	29	0.0345	0.0314	2.58
	(60.3)[3]	(60)	(0.0167)	(0.0152)	(1.64)
	80.0	80	0.0125	0.0114	1.57
	(80.0)	(82)	(0.0122)	(0.0111)	(1.52)
	93.0	14.3	0.0699	0.0637	11.9
	(93.0)	(20)	(0.0500)	(0.0456)	(8.52)
363.15	(90.0)	(45)	(0.0222)	(0.0165)	(2.92)
	93.0	28	0.0357	0.0265	5.16
	(93.0)	(27)	(0.0370)	(0.0275)	(5.34)
	94.9	22	0.0455	0.0338	6.96
	(94.9)	(30)	(0.0333)	(0.0247)	(5.10)
	97.7	13	0.0769	0.0571	13.1

[1] Original data.

[2] Ostwald and Bunsen coefficients and mole fraction calculated by compilers on basis that partition coefficient is equivalent to the inverse of the Ostwald coefficient and assuming that Henry's law applies.

[3] Revised data shown in brackets supplied by authors, May, 1983.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE: Gas chromatographic method used to evaluate partition coefficients. Reactor containing gas and acid solution mechanically shaken. After phase separation a measured volume of gas introduced into carrier gas for analysis. An equal volume of solution placed into a gas stripping cell for complete stripping of the propane by the carrier gas. The ratio of areas under the propane peaks used to determine the solubility. Actual equilibrium pressure not specified.	**SOURCE AND PURITY OF MATERIALS:** Sources and purities not specified. **ESTIMATED ERROR:** $\delta k/k = 0.10$ (authors) **REFERENCES:**

COMPONENTS:

(1) Butane; C_4H_{10}; [106-97-8]

(2) Sulfuric acid; H_2SO_4; [7664-93-9]

(3) Water; H_2O; [7732-18-5]

ORIGINAL MEASUREMENTS:

Rudakov, E.S.; Lutsyk, A.I.

Zh. Fiz. Khim., 1979, *53*, 1298-1300.

Russ. J. Phys. Chem. 1979, *53*, 731-733.

VARIABLES:

T/K: 298.15, 363.15

H_2SO_4/wt.%: 0 - 93.0

PREPARED BY:

E.S. Rudakov; W. Hayduk

EXPERIMENTAL VALUES:

T/K	Solvent wt.% H_2SO_4 [1]	Partition coefficient[1] k/cm^{3}cm^{-3}	Ostwald coefficient[2] L/cm^{3}cm^{-3}	Bunsen coefficient[2] α/cm^3(STP)cm^{-3}atm^{-1}	Mole fraction[2] $10^5 x_1$
298.15	0	37	0.0270	0.0244	2.05
	(60.3)[3]	(76)	(0.0132)	(0.0119)	(1.31)
	(80.0)	(77)	(0.0130)	(0.0118)	(1.65)
	(93.0)	(15)	(0.0667)	(0.0604)	(11.5)
363.15	0	223	0.00448	0.00328	0.29
	(90.0)	(45)	(0.0222)	(0.0163)	(2.95)
	(93.0)	(27)	(0.0385)	(0.0282)	(5.60)

[1] From original data.

[2] Ostwald coefficient, Bunsen coefficient and mole fraction calculated by compilers on basis that partition coefficient is equivalent to the inverse of the Ostwald coefficient and assuming that Henry's law applies.

[3] Revised data shown in brackets supplied by authors, May, 1983.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Gas chromatographic method used to evaluate partition coefficients. Reactor containing gas and acid solution mechanically shaken. After phase separation a measured volume of gas introduced into carrier gas for analysis. An equal volume of solution placed into a gas stripping cell for complete stripping of the butane by the carrier gas. The ratio of areas under the butane peaks used to determine the solubility. Actual equilibrium pressure not specified.

SOURCE AND PURITY OF MATERIALS:

Sources and purities not specified.

ESTIMATED ERROR:

$\delta k/k = 0.10$

(authors)

REFERENCES:

COMPONENTS:

(1) 2-Methyl propane (isobutane); C_4H_{10}; [75-28-5]

(2) Sulfuric acid; H_2SO_4; [7664-93-9]

(3) Water; H_2O; [7732-18-5]

ORIGINAL MEASUREMENTS:

Rudakov, E.S.; Lutsyk, A.I.

Zh. Fiz. Khim., 1979, *53*, 1298-1300.

Russ. J. Phys. Chem., 1979, *53*, 731-733.

VARIABLES:

T/K: 298.15

H_2SO_4/wt.%: 0 - 98.3

PREPARED BY:

E.S. Rudakov, W. Hayduk

EXPERIMENTAL VALUES:

T/K	Solvent wt.% $H_2SO_4^1$	Partition coefficient[1] k/cm^{3}cm$_1^{-3}$	Ostwald coefficient[2] L/cm^{3}cm^{-3}	Bunsen coefficient[2] α/cm^3(STP)cm^{-3}atm^{-1}	Mole fraction[2] 10^5x_1
298.15	0	47	0.0213	0.0193	1.62
	(60.3)[3]	(82)	(0.0122)	(0.0110)	(1.21)
	(80.0)	(95)	(0.0105)	(0.0105)	(1.33)
	86.4	50	0.0200	0.0181	2.89
	93.0	14	0.0714	0.0647	12.3
	(94.7)	(9.6)	(0.104)	(0.0944)	(19.1)
	95.4	9.1	0.110	0.0997	20.6
	98.3	3.9	0.256	0.232	53.7

[1] From original data

[2] Ostwald coefficient, Bunsen coefficient and mole fraction calculated by compilers on basis that partition coefficient is equivalent to the inverse of the Ostwald coefficient and assuming that Henry's law applies.

[3] Revised data shown in brackets supplied by authors, May, 1983.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Gas chromatographic method used to evaluate partition coefficients. Reactor containing gas and acid solution mechanically shaken. After phase separation a measured volume of gas introduced into carrier gas for analysis. An equal volume of solution placed into a gas stripping cell for complete stripping of the isobutane by the carrier gas. The ratio of areas under the isobutane peaks used to determine the solubility. Actual equilibrium pressure not specified.

SOURCE AND PURITY OF MATERIALS:

Sources and purities not specified.

ESTIMATED ERROR:

$\delta k/k = 0.10$

(authors)

REFERENCES:

COMPONENTS:

(1) Propane; C_3H_8; [74-98-6]

(2) Ammonium bromide; NH_4Br; [12124-97-9]

(3) Water; H_2O; [7732-18-5]

ORIGINAL MEASUREMENTS:

Wen, W.-Y.; Hung, J.H.

J. Phys. Chem. 1970, *74*, 170-180.

VARIABLES:

T/K: 278.15-308.15

P/kPa: 101.325 (1 atm)

m_3/mol kg^{-1}: 0-0.942

PREPARED BY:

H.L. Clever

EXPERIMENTAL VALUES:

T/K	Salt Molality m_3/mol kg^{-1}	Propane Solubility S_1/cm^3(STP) kg^{-1}	Setchenow Constant[1] k/kg mol^{-1}
278.15	0	69.57 ± 0.11	0.095
	0.107	68.06	
	0.224	67.08	
	0.428	63.47	
	0.707	60.23	
	0.942	50.86	
288.15	0	45.75 ± 0.06	0.086
	0.106	44.60	
	0.220	43.78	
	0.418	42.02	
	0.672	39.90	
	0.905	38.47	
298.15	0	32.31 ± 0.08	0.076
	0.107	31.61	
	0.210	31.28	

continued...

[1] Setchenow constant, k/kg mol^{-1} = (1/(m_3/mol kg^{-1})) log (S_1°/S_1).

The authors specify the value of the constant for m_3/mol kg^{-1} = 0.1.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The apparatus was similar to that described by Ben-Naim and Baer (1). Teflon needle valves were used in place of stopcocks.

The apparatus consists of three main parts, a dissolution cell of 300 to 600 cm^3 capacity, a gas volume measuring column, and a manometer.

The solvent is degassed in the dissolution cell, the gas is introduced and dissolved while the liquid is kept stirred by a magnetic stirrer immersed in the water bath. Dissolution of the gas results in the change in the height of a column of mercury which is measured by a cathetometer.

SOURCE AND PURITY OF MATERIALS:

1. Propane. Matheson Co. Stated to be better than 99.9 per cent pure.
2. Ammonium bromide. Baker Chemical Co. Analyzed reagent grade. Used as received.
3. Water. Distilled from an all Pyrex apparatus. Specific conductivity 1.5 x 10^{-6} (ohm cm)$^{-1}$.

ESTIMATED ERROR:

δT/K = ±0.005

$\delta S_1/S_1$ = ±0.003

REFERENCES:

1. Ben-Naim, A.; Baer, S. *Trans. Faraday Soc.* 1963, *59*, 2735.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Propane; C_3H_8; [74-98-6] (2) Ammonium bromide; NH_4Br; [12124-97-9] (3) Water; H_2O; [7732-18-5]	Wen, W.-Y.; Hung, J.H. *J. Phys. Chem.* 1970, *74*, 170-180.

VARIABLES:	PREPARED BY:
T/K: 278.15-308.15 *P*/kPa: 101.325 (1 atm) m_3/mol kg^{-1}: 0-0.942	H.L. Clever

EXPERIMENTAL VALUES: concluded

T/K	Salt Molality m_3/mol kg^{-1}	Propane Solubility S_1/cm^3(STP) kg^{-1}	Setchenow Constant[1] k/kg mol^{-1}
298.15	0.407	29.87	
	0.631	28.99	
	0.850	27.76	
308.15	0	23.91 ± 0.07	0.066
	0.105	23.50	
	0.224	23.26	
	0.427	22.88	
	0.667	21.69	
	0.885	21.03	

[1] Setchenow constant, k/kg mol^{-1} = (1/(m_3/mol kg^{-1})) log (S_1°/S_1)

The authors specify the value of the constant for m_3/mol kg^{-1} = 0.1.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The apparatus was similar to that described by Ben-Naim and Baer (1). Teflon needle valves were used in place of stopcocks.

The apparatus consists of three main parts, a dissolution cell of 300 to 600 cm^3 capacity, a gas volume measuring column, and a manometer.

The solvent is degassed in the dissolution cell, the gas is introduced and dissolved while the liquid is kept stirred by a magnetic stirrer immersed in the water bath. Dissolution of the gas results in the change in the height of a column of mercury which is measured by a cathetometer.

SOURCE AND PURITY OF MATERIALS:

1. Propane. Matheson Co. Stated to be better than 99.9 per cent pure.
2. Ammonium bromide. Baker Chemical Co. Analyzed reagent grade. Used as received.
3. Water. Distilled from an all Pyrex apparatus. Specific conductivity 1.5 x 10^{-6} (ohm cm)$^{-1}$.

ESTIMATED ERROR:

δT/K = ±0.005

$\delta S_1/S_1$ = ±0.003

REFERENCES:

1. Ben-Naim, A.; Baer, S. *Trans. Faraday Soc.* 1963, *59*, 2735.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Propane; C_3H_8; [74-98-6] (2) 1-Dodecanamine, hydrochloride or dodecylamine hydrochloride or DACl; $C_{12}H_{27}N \cdot HCl$; [929-73-7] (3) Water; H_2O; [7732-18-5]	Lin, I. J.; Metzer, A. *J. Phys. Chem.* 1971, *75*, 3000-4.
VARIABLES:	**PREPARED BY:**
$T/K = 298.2$ $p_1/kPa = 100.0$ $c_2/mol\ dm^{-3} = 1 \times 10^{-8} - 1 \times 10^{-3}$	H. L. Clever

EXPERIMENTAL VALUES:

Temperature		Dodecylamine Hydrochloride	Solubility/
$t/{}^0C$	T/K	$c_2/mol\ dm^{-3}$	cm^3(25 ^0C, 750 mmHg) per dm^3 solution.
25.0	298.2	1×10^{-8}	35.40
		1×10^{-6}	31.75
		5×10^{-6}	31.95
		1×10^{-5}	32.20
		5×10^{-5}	33.05
		1×10^{-4}	33.50
		5×10^{-4}	34.65
		1×10^{-3}	35.10

The values of the dodecyamine hydrochloride concentration and the propane solubility were read by the compiler from a large scale graph in the paper.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The solubilities were determined with the apparatus developed by Ben Naim and Baer (1). The solutions of dodecylamine hydrochloride were prepared with twice distilled, deaerated water, and introduced into the apparatus under vacuum.

SOURCE AND PURITY OF MATERIALS:

(1) Propane. No information.

(2) Dodecylamine hydrochloride. No information.

(3) Water. Double distilled.

ESTIMATED ERROR:

$\delta T/K = \pm 0.1$

The method is accurate to 0.2 percent (authors).

REFERENCES:

1. Ben Naim, A.; Baer, S. *Trans. Faraday Soc.* 1963, *59*, 2735.

COMPONENTS:

(1) Propane; C_3H_8; [74-98-6]

(2) Guanidine monohydrochloride; CH_6ClN_3; [50-01-1]

(3) Water; H_2O; [7732-18-5]

ORIGINAL MEASUREMENTS:

Wetlaufer, D.B.; Malik, S.K.; Stoller, L.; Coffin, R.L.

J. Am. Chem. Soc. 1964, *86*, 508-514.

VARIABLES:

T/K: 278.15-318.15

c_2/mol dm^{-3}: 4.87

P/kPa: 101.325

PREPARED BY:

W. Hayduk, C.L. Young

EXPERIMENTAL VALUES:

T/K	Salt Conc.[1] c_2/ mol dm^{-3}	Solution molar volume[1] /cm^{3}mol^{-1}	Solubility[1] s_1/mmol dm^{-3}	Mole Fraction[2] /10^5x_1	Ostwald Coeff.[2] L/cm^{3}cm^{-3}	Bunsen Coeff.[2] α
278.15	4.87	(41.25)[3]	2.53	6.13	0.0566	0.0555
298.15	4.87	41.04	1.53	3.73	0.0368	0.0336
318.15	4.87	(40.76)	1.10	2.70	0.0283	0.0241

[1] Original data.

[2] Calculated by compilers using real gas molar volumes.

[3] Molar volumes of solvent shown in brackets were estimated.

[4] No correction was made for the amount of gas retained by the solvent during extraction, estimated by the authors to be 1-1.5 per cent; hence the results are expected to be too low by this amount.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

A modified Van Slyke-Neill manometric blood gas apparatus, fitted with a magnetic stirrer was used. The solvent was saturated with gas; then a sample was transferred to the Van Slyke extraction chamber for gas desorption and volume measurement.

SOURCE AND PURITY OF MATERIALS:

1. Matheson Co. Instrument grade; minimum specified purity 99.5 per cent.
2. Reaction of reagent grade hydrochloric acid on recrystallized guanidinium carbonate.
3. Distilled.

ESTIMATED ERROR:

δT/K = 0.05

$\delta s_1/s_1$ = 0.02 (authors)[4]

REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Butane; C_4H_{10}; [106-97-8] (2) Guanidine monohydrochloride; CH_6ClN_3; [50-01-1] (3) Water; H_2O; [7732-18-5]	Wetlaufer, D.B.; Malik, S.K.; Stoller, L.; Coffin, R.L. *J. Am. Chem. Soc.* 1964, *86*, 508-514.

VARIABLES:	PREPARED BY:
T/K: 278.15-318.15 c_2/mol dm^{-3}: 4.87 P/kPa: 101.325	W. Hayduk, C.L. Young

EXPERIMENTAL VALUES:

T/K	Salt conc.[1] c_2/mol dm^{-3}	Solution molar volume[1] /cm^{3}mol^{-1}	Solubility[1] s_1/mmol dm^{-3}	Mole Fraction[2] /10^5x_1	Ostwald Coeff.[2] L/cm^{3}cm^{-3}	Bunsen Coeff.[2] α
278.15	4.87	(41.25)[3]	2.89	7.01	0.0633	0.0620
298.15	4.87	41.04	1.54	3.75	0.0365	0.0330
318.15	4.87	(40.76)	1.06	2.60	0.0273	0.0227

[1] Original data.

[2] Calculated by compilers using real gas molar volumes.

[3] Molar volumes of solvent shown in brackets were estimated.

[4] No correction was made for the amount of gas retained by the solvent during extraction, estimated by the authors to be 1-1.5 per cent; hence the results are expected to be too low by this amount.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:	SOURCE AND PURITY OF MATERIALS:
A modified Van Slyke-Neill manometric blood gas apparatus, fitted with a magnetic stirrer was used. The solvent was saturated with gas; then a sample was transferred to the Van Slyke extraction chamber for gas desorption and volume measurement.	1. Matheson Co. C.P. grade; minimum specified purity 99.5 per cent. 2. Reaction of reagent grade hydrochloric acid on recrystallized guanidinium carbonate. 3. Distilled.
	ESTIMATED ERROR: δT/K = 0.05 $\delta s_1/s_1$ = 0.02 (authors)[4]
	REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) 2-Methylpropane; C_4H_{10}; [75-28-5] (2) Guanidine monohydrochloride; CH_6ClN_3; [50-01-1] (3) Water; H_2O; [7732-18-5]	Wetlaufer, D.B.; Malik, S.K.; Stoller, L.; Coffin, R.L. *J. Am. Chem. Soc.* 1964, *86*, 508-514.

VARIABLES:	PREPARED BY:
T/k: 278.15-318.15 c_2/mol dm^{-3}: 4.87 P/kPa: 101.325	W. Hayduk, C.L. Young

EXPERIMENTAL VALUES:

T/K	Salt conc.[1] c_2/mol dm^{-3}	Solution molar volume[1] /cm^{3}mol^{-1}	Solubility[1] s_1/mmol dm^{-3}	Mole Fraction[2] /10^5x_1	Ostwald Coeff.[2] L/cm^{3}cm^{-3}	Bunsen Coeff.[2] α
278.15	4.87	(41.25)[3]	1.99	4.82	0.0436	0.0427
298.15	4.87	41.04	1.20	2.92	0.0285	0.0258
318.15	4.87	(40.76)	0.82	2.01	0.0209	0.0176

[1] Original data.

[2] Calculated by compilers using real gas molar volumes.

[3] Molar volumes of solvent shown in brackets were estimated.

[4] No correction was made for the amount of gas retained by the solvent during extraction, estimated by the authors to be 1-1.5 per cent; hence the results are expected to be too low by this amount.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

A modified Van Slyke-Neill manometric blood gas apparatus, fitted with a magnetic stirrer was used. The solvent was saturated with gas; then a sample was transferred to the Van Slyke extraction chamber for gas desorption and volume measurement.

SOURCE AND PURITY OF MATERIALS:

1. Matheson Co. Instrument grade; minimum specified purity 99.5 per cent.
2. Reaction of reagent grade hydrochloric acid on recrystallized guanidinium carbonate.
3. Distilled.

ESTIMATED ERROR:

$\delta T/K = 0.05$

$\delta s_1/s_1 = 0.02$ (authors)[4]

REFERENCES:

COMPONENTS:

(1) Propane; C_3H_8; [74-98-6]

(2) *N,N,N*-Trimethylmethanaminium bromide or tetramethylammonium bromide; $C_4H_{12}NBr$; [64-20-0]

(3) Water; H_2O; [7732-18-5]

ORIGINAL MEASUREMENTS:

Wen, W.-Y.; Hung, J.H.

J. Phys. Chem. 1970, *74*, 170-180.

VARIABLES:

T/K: 278.15-308.15

P/kPa: 101.325 (1 atm)

m_3/mol kg^{-1}: 0-0.885

PREPARED BY:

H.L. Clever

EXPERIMENTAL VALUES:

T/K	Salt Molality m_3/mol kg^{-1}	Propane Solubility S_1/cm^3(STP) kg^{-1}	Setchenow Constant[1] k/kg mol^{-1}
278.15	0	69.57 ± 0.11	-0.029
	0.165	70.44	
	0.325	71.52	
288.15	0	45.75 ± 0.06	-0.039
	0.165	46.32	
	0.325	47.03	
298.15	0	32.31 ± 0.08	-0.059
	0.328	33.59	
	0.885	35.84	
308.15	0	23.91 ± 0.07	-0.091
	0.165	24.68	
	0.325	25.46	

[1] Setchenow constant, k/kg mol^{-1} = (1/(m_3/mol kg^{-1})) log (S_1°/S_1).

The authors specify the value of the constant for m_3/mol kg^{-1} = 0.1.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The apparatus was similar to that described by Ben-Naim and Baer (1). Teflon needle valves were used in place of stopcocks.

The apparatus consists of three main parts, a dissolution cell of 300 to 600 cm^3 capacity, a gas volume measuring column, and a manometer.

The solvent is degassed in the dissolution cell, the gas is introduced and dissolved while the liquid is kept stirred by a magnetic stirrer immersed in the water bath. Dissolution of the gas results in the change in the height of a column of mercury which is measured by a cathetometer.

SOURCE AND PURITY OF MATERIALS:

1. Propane. Matheson Co. Stated to be better than 99.9 per cent pure.
2. Tetramethylammonium bromide. Eastman Kodak Co. Recrystallized and analyzed. Better than 99.9 per cent pure.
3. Water. Distilled from an all Pyrex apparatus. Specific conductivity 1.5 x 10^{-6} (ohm cm)$^{-1}$.

ESTIMATED ERROR:

δT/K = ±0.005

$\delta S_1/S_1$ = ±0.003

REFERENCES:

1. Ben-Naim, A.; Baer, S. *Trans. Faraday Soc.* 1963, *59*, 2735.

COMPONENTS:

(1) Butane; C_4H_{10}; [106-97-8]

(2) *N,N,N*-Trimethylmethanaminium bromide or tetramethylammonium bromide; $C_4H_{12}NBr$; [64-20-0]

(3) Water; H_2O; [7732-18-5]

ORIGINAL MEASUREMENTS:

Wen, W.-Y.; Hung, J.H.

J. Phys. Chem. 1970, *74*, 170-180.

VARIABLES:

T/K: 278.15-308.15
P/kPa: 101.325 (1 atm)
m_3/mol kg^{-1}: 0-0.850

PREPARED BY:

H.L. Clever

EXPERIMENTAL VALUES:

T/K	Salt Molality m_3/mol kg^{-1}	Butane Solubility S_1/cm^3(STP) kg^{-1}	Setchenow Constant[1] k/kg mol^{-1}
278.15	0	62.00 ± 0.10	-0.049
	0.850	69.23	
288.15	0	39.20 ± 0.05	-0.064
	0.850	44.13	
298.15	0	26.34 ± 0.06	-0.074
	0.850	30.25	
308.15	0	19.27 ± 0.06	-0.100
	0.850	23.10	

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[1] Setchenow constant, k/kg mol^{-1} = $(1/(m_3/\text{mol kg}^{-1}))\log(S_1^\circ/S_1)$.

The authors specify the value of the constant for m_3/mol kg^{-1} = 0.1.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The apparatus was similar to that described by Ben-Naim and Baer (1). Teflon needle valves were used in place of stopcocks.

The apparatus consists of three main parts, a dissolution cell of 300 to 600 cm^3 capacity, a gas volume measuring column, and a manometer.

The solvent is degassed in the dissolution cell, the gas is introduced and dissolved while the liquid is kept stirred by a magnetic stirrer immersed in the water bath. Dissolution of the gas results in the change in the height of a column of mercury which is measured by a cathetometer.

SOURCE AND PURITY OF MATERIALS:

1. Butane. Matheson Co. Stated to be better than 99.9 per cent pure.
2. Tetramethylammonium bromide. Eastman Kodak Co. Recrystallized and analyzed. Better than 99.9 per cent pure.
3. Water. Distilled from an all Pyrex apparatus. Specific conductivity 1.5 x 10^{-6} (ohm cm)$^{-1}$.

ESTIMATED ERROR:

δT/K = ±0.005

$\delta S_1/S_1$ = ±0.003

REFERENCES:

1. Ben-Naim, A.; Baer, S. *Trans. Faraday Soc.* 1963, *59*, 2735.

COMPONENTS:

(1) Propane; C_3H_8; [74-98-6]

(2) *N,N,N*-Triethylethanaminium bromide or tetraethylammonium bromide; $C_8H_{20}NBr$; [71-91-0]

(3) Water; H_2O; [7732-18-5]

ORIGINAL MEASUREMENTS:

Wen, W.-Y.; Hung, J.H.

J. Phys. Chem. 1970, *74*, 170-180.

VARIABLES:

T/K: 278.15-308.15

P/kPa: 101.325 (1 atm)

m_3/mol kg^{-1}: 0-0.425

PREPARED BY:

H.L. Clever

EXPERIMENTAL VALUES:

T/K	Salt Molality m_3/mol kg^{-1}	Propane Solubility S_1/cm^3(STP) kg^{-1}	Setchenow Constant[1] k/kg mol^{-1}
278.15	0	69.57 ± 0.11	-0.096
	0.161	72.50	
	0.425	76.60	
288.15	0	45.74 ± 0.06	-0.125
	0.158	47.95	
	0.425	51.82	
298.15	0	32.31 ± 0.08	-0.158
	0.154	33.65	
	0.425	36.75	
308.15	0	23.91 ± 0.06	-0.207
	0.174	25.94	
	0.425	28.50	

[1] Setchenow constant, k/kg mol^{-1} = $(1/(m_3/\text{mol kg}^{-1})) \log (S_1^\circ/S_1)$.

The authors specify the value of the constant for m_3/mol kg^{-1} = 0.1.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The apparatus was similar to that described by Ben-Naim and Baer (1). Teflon needle valves were used in place of stopcocks.

The apparatus consists of three main parts, a dissolution cell of 300 to 600 cm^3 capacity, a gas volume measuring column, and a manometer.

The solvent is degassed in the dissolution cell, the gas is introduced and dissolved while the liquid is kept stirred by a magnetic stirrer immersed in the water bath. Dissolution of the gas results in the change in the height of a column of mercury which is measured by a cathetometer.

SOURCE AND PURITY OF MATERIALS:

1. Propane. Matheson Co. Stated to be better than 99.9 per cent pure.
2. Tetraethylammonium bromide. Eastman Kodak Co. Recrystallized and analyzed. Better than 99.9 per cent pure.
3. Water. Distilled from an all Pyrex apparatus. Specific conductivity 1.5 x 10^{-6} (ohm cm)$^{-1}$.

ESTIMATED ERROR:

δT/K = ±0.005

$\delta S_1/S_1$ = ±0.003

REFERENCES:

1. Ben-Naim, A.; Baer, S. *Trans. Faraday Soc.* 1963, *59*, 2735.

COMPONENTS:

(1) Butane; C_4H_{10}; [106-97-8]

(2) *N,N,N*-Triethylethanaminium bromide or tetraethylammonium bromide; $C_8H_{20}NBr$; [71-91-0]

(3) Water; H_2O; [7732-18-5]

ORIGINAL MEASUREMENTS:

Wen, W.-Y.; Hung, J.H.

J. Phys. Chem. 1970, *74*, 170-180.

VARIABLES:

T/K: 278.15-308.15

P/kPa: 101.325 (1 atm)

m_3/mol kg^{-1}: 0-0.405

PREPARED BY:

H.L. Clever

EXPERIMENTAL VALUES:

T/K	Salt Molality m_3/mol kg^{-1}	Butane Solubility S_1/cm^3(STP) kg^{-1}	Setchenow Constant[1] k/kg mol^{-1}
278.15	0	62.00 ± 0.10	-0.149
	0.405	70.79	
288.15	0	39.20 ± 0.05	-0.152
	0.405	44.87	
298.15	0	26.34 ± 0.06	-0.168
	0.405	30.55	
308.15	0	19.27 ± 0.06	-0.226
	0.405	23.44	

[1] Setchenow constant, k/kg mol^{-1} = $(1/(m_3/\text{mol kg}^{-1}))\log(S_1^\circ/S_1)$

The authors specify the value of the constant for m_3/mol kg^{-1} = 0.1.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The apparatus was similar to that described by Ben-Naim and Baer (1). Teflon needle valves were used in place of stopcocks.

The apparatus consists of three main parts, a dissolution cell of 300 to 600 cm^3 capacity, a gas volume measuring column, and a manometer.

The solvent is degassed in the dissolution cell, the gas is introduced and dissolved while the liquid is kept stirred by a magnetic stirrer immersed in the water bath. Dissolution of the gas results in the change in the height of a column of mercury which is measured by a cathetometer.

SOURCE AND PURITY OF MATERIALS:

1. Butane. Matheson Co. Stated to be better than 99.9 per cent pure.
2. Tetraethylammonium bormide. Eastman Kodak Co. Recrystallized and analyzed. Better than 99.9 per cent pure.
3. Water. Distilled from an all Pyrex apparatus. Specific conductivity 1.5 x 10^{-6} (ohm cm)$^{-1}$.

ESTIMATED ERROR:

δT/K = ±0.005

$\delta S_1/S_1$ = ±0.003

REFERENCES:

1. Ben-Naim, A.; Baer, S. *Trans. Faraday Soc.* 1963, *59*, 2735.

COMPONENTS:

(1) Butane; C_4H_{10}; [106-97-8]

(2) N,N,N-Triethylethanaminium bromide or tetraethyl ammonium bromide; $(C_2H_5)_4NBr$; [71-91-0]

(3) Water; H_2O; [7732-18-5]

ORIGINAL MEASUREMENTS:

Morrison, T. J.; Johnstone, N. B. B.

J. Chem. Soc. 1955, 3655-9.

VARIABLES:

$T/K = 298.15$
$p/kPa = 101.325$
$m_2/mol\ kg^{-1} = 0,\ 1.0$

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

Temperature		Tetraethyl ammonium bromide	Salt Effect Parameter	
$t/^\circ C$	T/K	$m_2/mol\ kg^{-1}$	$k_{smm}/kg\ mol^{-1}$	$k_{smx}/kg\ mol^{-1}$
25	298.15	1.0	-0.122	-0.107

The k_{smx} value was calculated by the compiler.

The salt effect parameter is based on two measurements, the solubility of butane in water and in 1.0 molal salt solution. The actual solubilities were not reported in the paper.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The method of Morrison and Billett (1) was used. The previously degassed solvent flows through a glass helix in a thin film through the vapor saturated gas at a total pressure of one atmosphere. Volume changes in the gas are measured in attached calibrated burets.

SOURCE AND PURITY OF MATERIALS:

(1) Butane. British Oxygen Co. Purest sample available.

(2) Tetraethyl ammonium bromide. No information.

(3) Water. No information.

ESTIMATED ERROR:

$\delta k_{smm}/kg\ mol^{-1} = \pm\ 0.010$

REFERENCES:

1. Morrison, T. J.; Billett, F. *J. Chem. Soc.* 1952, 3819.

COMPONENTS:

(1) Propane; C_3H_8; [74-98-6]

(2) *N,N,N*-Tripropylpropanaminium bromide or tetrapropylammonium bromide; $C_{12}H_{28}NBr$; [1941-30-6]

(3) Water; H_2O; [7732-18-5]

ORIGINAL MEASUREMENTS:

Wen, W.-Y.; Hung, J.H.

J. Phys. Chem. 1970, *74*, 170-180.

VARIABLES:

T/K: 278.15-308.15
P/kPa: 101.325 (1 atm)
m_3/mol kg^{-1}: 0-1.07

PREPARED BY:

H.L. Clever

EXPERIMENTAL VALUES:

T/K	Salt Molality m_3/mol kg^{-1}	Butane Solubility S_1/cm^3(STP) kg^{-1}	Setchenow Constant[1] k/kg mol^{-1}
278.15	0	69.57 ± 0.11	-0.080
	0.103	70.99	
	0.210	72.73	
	0.271	73.35	
	0.410	74.41	
	0.436	74.61	
	0.492	73.85	
	0.784	73.82	
	0.963	73.28	
288.15	0	45.75 ± 0.06	-0.130
	0.110	47.24	
	0.210	48.58	
	0.267	49.51	
	0.415	51.54	

continued...

[1] Setchenow constant, k/kg mol^{-1} = (1/m_3/mol kg^{-1})) log (S_1°/S_1)

The authors specify the value of the constant for m_3/mol kg^{-1} = 0.1.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The apparatus was similar to that described by Ben-Naim and Baer (1) Teflon needle valves were used in place of stopcocks.

The apparatus consists of three main parts, a dissolution cell of 300 to 600 cm^3 capacity, a gas volume measuring column, and a manometer.

The solvent is degassed in the dissolution cell, the gas is introduced and dissolved while the liquid is kept stirred by a magnetic stirrer immersed in the water bath. Dissolution of the gas results in the change in the height of a column of mercury which is measured by a cathetometer.

SOURCE AND PURITY OF MATERIALS:

1. Propane. Matheson Co. Stated to be better than 99.9 per cent pure.
2. Tetrapropylammonium bromide. Eastman Kodak Co. Recrystallized and analyzed. Better than 99.9 per cent pure.
3. Water. Distilled from an all Pyrex apparatus. Specific conductivity 1.5 x 10^{-6} (ohm cm)$^{-1}$.

ESTIMATED ERROR:

δT/K = ±0.005

$\delta S_1/S_1$ = ±0.003

REFERENCES:

1. Ben-Naim, A.; Baer, S. *Trans. Faraday Soc.* 1963, *59*, 2735.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Propane; C_3H_8; [74-98-6] (2) *N,N,N*-Tripropylpropanaminium bromide or tetrapropylammonium bromide; $C_{12}H_{28}NBr$; [1941-30-6] (3) Water; H_2O; [7732-18-5]	Wen, W.-Y.; Hung, J.H. *J. Phys. Chem.* 1970, *74*, 170-180.

VARIABLES:	PREPARED BY:
T/K: 278.15-308.15 P/kPa: 101.325 (1 atm) m_3/mol kg^{-1}: 0-1.07	H.L. Clever

EXPERIMENTAL VALUES: concluded

T/K	Salt Molality m_3/mol kg^{-1}	Propane Solubility S_1/cm^3(STP) kg^{-1}	Setchenow Constant[1] k/kg mol^{-1}
288.15	0.465	51.78	
	0.689	53.14	
	1.070	54.78	
298.15	0	32.31 ± 0.08	-0.187
	0.102	33.77	
	0.267	35.65	
	0.420	37.38	
	0.609	39.96	
	1.050	43.80	
308.15	0	23.91 ± 0.07	-0.273
	0.107	25.61	
	0.271	27.72	
	0.457	30.66	
	0.656	32.73	

[1] Setchenow constant, k/kg mol^{-1} = (1/(m_3/mol kg^{-1})) log (S_1°/S_1.

The authors specify the value of the constant for m_3/mol kg^{-1} = 0.1.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The apparatus was similar to that described by Ben-Naim and Baer (1) Teflon needle valves were used in place of stopcocks.

The apparatus consists of three main parts, a dissolution cell of 300 to 600 cm^3 capacity, a gas volume measuring column, and a manometer.

The solvent is degassed in the dissolution cell, the gas is introduced and dissolved while the liquid is kept stirred by a magnetic stirrer immersed in the water bath. Dissolution of the gas results in the change in the height of a column of mercury which is measured by a cathetometer.

SOURCE AND PURITY OF MATERIALS:

1. Propane. Matheson Co. Stated to be better than 99.9 per cent pure.
2. Tetrapropylammonium bromide. Eastman Kodak Co. Recrystallized and analyzed. Better than 99.9 per cent pure.
3. Water. Distilled from an all Pyrex apparatus. Specific conductivity 1.5 x 10^{-6} (ohm cm)$^{-1}$.

ESTIMATED ERROR:

δT/K = ±0.005

$\delta S_1/S_1$ = ±0.003

REFERENCES:

1. Ben-Naim, A.; Baer, S. *Trans. Faraday Soc.* 1963, *59*, 2735.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Butane; C_4H_{10}; [106-97-8] (2) *N,N,N*-Tripropylpropanaminium bromide or tetrapropylammonium bromide; $C_{12}H_{28}NBr$; [1941-30-6] (3) Water; H_2O; [7732-18-5]	Wen, W.-Y.; Hung, J.H. *J. Phys. Chem.* 1970, *74*, 170-180.

VARIABLES:	PREPARED BY:
T/K: 278.15-308.15 *P*/kPa: 101.325 (1 atm) m_3/mol kg^{-1}: 0-0.405	H.L. Clever

EXPERIMENTAL VALUES:

T/K	Salt Molality m_3/mol kg^{-1}	Butane Solubility S_1/cm^3(STP) kg^{-1}	Setchenow Constant[1] k/kg mol^{-1}
278.15	0	62.00 ± 0.10	-0.120
	0.405	69.09	
288.15	0	39.20 ± 0.05	-0.165
	0.405	45.36	
298.15	0	26.34 ± 0.06	-0.227
	0.405	32.09	
308.15	0	19.27 ± 0.06	-0.307
	0.405	25.02	

[1] Setchenow constant, k/kg mol^{-1} = (1/(m_3/mol kg^{-1})) log (S_1°/S_1).

The authors specify the value of the constant for m_3/mol kg^{-1} = 0.1.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The apparatus was similar to that described by Ben-Naim and Baer (1) Teflon needle valves were used in place of stopcocks.

The apparatus consists of three main parts, a dissolution cell of 300 to 600 cm^3 capacity, a gas volume measuring column, and a manometer.

The solvent is degassed in the dissolution cell, the gas is introduced and dissolved while the liquid is kept stirred by a magnetic stirrer immersed in the water bath. Dissolution of the gas results in the change in the height of a column of mercury which is measured by a cathetometer.

SOURCE AND PURITY OF MATERIALS:

1. Butane. Matheson Co. Stated to be better than 99.9 per cent pure.
2. Tetrapropylammonium bromide. Eastman Kodak Co. Recrystallized and analyzed. Better than 99.9 per cent pure.
3. Water. Distilled from an all Pyrex apparatus. Specific conductivity 1.5 x 10^{-6} (ohm cm)$^{-1}$.

ESTIMATED ERROR:

δT/K = ±0.005

$\delta S_1/S_1$ = ±0.003

REFERENCES:

1. Ben-Naim, A.; Baer, S. *Trans. Faraday Soc.* 1963, *59*, 2735.

COMPONENTS:

(1) Propane; C_3H_8; [74-98-6]

(2) *N,N,N*-Tributylbutanaminium bromide or tetrabutylammonium bromide; $C_{16}H_{36}NBr$; [1643-19-2]

(3) Water; H_2O; [7732-18-5]

ORIGINAL MEASUREMENTS:

Wen, W.-Y.; Hung, J.H.

J. Phys. Chem. <u>1970</u>, *74*, 170-180.

VARIABLES:

T/K: 278.15-308.15
P/kPa: 101.325 (1 atm)
m_3/mol kg^{-1}: 0-0.624

PREPARED BY:

H.L. Clever

EXPERIMENTAL VALUES:

T/K	Salt Molality m_3/mol kg^{-1}	Propane Solubility S_1/cm^3(STP) kg^{-1}	Setchenow Constant[1] k/kg mol^{-1}
278.15	0	69.57 ± 0.11	-0.066
	0.165	71.78	
	0.300	72.70	
288.15	0	45.75 ± 0.06	-0.146
	0.180	48.68	
	0.300	50.35	
298.15	0	32.31 ± 0.08	-0.248
	0.305	37.26	
	0.624	43.25	
308.15	0	23.91 ± 0.07	-0.386
	0.193	28.06	
	0.304	30.24	

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[1] Setchenow constant, k/kg mol^{-1} = (1/m_3/mol kg^{-1})) log (S_1°/S_1).

The authors specify the value of the constant for m_3/mol kg^{-1} = 0.1.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The apparatus was similar to that described by Ben-Naim and Baer (1). Teflon needle valves were used in place of stopcocks.

The apparatus consists of three main parts, a dissolution cell of 300 to 600 cm^3 capacity, a gas volume measuring column, and a manometer.

The solvent is degassed in the dissolution cell, the gas is introduced and dissolved while the liquid is kept stirred by a magnetic stirrer immersed in the water bath. Dissolution of the gas results in the change in the height of a column of mercury which is measured by a cathetometer.

SOURCE AND PURITY OF MATERIALS:

1. Propane. Matheson Co. Stated to be better than 99.9 per cent pure.
2. Tetrabutylammonium bromide. Eastman Kodak Co. Recrystallized and analyzed. Better than 99.9 per cent pure.
3. Water. Distilled from an all Pyrex apparatus. Specific conductivity 1.5 x 10^{-6} (ohm cm)$^{-1}$.

ESTIMATED ERROR:

δT/K = ±0.005
$\delta S_1/S_1$ = ±0.003

REFERENCES:

1. Ben-Naim, A.; Baer, S. *Trans. Faraday Soc.* <u>1963</u>, *59*, 2735.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Butane; C_4H_{10}; [106-97-8] (2) *N,N,N*-Tributylbutanaminium bromide or tetrabutylammonium bromide; $C_{16}H_{36}NBr$; [1643-19-2] (3) Water; H_2O; [7732-18-5]	Wen, W.-Y.; Hung, J.H. *J. Phys. Chem.* 1970, *74*, 170-180.

VARIABLES:	PREPARED BY:
T/K: 278.15-308.15 *P*/kPa: 101.325 (1 atm) m_3/mol kg^{-1}: 0-0.310	H.L. Clever

EXPERIMENTAL VALUES:

T/K	Salt Molality m_3/mol kg^{-1}	Butane Solubility S_1/cm^3(STP) kg^{-1}	Setchenow Constant[1] k/kg mol^{-1}
278.15	0	62.00 ± 0.10	-0.104
	0.310	66.65	
288.15	0	39.20 ± 0.05	-0.180
	0.310	44.35	
298.15	0	26.34 ± 0.06	-0.286
	0.310	31.92	
308.15	0	19.27 ± 0.06	-0.435
	0.310	25.56	

[1] Setchenow constant, k/kg mol^{-1} = $(1/(m_3/\text{mol kg}^{-1}))\log(S_1^\circ/S_1)$.

The authors specify the value of the constant for m_3/mol kg^{-1} = 0.1

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The apparatus was similar to that described by Ben-Naim and Baer (1). Teflon needle valves were used in place of stopcocks.

The apparatus consists of three main parts, a dissolution cell of 300 to 600 cm^3 capacity, a gas volume measuring column, and a manometer.

The solvent is degassed in the dissolution cell, the gas is introduced and dissolved while the liquid is kept stirred by a magnetic stirrer immersed in the water bath. Dissolution of the gas results in the change in the height of a column of mercury which is measured by a cathetometer.

SOURCE AND PURITY OF MATERIALS:

1. Butane. Matheson Co. Stated to be better than 99.9 per cent pure.
2. Tetrabutylammonium bromide. Eastman Kodak Co. Recrystallized and analyzed. Better than 99.9 per cent pure.
3. Water. Distilled from an all Pyrex apparatus. Specific conductivity 1.5 x 10^{-6} (ohm cm)$^{-1}$.

ESTIMATED ERROR:

δT/K = ±0.005

$\delta S_1/S_1$ = ±0.003

REFERENCES:

1. Ben-Naim, A.; Baer, S. *Trans. Faraday Soc.* 1963, *59*, 2735.

COMPONENTS:

(1) Propane; C_3H_8; [74-98-6]

(2) 2-Hydroxy-*N*,*N*,*N*-tris(2-hydroxyethyl)-ethanaminium bromide or tetraethanolammonium bromide; $C_8H_{20}NO_4Br$; [4328-04-5]

(3) Water; H_2O; [7732-18-5]

ORIGINAL MEASUREMENTS:

Wen, W.-Y.; Hung, J.H.

J. Phys. Chem. 1970, *74*, 170-180.

VARIABLES:

T/K: 278.15-308.15
P/kPa: 101.325 (1 atm)
m_3/mol kg^{-1}: 0-0.508

PREPARED BY:

H.L. Clever

EXPERIMENTAL VALUES:

T/K	Salt Molality m_3/mol kg^{-1}	Propane Solubility S_1/cm^3(STP) kg^{-1}	Setchenow Constant[1] k/kg mol^{-1}
278.15	0	69.57 ± 0.11	0.000
	0.153	69.92	
288.15	0	45.75 ± 0.06	-0.025
	0.160	46.13	
298.15	0	32.31 ± 0.08	-0.061
	0.159	32.64	
	0.508	33.93	
308.15	0	23.91 ± 0.007	-0.113
	0.154	24.78	

[1] Setchenow constant, k/kg mol^{-1} = (1/(m_3/mol kg^{-1})) log (S_1°/S_1).

The authors specify the value of the constant for m_3/mol kg^{-1} = 0.1.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The apparatus was similar to that described by Ben-Naim and Baer (1). Teflon needle valves were used in place of stopcocks.

The apparatus consists of three main parts, a dissolution cell of 300 to 600 cm^3 capacity, a gas volume measuring column, and a manometer.

The solvent is degassed in the dissolution cell, the gas is introduced and dissolved while the liquid is kept stirred by a magnetic stirrer immersed in the water bath. Dissolution of the gas results in the change in the height of a column of mercury which is measured by a cathetometer.

SOURCE AND PURITY OF MATERIALS:

1. Propane. Matheson Co. Stated to be better than 99.9 per cent pure.
2. Tetraethanolammonium bromide. Prepared and analyzed. Better than 99.9 per cent pure. m.p., t/°C 102.
3. Water. Distilled from an all Pyrex apparatus. Specific conductivity 1.5 x 10^{-6} (ohm cm)$^{-1}$.

ESTIMATED ERROR:

δT/K = ±0.005
$\delta S_1/S_1$ = ±0.003

REFERENCES:

1. Ben-Naim, A.; Baer, S. *Trans. Faraday Soc.* 1963, *59*, 2735.

COMPONENTS:

(1) Butane; C_4H_{10}; [106-97-8]

(2) Lanthanum chloride; $LaCl_3$; [10099-58-8]

(3) Water; H_2O; [7732-18-5]

ORIGINAL MEASUREMENTS:

Morrison, T. J.; Billett, F.

J. Chem. Soc. 1952, 3819 - 3822.

VARIABLES:

T/K: 285.75 - 344.85

p/kPa: 101.325 (1 atm)

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

Temperature			Salt Effect Parameters		
t/°C	T/K	1/(T/K)	(1/c)log(S°/S)[1]	(1/m)log(S°/S)	(1/m)log(x°/x)
12.6	285.75	0.0035	0.182	0.546	0.576
30.0	303.15	0.0033	0.154	0.462	0.492
49.4	322.55	0.0031	0.154	0.462	0.492
71.7	344.85	0.0029	0.140	0.420	0.450

[1] For the 1-3 electrolyte the compiler changed to m = c/3 for m_2/mol kg^{-1} in the salt effect parameter.

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

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

Note that the first salt effect parameter above uses the author's notation with c in gram equivalents per kg water. The author's c would be better represented as $m_2((1/3)LaCl_3)/\text{mol kg}^{-1} = 3\ m_2(LaCl_3)/\text{mol kg}^{-1}$.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

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

SOURCE AND PURITY OF MATERIALS:

(1) Butane. Prepared from Grignard reagent. A second sample, Anglo-Iranian Oil Co. stated to be 99 per cent pure, gave the same result.

(2) Lanthanun chloride. "AnalaR" material.

(3) Water. No information given.

ESTIMATED ERROR:

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

REFERENCES:

1. Morrison, T. J.; Billett, F. *J. Chem. Soc.* 1948, 2033.

COMPONENTS:

(1) Butane; C_4H_{10}; [106-97-8]

(2) Barium chloride; $BaCl_2$; [10361-37-2]

(3) Water; H_2O; [7732-18-5]

ORIGINAL MEASUREMENTS:

Morrison, T. J.; Billett, F.

J. Chem. Soc. 1952, 3819 - 3822.

VARIABLES:

T/K: 285.75 - 344-85

P/kPa: 101.325 (1 atm)

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

Temperature			Salt Effect Parameters		
t/°C	T/K	1/(T/K)	(1/c)log(S°/S)[1]	(1/m)log(S°/S)	(1/m)log(x°/x)
12.6	285.75	0.0035	0.250	0.500	0.523
30.0	303.15	0.0033	0.210	0.420	0.443
49.4	322.55	0.0031	0.180	0.360	0.383
71.7	344.85	0.0029	0.165	0.330	0.353

[1] For the 1-2 electrolyte the compiler changed to m = c/2 for m_2/mol kg^{-1} in the salt effect parameter.

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

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

Note that the first salt effect parameter above uses the author's notation with c in gram equivalents per kg water. The author's c would be better represented as $m_2(\frac{1}{2}BaCl_2)$/mol kg^{-1} = 2 $m_2(BaCl_2)$/mol kg^{-1}.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

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

SOURCE AND PURITY OF MATERIALS:

(1) Butane. Prepared from Grignard reagent. A second sample, Anglo-Iranian Oil Co. stated to be 99 per cent pure, gave the same result.

(2) Barium chloride. "AnalaR" material.

(3) Water. No information given.

ESTIMATED ERROR:

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

REFERENCES:

1. Morrison, T. J.; Billett, F. *J. Chem. Soc.* 1948, 2033.

COMPONENTS:

(1) Propane; C_3H_8; [74-98-6]

(2) Lithium chloride; LiCl; [7447-41-8]

(3) Water; H_2O; [7732-18-5]

ORIGINAL MEASUREMENTS:

Morrison, T. J.; Billett, F.

J. Chem. Soc. 1952, 3819 - 3822.

VARIABLES:

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

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

Temperature			Salt Effect Parameters	
t/°C	T/K	1/(T/K)	$(1/m_2)\log(S°/S)$[1]	$(1/m_2)\log(x°/x)$
12.6	285.75	0.0035	0.175	0.190
30.0	303.15	0.0033	0.152	0.167
49.4	322.55	0.0031	0.138	0.153
71.7	344.85	0.0029	0.138	0.153

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

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

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

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

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

SOURCE AND PURITY OF MATERIALS:

(1) Propane. Prepared from Grignard reagent.

(2) Lithium chloride. "AnalaR" material.

(3) Water. No information given.

ESTIMATED ERROR:

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

REFERENCES:

1. Morrison, T. J.; Billett, F. *J. Chem. Soc.* 1948, 2033.

COMPONENTS:

(1) Butane; C_4H_{10}; [106-97-8]

(2) Lithium chloride; LiCl; [7447-41-8]

(3) Water; H_2O; [7732-18-5]

ORIGINAL MEASUREMENTS:

Morrison, T. J.; Billett, F.

J. Chem. Soc. 1952, 3819 - 3822.

VARIABLES:

T/K: 285.75 - 344.85

p/kPa: 101.325 (1 atm)

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

Temperature			Salt Effect Parameters	
t/°C	T/K	1/(T/K)	$(1/m_2)\log(S°/S)$[1]	$(1/m_2)\log(x°/x)$
12.6	285.75	0.0035	0.198	0.213
30.0	303.15	0.0033	0.171	0.186
49.4	322.55	0.0031	0.155	0.170
71.7	344.85	0.0029	0.150	0.165

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

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

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

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

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

SOURCE AND PURITY OF MATERIALS:

(1) Butane. Prepared from Grignard reagent. A second sample, Anglo-Iranian Oil Co. stated to be 99 per cent pure, gave the same result.

(2) Lithium chloride. "AnalaR" material.

(3) Water. No information given.

ESTIMATED ERROR:

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

REFERENCES:

1. Morrison, T. J.; Billett, F. *J. Chem. Soc.* 1948, 2033.

COMPONENTS:

(1) Propane; C_3H_8; [74-98-6]

(2) Sodium chloride; NaCl; [7647-14-5]

(3) Water; H_2O; [7732-18-5]

ORIGINAL MEASUREMENTS:

Morrison, T. J.; Billett, F.

J. Chem. Soc. 1952, 3819 - 3822.

VARIABLES:

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

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

Temperature			Salt Effect Parameters	
t/°C	T/K	1/(T/K)	$(1/m_2)\log(S°/S)$[1]	$(1/m_2)\log(x°/x)$
12.6	285.75	0.0035	0.216	0.231
30.0	303.15	0.0033	0.194	0.224
49.4	322.55	0.0031	0.178	0.193
71.7	344.85	0.0029	0.165	0.180

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

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

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

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

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

SOURCE AND PURITY OF MATERIALS:

(1) Propane. Prepared from Grignard reagent.

(2) Sodium chloride. "AnalaR" material.

(3) Water. No information given.

ESTIMATED ERROR:

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

REFERENCES:

1. Morrison, T. J.; Billett, F. *J. Chem. Soc.* 1948, 2033.

COMPONENTS:

(1) Propane; C_3H_8; [74-98-6]

(2) Sodium chloride; NaCl; [7647-14-5]

(3) Water; H_2O; [7732-18-5]

ORIGINAL MEASUREMENTS:

Umano, S.; Nakano, Y.

Kogyo Kagaku Zasshi 1958, *61*, 536-44.

VARIABLES:

T/K = 264.7-298.2

P/kP = 10.3-102.5

PREPARED BY:

H.L. Clever

EXPERIMENTAL VALUES:

Temperature		Sodium Chloride		Total Pressure	Propane Partial Pressure	Mol Ratio
t/°C	T/K	wt %	m_2/mol kg^{-1}	p/atm	p_1/atm	$10^5(n_1/n_3)$
-8.5	264.7	16.36	3.347	0.1095	0.1068	0.2051
				0.3064	0.3036	0.5650
				0.5037	0.5010	0.9580
				0.7014	0.6987	1.3342
				1.0047	1.0020	1.8074
-5	268.2	11.45	2.213	0.1095	0.1057	0.4177
				0.3068	0.3031	0.9985
				0.5042	0.5005	1.6562
				0.7016	0.6978	2.2288
				1.0042	1.0005	3.2027
		16.36	3.347	0.1101	0.1065	0.1786

continued...

The Kelvin temperature and the sodium chloride molality values were calculated by the compiler.

The mole ratio is moles of propane per mole of water. For the solutions containing no sodium chloride the values are the same as the mole fraction. Multiplication by 55.51 will convert the values to molality, m_1/mol kg^{-1}.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The apparatus consists of a gas reservoir, a manometer-buret system, a thermostated mixing cell, and a solvent reservoir.

The apparatus is evacuated, and then filled with gas to condition the glass surface, vinyl tubing and stopcock grease. The solvent is degassed by boiling under reduced pressure. The solvent is transferred to the evacuated mixing cell and the gas is added to the pressure of the measurement. The cell is shaken until equilibrium is attained.

SOURCE AND PURITY OF MATERIALS:

1. Oakford Gas and Appliance Co. Long Beach, California, U.S.A. Purity found to be at least 99.0 per cent.
2. Source and purity not given.
3. Treatment not specified.

ESTIMATED ERROR:

δT/K = 0.05

$\delta m_2/m_2$ = 0.01

$\delta n_1/n_1$ = 0.01 (compiler)

REFERENCES:

COMPONENTS:

(1) Propane; C_3H_8; [74-98-6]

(2) Sodium chloride; NaCl; [7647-14-5]

(3) Water; H_2O; [7732-18-5]

ORIGINAL MEASUREMENTS:

Umano, S.; Nakano, Y.

Kogyo Kagaku Zasshi 1958, *61*, 536-44.

VARIABLES:

T/K: 264.7-298.2

P/kPa: 10.3-102.5

PREPARED BY:

H.L. Clever

EXPERIMENTAL VALUES:

Temperature		Sodium Chloride		Total Pressure	Propane Partial Pressure	Mol Ratio
t/°C	T/K	wt %	m_2/mol kg^{-1}	p/atm	p_1/atm	$10^5(n_1/n_3)$
-5	268.2	16.36	3.347	0.3175	0.3065	0.5191
				0.5020	0.4984	0.8903
				0.6993	0.6957	1.1398
				1.0014	0.9977	1.6501
		23.70	5.315	1.0118	1.0086	0.8087
0	273.2	0	0	0.1035	0.09747	0.4410
				0.3009	0.2948	1.5795
				0.4982	0.4922	3.1777
				0.6956	0.6896	4.6873
				0.9982	0.9922	6.7939
		2.96	0.522	0.1088	0.1028	0.5295
				0.3057	0.2998	1.5463
				0.5027	0.4968	2.6743
				0.7007	0.6948	3.6457
				1.0039	0.9980	5.1633
		5.77	1.048	0.1136	0.1078	0.4815
				0.3094	0.3037	1.3552
				0.5068	0.5010	2.1150
				0.7050	0.6992	3.0650
				1.0073	1.0016	4.0366
		11.45	2.213	0.1134	0.1078	0.3055
				0.3107	0.3051	0.8077
				0.5074	0.5019	1.3892
				0.7053	0.6997	1.8409
				1.0074	1.0018	2.5828
		16.36	3.347	0.1111	0.1058	0.1696
				0.3085	0.3032	0.4680
				0.5059	0.5005	0.7504
				0.7032	0.6979	1.0220
				1.0059	1.0005	1.4730
		23.70	5.315	1.0118	1.0072	0.7043
5	278.2	0	0	0.1048	0.09621	0.4755
				0.3022	0.2936	1.5059
				0.5008	0.4922	2.5663
				0.6969	0.6883	3.5123
				1.0008	0.9922	5.2597
		2.96	0.522	0.1005	0.09157	0.4297
				0.2946	0.2889	1.1992
				0.4952	0.4863	2.1037
				0.6929	0.6839	2.9700
				0.9966	0.9876	4.2357
		5.77	1.048	0.1013	0.0930	0.3336
				0.2987	0.2904	1.0695
				0.4960	0.4877	1.7265
				0.6945	0.6862	2.5254
				0.9971	0.9888	3.4242

continued...

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Propane; C_3H_8; [74-98-6] (2) Sodium Chloride; NaCl; [7647-14-5] (3) Water; H_2O; [7732-18-5]	Umano, S.; Nakano, Y. *Kogyo Kagaku Zasshi* 1958, *61*, 536-44.
VARIABLES:	**PREPARED BY:**
T/K: 264.7-298.2 P/kPa: 10.3-102.5	H.L. Clever

EXPERIMENTAL VALUES:

Temperature		Sodium Chloride		Total Pressure	Propane Partial Pressure	Mol Ratio
t/°C	T/K	wt %	m_2/mol kg^{-1}	p/atm	p_1/atm	$10^5(x_1/x_3)$
5	278.2	11.45	2.213	0.1086	0.1007	0.2607
				0.3057	0.2978	0.6694
				0.5030	0.4952	1.0404
				0.7004	0.6925	1.5609
				1.0079	1.0000	2.1845
		16.36	3.347	0.1159	0.1084	0.1584
				0.3130	0.3062	0.3485
				0.5069	0.5069	0.5088
				0.7043	0.6968	0.8903
				1.0067	0.9992	1.2221
		23.70	5.315	1.0041	0.9974	0.5073
10	283.2	0	0	0.1090	0.09690	0.3078
				0.3064	0.2943	1.1979
				0.5038	0.4916	2.0493
				0.7011	0.6880	3.0487
				1.0037	0.9916	4.2204
		2.96	0.522	0.1141	0.1021	0.3449
				0.3106	0.2986	1.0784
				0.5071	0.4951	1.7806
				0.7014	0.6895	2.4952
				1.0033	0.9913	3.6475
		5.77	1.048	0.1026	0.0909	0.2942
				0.3000	0.2883	0.8653
				0.5046	0.4929	1.3730
				0.7022	0.6905	2.0031
				1.0043	0.9924	2.8709
		11.45	2.213	0.1171	0.1060	0.2167
				0.3145	0.3033	0.6415
				0.5119	0.5007	0.9466
				0.7055	0.6942	1.3275
				1.0071	0.9959	1.8558
		16.36	3.347	0.1032	0.0926	0.1366
				0.3006	0.2899	0.3625
				0.4964	0.4857	0.5512
				0.7009	0.6885	0.8103
				1.0107	1.0000	1.1421
		23.70	5.315	1.0012	0.9917	0.4550
15	288.2	0	0	0.1061	0.08914	0.2686
				0.3033	0.2865	0.9077
				0.5007	0.4839	1.6691
				0.6974	0.6805	2.3853
				1.0000	0.9832	3.4902
		2.96	0.522	0.1168	0.9943	0.3422
				0.3139	0.2965	0.9182
				0.5112	0.4939	1.4920

continued...

COMPONENTS:

(1) Propane; C_3H_8; [74-98-6]

(2) Sodium Chloride; NaCl; [7647-14-5]

(3) Water; H_2O; [7732-18-5]

ORIGINAL MEASUREMENTS:

Umano, S.; Nakano, Y.

Kogyo Kagaku Zasshi 1958, *61*, 536-44.

VARIABLES:

T/K: 264.7-298.2

P/kPa: 10.3-102.5

PREPARED BY:

H.L. Clever

EXPERIMENTAL VALUES:

Temperature		Sodium Chloride		Total Pressure	Propane Partial Pressure	Mol Ratio
t/°C	T/K	wt %	m_2/mol kg^{-1}	p/atm	p_1/atm	$10^5(x_1/x_3)$
15	288.2	2.96	0.522	0.7086	0.6912	2.1916
				1.0112	0.9939	3.0898
		5.77	1.048	0.1018	0.08558	0.2332
				0.2991	0.2829	0.7281
				0.4965	0.4803	1.2311
				0.6939	0.6777	1.6318
				0.9965	0.9803	2.4526
		11.45	2.213	0.1166	0.1010	0.1495
				0.3134	0.2979	0.5041
				0.5092	0.4937	0.7743
				0.7041	0.6886	1.1473
				1.0067	0.9912	1.4972
		16.36	3.347	0.1060	0.0911	0.1161
				0.3033	0.2885	0.3116
				0.4999	0.4851	0.4737
				0.6981	0.6832	0.7003
				1.0007	0.9858	0.9756
		23.70	5.315	1.0053	0.9917	0.4112
20	293.2	0	0	0.1039	0.08087	0.1309
				0.3013	0.2782	0.8018
				0.4981	0.4751	1.3908
				0.6955	0.6724	1.9943
				0.9981	0.9750	3.0749
		2.96	0.522	0.1045	0.08176	0.2700
				0.3012	0.2798	0.7446
				0.4985	0.4758	1.2423
				0.6958	0.6731	1.8149
				0.9993	0.9766	2.4687
		5.77	1.048	0.0962	0.07396	0.1658
				0.2919	0.2695	0.6093
				0.4883	0.4661	0.9729
				0.6836	0.6608	1.4216
				0.9854	0.9631	1.9701
		11.45	2.213	0.1049	0.0835	0.1162
				0.3023	0.2809	0.4384
				0.4997	0.4782	0.6929
				0.6970	0.6756	1.0191
				1.0001	0.9786	1.4871
		16.36	3.347	0.1122	0.0918	0.0863
				0.3096	0.2891	0.3222
				0.5069	0.4865	0.4545
				0.7046	0.6841	0.6536
				1.0072	0.9867	0.8977
		23.70	5.315	0.9906	0.9721	0.3770
25	298.2	2.96	0.522	0.1116	0.08046	0.2413
				0.3090	0.2778	0.6931

continued...

COMPONENTS	ORIGINAL MEASUREMENTS:
(1) Propane; C_3H_8; [74-98-6] (2) Sodium Chloride; NaCl; [7647-14-5] (3) Water; H_2O; [7732-18-5]	Umano, S.; Nakano, Y. *Kogyo Kagaku Zasshi* 1958, *61*, 536-44.
VARIABLES: T/K: 264.7-298.2 P/kPa: 10.3-102.5	PREPARED BY: H.L. Clever

EXPERIMENTAL VALUES: (concluded)

Temperature		Sodium Chloride		Total Pressure	Propane Partial Pressure	Mol Ratio
t/°C	T/K	wt %	m_2/mol kg^{-1}	p/atm	p_1/atm	$10^5(x_1/x_3)$
25	298.2	2.96	0.522	0.5074	0.4762	1.1643
				0.7049	0.6737	1.6451
				1.0060	0.9749	2.4117

The Kelvin temperature and the sodium chloride molality values were calculated by the compiler.

The mole ratio is moles or propane per mole of water. For the solutions containing no sodium chloride the values are the same as the mole fraction. Multiplication by 55.51 will convert the values to molality, m_1/mol kg^{-1}.

COMPONENTS:

(1) Propane; C_3H_8; [74-98-6]
(2) Sodium chloride; NaCl;
[7647-14-5]
(3) Water; H_2O; [7732-18-5]

ORIGINAL MEASUREMENTS:

Yano, T.; Suetaka, T.;
Umehara, T.; Horiuchi, A.
Kagaku Kogaku
1974, *38*, 320-323.

VARIABLES:

T/K: 298.2
c_2/mol L^{-1}: 0-1.5
P/kPa: 101.325

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K = 298.2

Concentration of electrolyte c_2 /mol L^{-1}	Solubility[a] of propane /mmol L^{-1}
0.000	1.44
0.250	1.34
0.750	0.941
1.000	0.814
1.500	0.619

[a] At 1 atmosphere pressure.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

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

SOURCE AND PURITY OF MATERIALS:

1. High purity sample, purity better than 99.5 mole per cent.
2. Special grade.
3. Distilled.

ESTIMATED ERROR:

$\delta s/s = 0.01$ (compiler)

REFERENCES:

1. Yano, T.; Suetaka, T.; Umehara, T. *Nippon Kagaku Kaishi* 1972, *11*, 2194.

COMPONENTS:

(1) Butane; C_4H_{10}; [106-97-8]

(2) Sodium chloride; NaCl; [7647-14-5]

(3) Water; H_2O; [7732-18-5]

ORIGINAL MEASUREMENTS:

Umano, S.; Nakano, Y.

Kogyo Kagaku Zasshi 1958, *61*, 536-44.

VARIABLES:

T/K: 263.9-293.2

P/kPa: 61.7-101.9

PREPARED BY:

H.L. Clever

EXPERIMENTAL VALUES:

Temperature		Sodium Chloride		Total Pressure	Butane Partial Pressure	Mol Ratio
t/°C	T/K	wt %	m_1/mol kg^{-1}	p/atm	p_1/atm	$10^5(x_1/x_3)$
-9.3	263.9	19.8	4.224	0.6093	0.6068	0.398
-8.6	264.6	16.46	3.371	0.5991	0.5963	0.617
-3.15	270.0	16.46	3.371	0.8557	0.7924	1.684
0	273.2	0	0	1.0030	0.9969	6.793
		4.79	0.961	0.9989	0.9931	3.950
		10.01	1.903	1.0000	0.9944	2.388
		16.46	3.371	1.0060	1.0009	1.200
		19.8	4.224	1.0041	0.9991	0.960
5	278.2	0	0	1.0030	0.9944	4.925
		4.79	0.861	0.9989	0.9906	2.746
		10.01	1.903	1.0000	0.9921	1.672
		16.46	3.371	1.0060	0.9987	0.921
		19.8	4.224	1.0041	0.9970	0.701

continued...

The Kelvin temperature and the sodium chloride molality values were calculated by the compiler.

The mole ratio is moles of butane per mole of water. For the solutions containing no sodium chloride the values are the same as the mole fraction. Multiplication by 55.51 will convert the values to molality, m_1/mol kg^{-1}.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The apparatus consists of a gas reservoir, a manometer-buret system, a thermostated mixing cell, and a solvent reservoir.

The apparatus is evacuated, and then filled with gas to condition the glass surface, vinyl tubing and stopcock grease. The solvent is degassed by boiling under reduced pressure. The solvent is transferred to the evacuated mixing cell and the gas is added to the presure of the measurement. The cell is shaken until equilibrium is attained.

SOURCE AND PURITY OF MATERIALS:

1. Oakford Gas and Appliance Co. Long Beach, California U.S.A. Purity found to be at least 99.0 per cent.
2. Source and purity not given.
3. Treatment not specified.

ESTIMATED ERROR:

$\delta T/K$ = 0.05

$\delta m_2/m_2$ = 0.01

$\delta n_1/n_1$ = 0.01 (compiler)

REFERENCES:

COMPONENTS:

(1) Butane; C_4H_{10}; [106-97-8]

(2) Sodium chloride; NaCl; [7647-14-5]

(3) Water; H_2O; [7732-18-5]

ORIGINAL MEASUREMENTS:

Rice, P. A.; Gale, R. P.; Barduhn, A. J.

J. Chem. Eng. Data 1976, *21*, 204-6.

VARIABLES:

$T/K = 273.45 - 292.15$
$p_1/kPa = 51.98, 73.06, 101.325$
$m_2/mol\ kg^{-1} = 0, 0.621, 1.288$

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

Temperature		Partial Pressure	Sodium Chloride		Solubility	Salt Effect Parameter
$t/^{\circ}C$	T/K	p_1/atm	wt %	$m_2/mol\ kg^{-1}$	ppm	$k_{smm}/kg\ mol^{-1}$
0.3	273.45	1	0	0	(211.8)	-
			7.0	1.288	99.3	0.23
0.5	273.65	1	0	0	(209.2)	-
			3.5	0.621	137.2	0.27
3	276.15	1	0	0	(181.1)	-
		1	3.5	0.621	113.4	0.31
		0.513	7.0	1.288	40.9	-
		0.721			56.9	-
		1			79.8	0.25
7	280.15	1	0	0	(147.1)	-
			3.5	0.621	92.9	0.30
			7.0	1.288	65.5	0.25
11	284.15	1	0	0	(122.7)	-
			3.5	0.621	84.1	0.24
			7.0	1.288	55.0	0.25
14	287.15	1	0	0	(109.0)	-
			7.0	1.288	50.1	0.24
15	288.15	1	0	0	(105.1)	-
			3.5	0.621	74.7	0.22
19	292.15	1	0	0	(92.1)	-
			3.5	0.621	63.8	0.23
			7.0	1.288	46.0	0.21

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The solubility equilibrium was established in a one liter Pyrex cell with a Plexiglass top with ports for sampling, pressure connection, vacuum line, and introduction of the gas.

About 700 cm^3 of solvent was placed in the cell, it was sealed, thermostated, and evacuated to the vapor pressure of the solvent for about one hour to degass the solvent.

Butane gas was added and the system was stirred for 24-48 hours. It was assumed that equilibrium was established when no pressure change was observed in a four hour period. Saturation was approached from both a higher and a lower temperature. Samples of the liquid were taken in a microliter syringe. The samples were injected directly into a total carbon analyzer. Three to nine samples were analyzed.

The compiler added the solubility in water from the smoothed equation of the author's data. The compiler also added the T/K and sodium chloride molality data, and calculated butane molality values (not shown) and the salt effect parameters.
ppm = parts per million by weight

SOURCE AND PURITY OF MATERIALS:

(1) Butane. Source not given. Stated to be 99.5 % instrument purity.

(2) Sodium chloride. Source not given. Stated to be reagent grade.

(3) Water. No information.

ESTIMATED ERROR:

$\delta T/K = \pm 0.02$
$\delta pmm/pmm = \pm 0.01$

COMPONENTS:

(1) Butane; C_4H_{10}; [106-97-8]

(2) Sodium chloride; NaCl; [7647-14-5]

(3) Water; H_2O; [7732-18-5]

ORIGINAL MEASUREMENTS:

Umano, S.; Nakano, Y.

Kogyo Kagaku Zasshi 1958, *61*, 536-44.

VARIABLES:

T/K: 263.9-293.2

P/kPa: 61.7-101.9

PREPARED BY:

H.L. Clever

EXPERIMENTAL VALUES: concluded

Temperature		Sodium chloride		Total Pressure	Butane Partial Pressure	Mol Ratio
t/°C	T/K	wt %	m_2/mol kg^{-1}	p/atm	p_1/atm	$10^5(x_1/x_3)$
10	283.2	0	0	1.0030	0.9908	3.952
		4.79	0.861	0.9989	0.9872	2.222
		10.01	1.903	1.0000	0.9887	1.365
		16.46	3.371	1.0060	0.9956	0.833
		19.8	4.224	1.0059	0.9958	0.606
15	288.2	0	0	1.0030	0.9865	3.353
		4.79	0.861	0.9989	0.9826	1.949
		10.01	1.903	1.0000	0.9862	1.155
		16.46	3.371	1.0060	0.9910	0.698
		19.8	4.224	1.0059	0.9917	0.519
20	293.2	0	0	1.0030	0.9799	2.776
		4.79	0.861	0.9989	0.9765	1.713
		10.01	1.903	1.0000	0.9784	1.153
		16.46	3.371	1.0060	0.9853	0.632
		19.8	4.224	1.0059	0.9864	0.507

The Kelvin temperature and the sodium chloride molality values were calculated by the compiler.

The mole ratio is moles of butane per mole of water. For the solutions containing no sodium chloride the values are the same as the mole fraction. Multiplication by 55.51 will convert the values to molality, m_1/mol kg^{-1}.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The apparatus consists of a gas reservoir, a manometer-buret system, a thermostated mixing cell, and a solvent reservoir.

The apparatus is evacuated, and then filled with gas to condition the glass surface, vinyl tubing and stopcock grease. The solvent is transferred to the evacuated mixing cell and the gas is added to the pressure of the measurement. The cell is shaken until equilibrium is attained.

SOURCE AND PURITY OF MATERIALS:

1. Oakford Gas and Appliance Co. Long Beach, California U.S.A. Purity found to be at least 99.0 per cent.
2. Source and purity not given.
3. Treatment not specified.

ESTIMATED ERROR:

δT/K = 0.05

$\delta m_2/m_2$ = 0.01

$\delta n_1/n_1$ = 0.01 (compiler)

REFERENCES:

COMPONENTS:

(1) Butane; C_4H_{10}; [106-97-8]

(2) Sodium chloride; NaCl; [7647-14-5]

(3) Water; H_2O; [7732-18-5]

ORIGINAL MEASUREMENTS:

Morrison, T. J.; Billett, F.

J. Chem. Soc. 1952, 3819 - 3822.

VARIABLES:

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

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

Temperature			Salt Effect Parameters	
t/°C	T/K	1/(T/K)	$(1/m_2)\log(S°/S)$[1]	$(1/m_2)\log(x°/x)$
12.6	285.75	0.0035	0.243	0.258
30.0	303.15	0.0033	0.217	0.232
49.4	322.55	0.0031	0.194	0.209
71.7	344.85	0.0029	0.176	0.191

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

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

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

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

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

SOURCE AND PURITY OF MATERIALS:

(1) Butane. Prepared from Grignard reagent. A second sample, Anglo-Iranian Oil Co. stated to be 99 per cent pure, gave the same result.

(2) Sodium chloride. "AnalaR" material.

(3) Water. No information given.

ESTIMATED ERROR:

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

REFERENCES:

1. Morrison, T. J.; Billett, F. *J. Chem. Soc.* 1948, 2033.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Butane; C_4H_{10}; [106-97-8] (2) Sodium chloride; NaCl; [7647-14-5] (3) Water; H_2O; [7732-18-5]	Denton, W.H.; Smith, M.J.S.; Klaschka, J.T.; Forgan, R. *et al.* *Fourth Int. Symp. Fresh Water Sea* 1973, *3*, 291-311.
VARIABLES: T/K: 298.15 m_2/mol kg^{-1}: 0-1.88 P/kPa: 0.101-101.325	**PREPARED BY:** W. Hayduk

EXPERIMENTAL VALUES:

T/K	Salt Concentration Mass%[1]	Molality[2] m_2/mol kg^{-1}	Butane Solubility z[1] /mol(10^{6}mol)$^{-1}$	s[2] /cm^3(STP)kg^{-1}	Setchenow Constant[2] k/kg mol^{-1}
298.15	0	0	21.0	25.0	0.197
	3.5	0.60	16.0	18.6	0.299
	7.0	1.20	9.2	10.4	
	10.5	1.88	6.6	7.26	0.267

[1] Results presented only on a log-log graph which was replotted by compiler for estimation of values shown here. Values show that Henry's law is obeyed; the slope of the graph is 1.

[2] Calculated by compiler using a real gas butane molar volume. The Setchenow constant was calculated on the basis of the butane solubility expressed as mol dm^{-3} and the salt concentration as mol kg^{-1}.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:	SOURCE AND PURITY OF MATERIALS:
A chromatographic technique for analysis of butane in water and aqueous sodium chloride solutions stated to be capable of detecting concentrations down to 0.001 mg dm^{-3} was used. Details not given.	Sources and purities not specified. **ESTIMATED ERROR:** $\delta z/z$ = 0.02 (authors) **REFERENCES:**

COMPONENTS:

(1) Propane; C_3H_8; [74-98-6]
(2) Sodium bromide; NaBr;
[7647-15-6]
(3) Water; H_2O; [7732-18-5]

ORIGINAL MEASUREMENTS:

Yano, T.; Suetaka, T.;
Umehara, T.; Horiuchi, A.
Kagaku Kogaku
1974, *38*, 320-323.

VARIABLES:

T/K: 298.2
c_2/mol L^{-1}: 0-1.5
P/kPa: 101.325

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K = 298.2

Concentration of electrolyte c_2/mol L^{-1}	Solubility[a] of propane /mmol L^{-1}
0.000	1.44
0.500	1.12
1.000	0.872

[a] At 1 atmosphere pressure.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

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

SOURCE AND PURITY OF MATERIALS:

1. High purity sample, purity better than 99.5 mole per cent.
2. Special grade.
3. Distilled.

ESTIMATED ERROR:

$\delta s/s =$ 0.01 (compiler)

REFERENCES:

1. Yano, T.; Suetaka, T.; Umehara, T. *Nippon Kagaku Kaishi* 1972, *11*, 2194.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Propane; C_3H_8; [74-98-6] (2) Sodium carbonate; Na_2CO_3; [497-19-8] (3) Water; H_2O; [7732-18-5]	Yano, T.; Suetaka, T.; Umehara, T.; Horiuchi, A. *Kagaku Kogaku* 1974, *38*, 320-323.
VARIABLES: T/K: 298.2 c_2/mol L^{-1}: 0-1.0 P/kPa: 101.325	PREPARED BY: C. L. Young

EXPERIMENTAL VALUES:

T/K = 298.2

Concentration of electrolyte c_2/mol L^{-1}	Solubility[a] of propane /mmol L^{-1}
0.000	1.44
0.500	0.628
1.000	0.301

[a] At 1 atmosphere pressure.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

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

SOURCE AND PURITY OF MATERIALS:

1. High purity sample, purity better than 99.5 mole per cent.
2. Special grade.
3. Distilled.

ESTIMATED ERROR:

$\delta s/s =$ 0.01 (compiler)

REFERENCES:

1. Yano, T.; Suetaka, T.; Umehara, T. *Nippon Kagaku Kaishi* 1972, *11*, 2194.

COMPONENTS:

(1) Butane; C_4H_{10}; [106-97-8]

(2) Z-9-Octadecenoic acid, sodium salt or sodium oleate; $C_{18}H_{33}O_2.Na$; [143-19-1]

(3) Water; H_2O; [7732-18-5]

ORIGINAL MEASUREMENTS:

Zimmels, Y.; Metzer, A.

J. Coll. Interface Sci. 1976, *57*, 75-84.

VARIABLES:

$T/K = 299.2$
$p_1/kPa = 71.1, 84.4, 97.7$

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

Temperature $t/^\circ C$	Temperature T/K	Sodium Oleate $10^5c_2/mol\ dm^{-3}$	Pressure Range $p_1/mmHg$	Henry's Constant[a] K	Solubility $cm^3(299.2\ K)\ dm^{-3}$ at 760 mmHg
26	299.2	5	0-533	23.81	
			533-633	23.81	
			633-733	22.72	
				23.66 av.	
			0-733	23.74	32.0
		8	0-533	26.31	
			533-633	25.00	
			633-733	22.72	
				25.57 av.	
			0-733	25.39	29.9
		20	0-533	28.57	
			533-633	25.00	
			633-733	23.25	
				27.19 av.	
			0-733	27.31	27.8
		50	0-533	27.77	
			533-633	25.64	
			633-733	20.41	
				26.18 av.	
			0-733	24.80	30.6
		80	0-533	29.41	
			533-633	27.77	
			633-733	25.00	
				28.49 av	
			0-733	27.65	27.5

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

An absorption cell, based on the design of Ben-Naim and Baer (1),was combined with an automated device which acted as a sensitive gas volume meter and constant pressure monitor.

Henry's constant was measured over pressure ranges of 0-533, 533-633 and 633-733 mmHg. The accummulative amount of gas absorbed in the three pressure ranges was summed (av. in above table) and compared with Henry's constant determined over the 0-733 mmHg pressure range.

[a] Henry's constant,

$$K/\text{mmHg cm}^{-3}(299.2\ K)\ \text{dm}^3 = (p_1/\text{mmHg})/(S/\text{cm}^3(299.2\ K)\ \text{dm}^{-3}$$

The solubility at 299.2 K and 760 mm Hg was calculated by the compiler from the 0-733 mmHg Henry's constant.

The paper shows the solubility of CH_4, C_2H_6, C_3H_8, and C_4H_{10} at 46 °C (319.2 K) in aqueous sodium oleate on a small graph.

SOURCE AND PURITY OF MATERIALS:

(1) Butane. Matheson Co., Inc. Stated to be 99.9 per cent or better purity.

(2) Sodium oleate. Prepared by the neutralization of oleic acid (Fluka, 99.5 %) by sodium hydroxide (analytical grade).

(3) Water. Distilled. Specific conductivity $(2\pm0.1)\times10^{-6}\Omega^{-1}cm^{-1}$. Surface tension 72.2-72.5 dyne cm^{-1}.

ESTIMATED ERROR:

$\delta T/K = \pm\ 0.1$
$\delta K/K = \pm\ 0.005$ (authors)

REFERENCES:

1. Ben Naim, A.; Bear, S. *Trans. Faraday Soc.* 1963, *59*,2735.

2. Zimmels, Y. *Rev. Sci. Instrum.* 1975, *46*, 726.

COMPONENTS:

(1) Propane; C_3H_8; [74-98-6]

(2) Potassium chloride; KCl; [7747-40-7]

(3) Water; H_2O; [7732-18-5]

ORIGINAL MEASUREMENTS:

Yano, T.; Suetaka, T.; Umehara, T.; Horiuchi, A.

Kagaku Kogaku

1974, *38*, 320-323.

VARIABLES:

T/K: 298.2

c_2/mol L^{-1}: 0-1.5

P/kPa: 101.325

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K = 298.2

Concentration of electrolyte c_2/mol L^{-1}	Solubility[a] of propane /mmol L^{-1}
0.000	1.44
0.250	1.35
0.500	1.14
1.000	0.895
1.500	0.669

[a] At 1 atmosphere pressure.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

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

SOURCE AND PURITY OF MATERIALS:

1. High purity sample, purity better than 99.5 mole per cent.
2. Special grade.
3. Distilled.

ESTIMATED ERROR:

$\delta s/s = 0.01$ (compiler)

REFERENCES:

1. Yano, T.; Suetaka, T.; Umehara, T. *Nippon Kagaku Kaishi* 1972, *11*, 2194.

COMPONENTS:

(1) Butane; C_4H_{10}; [106-97-8]

(2) Potassium chloride; KCl; [7447-40-7]

(3) Water; H_2O; [7732-18-5]

ORIGINAL MEASUREMENTS:

Morrison, T. J.; Billett, F.

J. Chem. Soc. 1952, 3819 - 3822.

VARIABLES:

T/K: 285.75 - 344.85

p/kPa: 101.325 (1 atm)

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

Temperature			Salt Effect Parameters	
t/°C	T/K	1/(T/K)	$(1/m_2)\log(S°/S)$[1]	$(1/m_2)\log(x°/x)$
12.6	285.75	0.0035	0.200	0.215
30.0	303.15	0.0033	0.182	0.197
49.4	322.55	0.0031	0.164	0.179
71.7	344.85	0.0029	0.144	0.159

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

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

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

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

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

SOURCE AND PURITY OF MATERIALS:

(1) Butane. Prepared from Grignard reagent. A second sample, Anglo-Iranian Oil Co. stated to be 99 per cent pure, gave the same result.

(2) Potassium chloride. "AnalaR" material.

(3) Water. No information given.

ESTIMATED ERROR:

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

REFERENCES:

1. Morrison, T. J.; Billett, F. *J. Chem. Soc.* 1948, 2033.

COMPONENTS:

(1) Propane; C_3H_8; [74-98-6]
(2) Potassium bromide; KBr; [7758-02-3]
(3) Water; H_2O; [7732-18-5]

ORIGINAL MEASUREMENTS:

Yano, T.; Suetaka, T.;
Umehara, T.; Horiuchi, A.
Kagaku Kogaku
1974, *38*, 320-323.

VARIABLES:

T/K: 298.2
c_2/mol L^{-1}: 0, 0.5
P/kPa: 101.325

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K = 298.2

Concentration of electrolyte c_2/mol L^{-1}	Solubility[a] of propane /mmol L^{-1}
0.000	1.44
0.500	1.11

[a] At 1 atmosphere pressure.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

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

SOURCE AND PURITY OF MATERIALS:

1. High purity sample, purity better than 99.5 mole per cent.
2. Special grade.
3. Distilled.

ESTIMATED ERROR:

$\delta s/s =$ 0.01 (compiler)

REFERENCES:

1. Yano, T.; Suetaka, T.; Umehara, T. *Nippon Kagaku Kaishi* 1972, *11*, 2194.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Butane; C_4H_{10}; [106-97-8] (2) Potassium bromide; KBr; [7758-02-3] (3) Water; H_2O; [7732-18-5]	Morrison, T. J.; Johnstone, N. B. B. *J. Chem. Soc.* 1955, 3655 - 9.

VARIABLES:	PREPARED BY:
$T/K = 298.15$ $p/kPa = 101.325$ $m_2/mol\ kg^{-1} = 1.0$	H. L. Clever

EXPERIMENTAL VALUES:

Temperature		Potassium Bromide	Salt Effect Parameter	
$t/^{\circ}C$	T/K	$m_2/mol\ kg^{-1}$	$k_{smm}/kg\ mol^{-1}$	$k_{smx}/kg\ mol^{-1}$
25	298.15	1.0	0.174	0.189

The compiler calculated the k_{smx} value.

The salt effect parameter is based on two measurements, the solubility of butane in water and in 1.0 molal KBr solution.

The solubilities are not given in the paper.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The method of Morrison and Billett (1) is used. The previously degassed solvent flows in a thin film down an absorption helix through the solvent vapor saturated butane at a total pressure of one atmosphere. Volume changes are measured in attached calibrated burets.

SOURCE AND PURITY OF MATERIALS:

(1) Butane. British Oxygen Co. Purest sample available.

(2) Potassium bromide. No information.

(3) Water. No information.

ESTIMATED ERROR:

$\delta k_{smm}/kg\ mol^{-1} = \pm 0.010$

REFERENCES:

1. Morrison, T. J.; Billett, F. *J. Chem. Soc.* 1952, 3819.

COMPONENTS:

(1) Propane; C_3H_8; [74-98-6]

(2) Potassium iodide; KI; [7681-11-0]

(3) Water; H_2O; [7732-18-5]

ORIGINAL MEASUREMENTS:

Morrison, T. J.; Billett, F.

J. Chem. Soc. 1952, 3819 - 3822.

VARIABLES:

T/K: 285.75 - 344.85

p/kPa: 101.325 (1 atm)

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

Temperature			Salt Effect Parameters	
t/°C	T/K	1/(T/K)	$(1/m_2)\log(S°/S)$[1]	$(1/m_2)\log(x°/x)$
12.6	285.75	0.0035	0.121	0.136
30.0	303.15	0.0033	0.103	0.118
49.4	322.55	0.0031	0.085	0.100
71.7	344.85	0.0029	0.067	0.082

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

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

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

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

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

SOURCE AND PURITY OF MATERIALS:

(1) Propane. Prepared from Grignard reagent.

(2) Potassium iodide. "AnalaR" material.

(3) Water. No information given.

ESTIMATED ERROR:

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

REFERENCES:

1. Morrison, T. J.; Billett, F. *J. Chem. Soc.* 1948, 2033.

COMPONENTS:

(1) Butane; C_4H_{10}; [106-97-8]

(2) Potassium iodide; KI; [7681-11-0]

(3) Water; H_2O; [7732-18-5]

ORIGINAL MEASUREMENTS:

Morrison, T. J.; Billett, F.

J. Chem. Soc. 1952, 3819 - 3822.

VARIABLES:

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

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

Temperature			Salt Effect Parameters	
t/°C	T/K	$1/(T/K)$	$(1/m_2)\log(S°/S)$[1]	$(1/m_2)\log(x°/x)$
12.6	285.75	0.0035	0.109	0.124
30.0	303.15	0.0033	0.098	0.113
49.4	322.55	0.0031	0.080	0.095
71.7	344.85	0.0029	0.059	0.074

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

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

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

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

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

SOURCE AND PURITY OF MATERIALS:

(1) Butane. Prepared from Grignard reagent. A second sample, Anglo-Iranian Oil Co. stated to be 99 per cent pure, gave the same result.

(2) Potassium iodide. "AnalaR" material.

(3) Water. No information given.

ESTIMATED ERROR:

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

REFERENCES:

1. Morrison, T. J.; Billett, F. *J. Chem. Soc.* 1948, 2033.

COMPONENTS:

(1) Butane; C_4H_{10}; [106-97-8]

(2) Sea Salt (synthetic)

(3) Water; H_2O; [7732-18-5]

ORIGINAL MEASUREMENTS:

Rice, P. A.; Gale, R. P.;
Barduhn, A. J.

J. Chem. Eng. Data 1976, *21*, 204-6.

VARIABLES:

T/K = 276.15 - 292.15
p_1/kPa = 101.325
Sea salt/wt % = 0, 3.5, 7.0

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

Temperature $t/^\circ C$	T/K	Sea Salt wt %	Butane Solubility ppm
3	276.15	0	(181.1) 182.4
		3.5	114.1
		7.0	78.5
11	284.15	0	(122.7)
		3.5	83.1
		7.0	54.8
15	288.15	0	(105.1)
		3.5	75.0
19	292.15	0	(92.1) 91.9
		3.5	63.5
		7.0	45.5

The compiler added the T/K values. He also added the smoothed water solubility values in ( ) which were calculated from the author's data. See equation on the author's butane + water data.

The synthetic sea salt was prepared by weighing five salts to give the ppm (by weight) of NaCl 24,067, $MgCl_2$ 5,107, Na_2SO_4 4,016, $CaCl_2$ 1,130, and KCl 680 (1).

ppm = parts per million by weight

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The solubility equilibrium was established in a one liter Pyrex cell with a Plexiglass top with ports for sampling, pressure connection, vacuum line, and introduction of the gas.

About 700 cm^3 of solvent was placed in the cell; it was sealed, thermostated, and evacuated to the vapor pressure of the solvent for about one hour to degass the solvent.

Butane gas was added and the system was stirred for 24-48 hours. It was assumed that equilibrium was established when no pressure change was observed in a four hour period. Saturation was approached from both a higher and a lower temperature. Samples of the liquid were taken in a microliter syringe. The samples were injected directly into a total carbon analyzer. Three to nine samples were analyzed from one or more runs. The results were averaged to give the results above.

SOURCE AND PURITY OF MATERIALS:

(1) Butane. Source not given. Stated to be 99.5 % instrument purity.

(2) Synthetic sea salt components. Reagent grade chemicals. All were dried, cooled and weighed except the $MgCl_2$ which was taken from a freshly opened bottle as $MgCl_2 \cdot 6H_2O$.

(3) Water. No information.

ESTIMATED ERROR:

δT/K = 0.02
δpmm/pmm = 0.01

REFERENCES:

1. Tallmadge, J. A.; Butt, J. B.; Solomon, H. J. *Ind. Eng. Chem.* 1964, *56*(7), 46.

COMPONENTS:

(1) Propane; C_3H_8; [74-98-6]
(2) Urea; CH_4N_2O; [57-13-6]
(3) Water; H_2O; [7732-18-5]

ORIGINAL MEASUREMENTS:

Wen, W.-Y.; Hung, J.H.

J. Phys. Chem. 1970, *74*, 170-180.

VARIABLES:

T/K: 278.15-308.15
P/kPa: 101.325 (1 atm)
m_3/mol kg^{-1}: 0-0.495

PREPARED BY:

H.L. Clever

EXPERIMENTAL VALUES:

T/K	Urea Molality m_3/mol kg^{-1}	Propane Solubility S_1/cm^3(STP) kg^{-1}	Setchenow Constant[1] k/kg mol^{-1}
278.15	0	69.57 ± 0.11	+0.013
	0.495	69.10	
288.15	0	45.75 ± 0.06	-0.002
	0.495	46.08	
298.15	0	32.31 ± 0.08	-0.10
	0.495	32.66	
308.15	0	23.91 ± 0.07	-0.012
	0.495	24.72	

[1] Setchenow constant, k/kg mol^{-1} = (1/(m_3/mol kg^{-1})) log (S_1°/S_1).

The authors specify the value of the constant for m_3/mol kg^{-1} = 0.1.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The apparatus was similar to that described by Ben-Naim and Baer (1). Teflon needle valves were used in place of stopcocks.

The apparatus consists of three main parts, a dissolution cell of 300 to 600 cm^3 capacity, a gas volume measuring column, and a manometer.

The solvent is degassed in the dissolution cell, the gas is introduced and dissolved while the liquid is kept stirred by a magnetic stirrer immersed in the water bath. Dissolution of the gas results in the change in the height of a column of mercury which is measured by a cathetometer.

SOURCE AND PURITY OF MATERIALS:

1. Propane. Matheson Co. Stated to be better than 99.9 per cent pure.
2. Urea. No information.
3. Water. Distilled from an all Pyrex apparatus. Specific conductivity 1.5 x 10^{-6} (ohm cm)$^{-1}$.

ESTIMATED ERROR:

δT/K = ±0.005
$\delta S_1/S_1$ = ±0.003

REFERENCES:

1. Ben-Naim, A.; Baer, S. *Trans. Faraday Soc.* 1963, *59*, 2735.

COMPONENTS:

(1) Propane; C_3H_8; [74-98-6]

(2) Urea; CH_4N_2O; [57-13-6]

(3) Water; H_2O; [7732-18-5]

ORIGINAL MEASUREMENTS:

Wetlaufer, D.B.; Malik, S.K.;
Stoller, L.; Coffin, R.L.

J. Am. Chem. Soc. 1964, *86*,
508-514.

VARIABLES:

T/K: 278.15-318.15
c_2/mol dm^{-3}: 6.96
P/kPa: 101.325

PREPARED BY:

W. Hayduk, C.L. Young

EXPERIMENTAL VALUES:

T/K	Urea conc.[1] c_2/mol dm^{-3}	Solution molar volume[1] /cm^{3}mol^{-1}	Solubility[1] s_1/mmol dm^{-3}	Mole Fraction[2] /$10^5 x_1$	Ostwald Coeff.[2] L/cm^{3}cm^{-3}	Bunsen Coeff.[2] α
278.15	6.96	(45.15)[3]	2.49	5.52	0.0557	0.0546
298.15	6.96	44.95	1.50	3.34	0.0361	0.0329
318.15	6.96	(44.65)	1.12	2.51	0.0289	0.0246

[1] Original data.

[2] Calculated by compilers using real gas molar volumes.

[3] Molar volumes of solvent shown in brackets were estimated.

[4] No correction was made for the amount of gas retained by the solvent during extraction, estimated by the authors to be 1-1.5 per cent; hence the results are expected to be too low by this amount.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

A modified Van Slyke-Neill manometric blood gas apparatus, fitted with a magnetic stirrer was used. The solvent was saturated with gas; then a sample was transferred to the Van Slyke extraction chamber for gas desorption and volume measurement.

SOURCE AND PURITY OF MATERIALS:

1. Matheson Co. Instrument grade; minimum specified purity 99.5 per cent.
2. Commercial sample, purified by two recrystallizations from 65 per cent ethanol.
3. Distilled.

ESTIMATED ERROR:

$\delta T/\mathrm{K} = 0.05$

$\delta s_1/s_1 = 0.02$ (authors)[4]

REFERENCES:

COMPONENTS:

(1) Butane; C_4H_8; [106-97-8]

(2) Urea; CH_4N_2O; [57-13-6]

(3) Water; H_2O; [7732-18-5]

ORIGINAL MEASUREMENTS:

Wetlaufer, D.B.; Malik, S.K.; Stoller, L.; Coffin, R.L.

J. Am. Chem. Soc. 1964, *86*, 508-514.

VARIABLES:

T/K: 278.15-318.15
c_2/mol dm^{-3}: 6.96
P/kPa: 101.325

PREPARED BY:

W. Hayduk, C.L. Young

EXPERIMENTAL VALUES:

T/K	Urea conc.[1] c_2/mol dm^{-3}	Solution molar volume[1] /cm^{3}mol^{-1}	Solubility[1] s_1/mmol dm^{-3}	Mole Fraction[2] /10^5x_1	Ostwald Coeff.[2] L/cm^{3}cm^{-3}	Bunsen Coeff.[2] α
278.15	6.96	(45.15)[3]	2.63	5.83	0.0576	0.0564
298.15	6.96	44.95	1.44	3.20	0.0341	0.0309
318.15	6.96	(44.65)	0.98	2.20	0.0250	0.0210

[1] Original data.

[2] Calculated by compilers using real gas molar volumes.

[3] Molar volumes of solvent shown in brackets were estimated.

[4] No correction was made for the amount of gas retained by the solvent during extraction, estimated by the authors to be 1-1.5 per cent; hence the results are expected to be too low by this amount.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

A modified Van Slyke-Neill manometric blood gas apparatus, fitted with a magnetic stirrer was used. The solvent was saturated with gas; then a sample was transferred to the Van Slyke extraction chamber for gas desorption and volume measurement.

SOURCE AND PURITY OF MATERIALS:

1. Matheson Co. C.P. grade; minimum specified purity 99 percent.
2. Commercial sample, purified by two recrystallizations from 65 per cent ethanol.
3. Distilled.

ESTIMATED ERROR:

δT/K = 0.05

$\delta s_1/s_1$ = 0.02 (authors)[4]

REFERENCES:

COMPONENTS:

(1) 2-Methylpropane; C_4H_{10}; [75-28-5]

(2) Urea; CH_4N_2O; [57-13-6]

(3) Water; H_2O; [7732-18-5]

ORIGINAL MEASUREMENTS:

Wetlaufer, D.B.; Malik, S.K.; Stoller, L.; Coffin, R.L.

J. Am. Chem. Soc. 1964, *86*, 508-514.

VARIABLES:

T/K: 278.15-318.15

c_2/mol dm^{-3}: 6.96

P/kPa: 101.325

PREPARED BY:

W. Hayduk, C.L. Young

EXPERIMENTAL VALUES:

T/K	Urea conc.[1] c_2/mol dm^{-3}	Solution molar volume[1] /cm^{3}mol^{-1}	Solubility[1] s_1/mmol dm^{-3}	Mole Fraction[2] /10^5x_1	Ostwald Coeff.[2] L/cm^{3}cm^{-3}	Bunsen Coeff.[2] α
278.15	6.96	(45.15)[3]	1.92	4.25	0.0421	0.0412
298.15	6.96	44.95	1.13	2.51	0.0268	0.0243
318.15	6.96	(44.65)	0.80	1.79	0.0204	0.0172

[1] Original data.

[2] Calculated by compilers using real gas molar volumes.

[3] Molar volumes of solvent shown in brackets were estimated.

[4] No correction was made for the amount of gas retained by the solvent during extraction, estimated by the authors to be 1-1.5 per cent; hence the results are expected to be too low by this amount.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

A modified Van Slyke-Neill manometric blood gas apparatus, fitted with a magnetic stirrer was used. The solvent was saturated with gas; then a sample was transferred to the Van Slyke extraction chamber for gas desorption and volume measurement.

SOURCE AND PURITY OF MATERIALS:

1. Matheson Co. Instrument grade; minimum specified purity 99.5 per cent.
2. Commercial sample, purified by two recrystallizations from 65 per cent ethanol.
3. Distilled.

ESTIMATED ERROR:

δT/K = 0.05

$\delta s_1/s_1$ = 0.02 (authors)[4]

REFERENCES:

COMPONENTS:	EVALUATOR:
(1) Propane; C_3H_8; [74-98-6] (2) Two-component, non-aqueous solvent solutions	Walter Hayduk Department of Chemical Engineering University of Ottawa Ottawa, Canada K1N 9B4 November, 1984

CRITICAL EVALUATION:

Solubilities are available for *propane* in four two-component, non-aqueous solvent solutions; two of these contain the salt *sodium iodide* dissolved in *2-propanone (acetone)* and in *N, N-dimethylformamide* while the other two contain *octadecanoic (stearic) acid* also dissolved in *2-propanone* and *N, N-dimethylformamide*. The solubility data for *propane* in *2-propanone*, and *N, N-dimethylformamide*, of Rosenthal[1] have been examined elsewhere in this volume and found to be approximately 3-5 percent, and 10-15 percent, respectively, higher than other comparable data. It appears likely that the relative effects of the *sodium iodide* salt and *octadecanoic acid* on the solubility of *propane* in *2-propanone* and *N, N-dimethylformamide* are significant even although the actual solubilities may not be accurate. The presence of *sodium iodide* salt appreciably reduces the solubility of *propane* in both solvents; while the presence of *octadecanoic acid* slightly increases the solubility of *propane* in both solvents. These data are classified as tentative.

References

1. Rosenthal, W.; *Thès. fac. sci. Univ. Strasbourg (France)*, 1954.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Propane; C_3H_8; [74-98-6] (2) Sodium iodide; NaI; [7681-82-5] (3) 2-Propanone (acetone); C_3H_6O; [67-64-1]	Rosenthal, W. *Thès. fac. sci. Univ. Strasbourg (France)* 1954.
VARIABLES:	**PREPARED BY:**
T/K: 293.15 P/kPa: 101.325 m_2/mol kg⁻¹: 0 - 1.30	W. Hayduk

EXPERIMENTAL VALUES:

T/K	Salt concentration in solvent: Mass fraction[1] c_2/g g^{-1}	Molar conc.[2] m_2/mol kg^{-1}	Ostwald Coefficient[1] L/cm^3 cm^{-3}	Setschenow Constant[2] k_{scL}/kg mol^{-1}
293.15	0	0	11.76	
	0.1275	0.851	7.93	0.201
	0.1947	1.299	6.47	0.200

[1] Original data. The salt concentration was expressed as mass of salt per unit mass of salt solution.

[2] Molar concentration and Setschenow constant calculated by compiler as follows:

$$k_{scL} = (m_2)^{-1} \log (L^0 L^{-1})$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:	SOURCE AND PURITY OF MATERIALS:
The prepared solvent solution was charged into an evacuated cell after degassing, and the mass of solvent was determined by weight. Gas was introduced into the cell from a measuring burette in which the gas was stored over mercury. The cell was agitated while the gas pressure was maintained by adjusting the gas volume. The Ostwald coefficient was determined from the mass of solvent and volume of gas used. Solubilities were measured at pressures above and below atmospheric.	1. Source and purity not given. 2. Source and purity not given. Recrystallized from water and dried. 3. Research grade. Purity not given. Dried and distilled. **ESTIMATED ERROR:** δT/K = 0.2 δP/kPa = 0.1 $\delta L/L$ = 0.02 (compiler) **REFERENCES:**

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Propane; C_3H_8; [74-98-6] (2) Sodium iodide; NaI; [7681-82-5] (3) N,N-Dimethylformamide; C_3H_7NO; [68-12-2]	Rosenthal, W. *Thès. fac. sci. Univ. Strasbourg (France)* 1954.

VARIABLES:	PREPARED BY:
T/K: 293.15 P/kPa: 101.325 m_2/mol kg^{-1}: 0,0.360	W. Hayduk

EXPERIMENTAL VALUES:

T/K	Salt concentration in solvent: Mass fraction[1] c_2/g g^{-1}	Molar conc.[2] m_2/mol kg^{-1}	Ostwald Coefficient[1] L/cm^3 cm^{-3}	Setschenow Constant[2] k_{scL}/kg mol^{-1}
293.15	0	0	5.68	
	0.3603	0.3603	4.51	0.278

[1] Original data. The salt concentration was expressed as mass of salt per unit mass of salt solution.

[2] Molar concentration and Setschenow constant calculated by compiler as follows:

$$k_{scL} = (m_2)^{-1} \log (L^0 L^{-1})$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The prepared solvent solution was charged into an evacuated cell after degassing, and the mass of solvent was determined by weight. Gas was introduced into the cell from a measuring burette in which the gas was stored over mercury. The cell was agitated while the gas pressure was maintained by adjusting the gas volume. The Ostwald coefficient was determined from the mass of solvent and volume of gas used. Solubilities were measured at pressures above and below atmospheric.

SOURCE AND PURITY OF MATERIALS:

1. Source and purity not given.
2. Source and purity not given.
3. S.E.P.P.I.C. of Paris. Purity not given. Exposure to air avoided. Distilled prior to use.

ESTIMATED ERROR:

δT/K = 0.2
δP/kPa = 0.1
$\delta L/L$ = 0.02 (compiler)

REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Propane; C_3H_8; [74-98-6] (2) Octadecanoic (stearic)acid; $C_{18}H_{36}O_2$; [57-11-4] (3) 2-Propanone (acetone); C_3H_6O; [67-64-1]	Rosenthal, W. *Thès. fac. sci. Univ. Strasbourg (France)* 1954.
VARIABLES: T/K: 293.15 P/kPa: 101.325 w_2/mass fraction: 0-0.0293	**PREPARED BY:** W. Hayduk

EXPERIMENTAL VALUES:

T/K	Stearic acid conc. in solvent: Mass fraction[1] w_2	Mole fraction[2] x_2	Ostwald Coefficient[1] $L/\mathrm{cm^3 cm^{-3}}$	Bunsen Coefficient[2] $\alpha/\mathrm{cm^3 (STP) cm^{-3}}$	Mole Fraction[2] x_1
293.15	0	0	11.76	10.91	0.0353
	0.01495	0.00309	11.92	11.06	0.0361
	0.0293	0.00613	11.95	11.09	0.0365

[1] Original data based on mass fraction stearic acid in gas-free solution.

[2] Calculated by compiler.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The prepared solvent solution was charged into an evacuated cell after degassing, and the mass of solvent was determined by weight. Gas was introduced into the cell from a measuring burette in which the gas was stored over mercury. The cell was agitated while the gas pressure was maintained by adjusting the gas volume. The Ostwald coefficient was determined from the mass of solvent and volume of gas used. Solubilities were measured at pressures above and below atmospheric.

SOURCE AND PURITY OF MATERIALS:

1. Source and purity not given.
2. Merck. Melting point 69.3°C. Used without further purification.
3. Research grade. Purity not given. Dried and distilled.

ESTIMATED ERROR:

δT/K = 0.2
δP/kPa = 0.1
$\delta L/L$ = 0.02 (compiler)

REFERENCES:

COMPONENTS:

(1) Propane; C_3H_8; [74-98-6]

(2) Octadecanoic (stearic) acid; $C_{18}H_{36}O_2$; [57-11-4]

(3) N,N-Dimethylformamide; C_3H_7NO; [68-12-2]

ORIGINAL MEASUREMENTS:

Rosenthal, W.

Thès. fac. sci. Univ. Strasbourg (France) 1954.

VARIABLES:
T/K: 293.15
P/kPa: 101.325
w_2/mass fraction: 0-0.0342

PREPARED BY:

W. Hayduk

EXPERIMENTAL VALUES:

T/K	Stearic acid conc. in solvent: Mass fraction[1] w_2	Mole fraction[2] x_2	Ostwald Coefficient[1] $L/\mathrm{cm^3\,cm^{-3}}$	Bunsen Coefficient[2] $\alpha/\mathrm{cm^3(STP)\,cm^{-3}}$	Mole Fraction[2] x_1
293.15	0	0	5.68	5.27	0.0182
	0.0172	0.00448	5.78	5.36	0.0187
	0.0342	0.00902	5.98	5.55	0.0196

[1] Original data based on mass fraction stearic acid in gas-free solution.

[2] Calculated by compiler.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The prepared solvent solution was charged into an evacuated cell after degassing, and the mass of solvent was determined by weight. Gas was introduced into the cell from a measuring burette in which the gas was stored over mercury. The cell was agitated while the gas pressure was maintained by adjusting the gas volume. The Ostwald coefficient was determined from the mass of solvent and volume of gas used. Solubilities were measured at pressures above and below atmospheric.

SOURCE AND PURITY OF MATERIALS:

1. Source and purity not given
2. Merck. Melting point 69.3 °C. Used without further purification.
3. S.E.P.P.I.C. of Paris. Purity not given. Exposure to air avoided. Distilled prior to use.

ESTIMATED ERROR:

$\delta T/\mathrm{K} = 0.2$
$\delta P/\mathrm{kPa} = 0.1$
$\delta x_1/x_1 = 0.02$ (compiler)

REFERENCES:

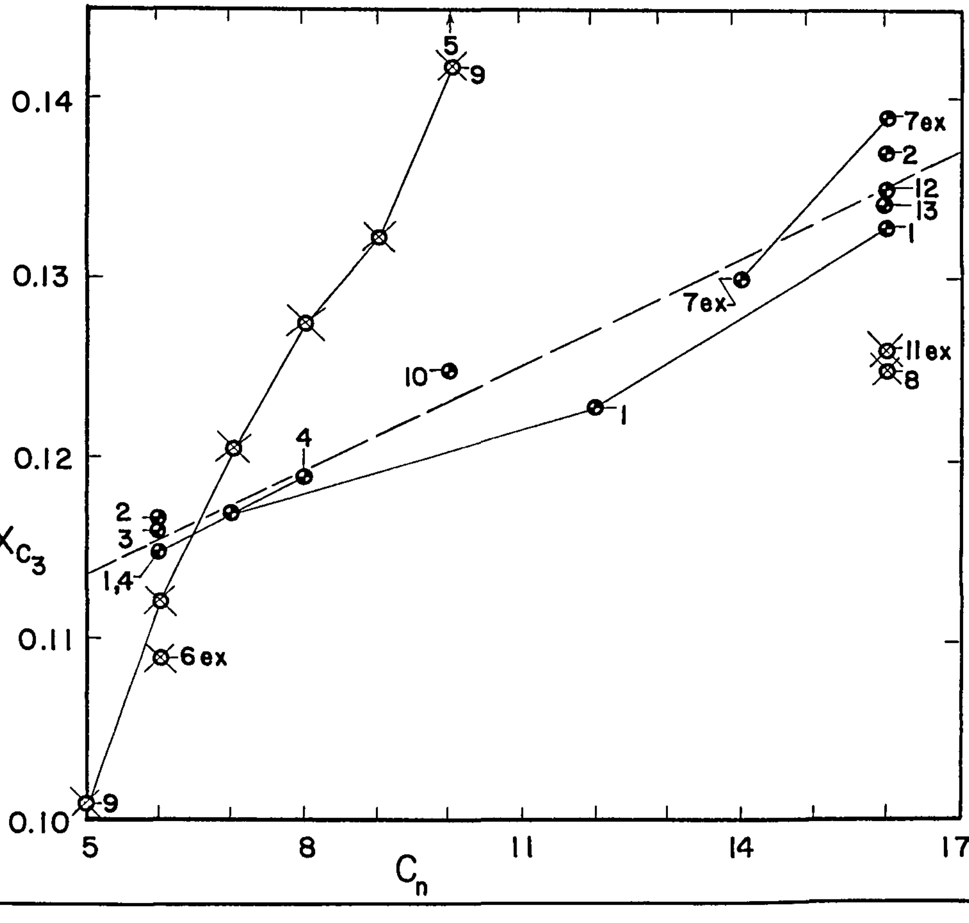
COMPONENTS:	EVALUATOR:
(1) Propane; C_3H_8; [74-98-6] Butane; C_4H_{10}; [106-97-8] 2-Methylpropane; C_4H_{10}; [75-28-5] (2) Alkane solvents	Walter Hayduk Department of Chemical Engineering University of Ottawa Ottawa, Canada K1N 9B4 January, 1984

CRITICAL EVALUATION:

The solubility of *propane* in the n-alkanes which are normally liquid has been studied by at least thirteen groups of workers. The sources for the *propane* solubilities in the particular n-alkane solvents are: pentane (9), hexane (1,2,3,4,6), heptane (1,9), octane (4,9), nonane (9), decane (5,9,10), dodecane (1), tetradecane (7), and hexadecane (1,2,7,8,11,12,13). Data from these sources are shown in the diagram below as the mole fraction *propane* solubility for a gas partial pressure at 101.325 kPa and 298.15 K, x_1, as a linear function of the number of carbon atoms in the solvent molecule, C_n. In a number of instances an extrapolation of the data was required for comparison at 298.15 K and for these cases "ex" has been added after the reference number. Except for the solubilities in hexane and heptane, the data of Jadot (9) appear to be erratic and are rejected. The chromatographic method used, effectively at low gas partial pressures, may have contributed to the apparently unreliable results. The data of Gerrard (5) for the solubility in decane is very much higher than any other data and is also rejected. The extrapolated data of Tilquin et al. (6) in hexane, of Chappelow and Prausnitz (11) in hexadecane and of Lin and Parcher (8) also in hexadecane appear to be at least 5% lower than those of several other workers and are classified as doubtful. The remaining data, classified as tentative, were used to determine a regression line which is shown in Figure 1 as a dashed line:

$$x_{C_3} = 0.1036 + 0.00197\ C_n \qquad \text{Correlation coefficient} = 0.975$$

Figure 1. Solubility of *propane* in n-alkane solvents at 298.15 K.



COMPONENTS:

(1) Propane; C_3H_8; [74-98-6]
Butane; C_4H_{10}; [106-97-8]
2-Methylpropane; C_4H_{10}; [75-28-5]

(2) Alkane solvents

EVALUATOR:

Walter Hayduk
Department of Chemical Engineering
University of Ottawa
Ottawa, Canada K1N 9B4

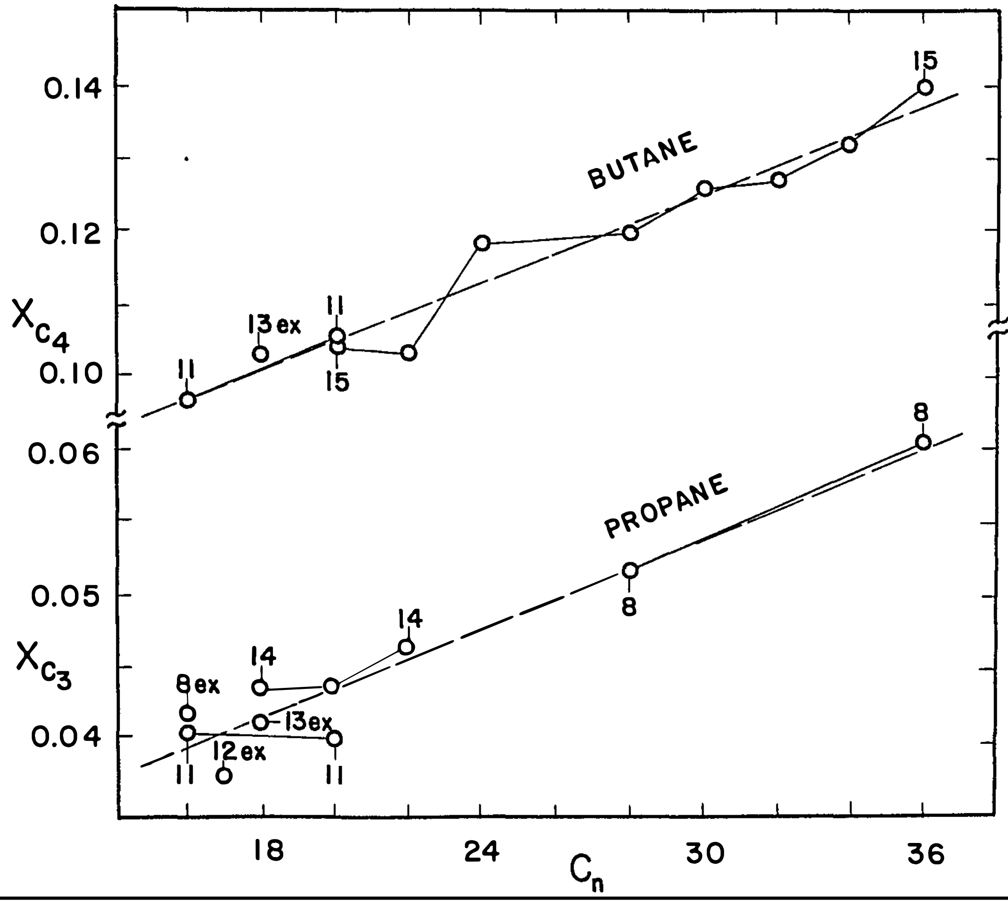
January, 1984

CRITICAL EVALUATION:

There are conflicting data for the solubility in branched isomers of alkane solvents. The solubilities in the four branched C_6 solvents, 2-methylpentane, 3-methylpentane, 2,2'-dimethylbutane, (neohexane) and 2,3-dimethylbutane reported in ref. (3) are all similar to those in n-hexane; the mean value at 298.14 K is almost identical to that calculated from the equation shown above. These data suggest that branching in solvents has only a small effect if any on the solubility, provided that the same number of carbons are present in the solvent molecules. On the other hand, the extrapolated data for the solubility in 2,2'-dimethylbutane of Tilquin et al. (6) is some 15% higher than that for n-hexane solvent. Yet a similar comparison for *butane* gas solubility by those authors indicates a *butane* solubility in 2,2'-dimethylbutane which is significantly lower than in n-hexane. Furthermore, the *propane* solubility in 2,2,4,6,8,8-heptamethylnonane ($C_{16}H_{34}$) as reported by Richon and Renon (13) at 298.15 K is almost *four times* as great as that in n-hexadecane also as reported by the same authors, an incredible difference. In may be concluded that there are insufficient data to form a sound opinion concerning the effect of branching in alkane solvents.

The solubility of *propane* in n-alkane solvents of higher molecular weight are compared at 373.15 K, a temperature at which all the normally solid alkanes are liquids, in Figure 2. Extrapolation was

Figure 2. Solubility of *propane* and *butane* in high molecular weight n-alkane solvents at 373.15 K.



COMPONENTS:	EVALUATOR:
(1) Propane; C_3H_8; [74-98-6] Butane; C_4H_{10}; [106-97-8] 2-Methylpropane; C_4H_{10}; [75-28-5] (2) Alkane solvents	Walter Hayduk Department of Chemical Engineering University of Ottawa Ottawa, Canada K1N 9B4 January, 1984

CRITICAL EVALUATION:

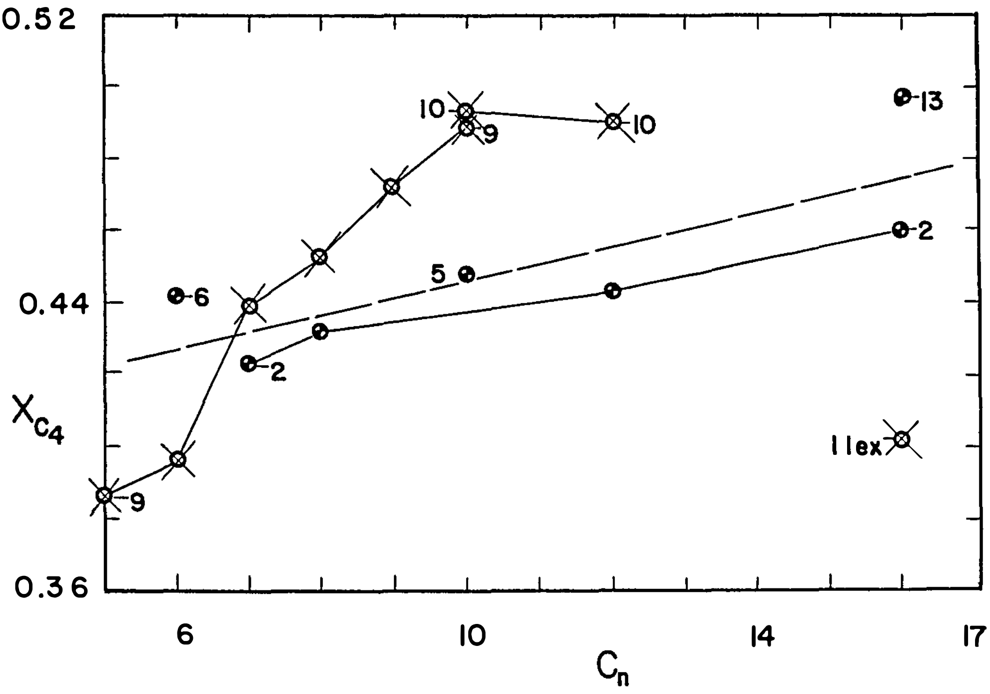
required in several instances to estimate the solubility at 373.15 K. Although scarce, the data show a trend consistent with that of lower molecular weight alkanes, a linear increase in mole fraction solubility with number of carbons per molecule of solvent. The data sources are: for heptadecane (12), octadecane (13,14), eicosane (11,14), docosane (14), octacosane (8) and hexatriacontane (8). These data are all classified as tentative. A straight line through the (extrapolated) data points, shown as a dashed line in Figure 2, has the following constants for use at 373.15 K:

$$x_{C_3} = 0.02250 + 0.00105\ C_n \qquad \text{Correlation coefficient} = 0.964$$

The solubility of *propane* in the branched alkane, 2,6,10,15,19, 23-hexamethyltetracosane or squalane ($C_{30}H_{62}$) at 373.15 K (11) is similar to that for an n-alkane with the same number of carbons. These data are also classified as tentative.

The data for the solubility of *butane* in n-alkane solvents from pentane to hexadecane for a temperature of 298.15 K are shown in Figure 3. The sources of data are listed according to solvent: pentane (9), hexane (6,9), heptane (2,9), octane (2,9), nonane (9), decane (5,9.10), dodecane (2,10), and hexadecane (2,11,13). Except for the solvents hexane and heptane, the solubilities of Jadot (9) appear erratic as they did for *propane* solubilities and hence are rejected. The data of Montfort and Arriaga in decane and dodecane (10) appear too high and are also rejected. The extrapolated data of Chappelow and Prausnitz in hexadecane (11) appear low by more than 5% as they did for *propane* gas in the same solvent, and are rejected. The remaining data (2,5,6,13) are classified as tentative and were used to obtain a regression line for the mole fraction solubility at 298.15 K:

Figure 3. Solubility of *butane* in n-alkane solvents at 298.15 K.



COMPONENTS:	EVALUATOR:
(1) Propane; C_3H_8; [74-98-6] Butane; C_4H_{10}; [106-97-8] 2-Methylpropane; C_4H_{10}; [75-28-5] (2) Alkane solvents	Walter Hayduk Department of Chemical Engineering University of Ottawa Ottawa, Canada K1N 9B4 January, 1984

CRITICAL EVALUATION: continued

$x_{C_4} = 0.3975 + 0.00484\ C_n$ Correlation coefficient = 0.813

The solubility of *butane* in 2,2'-dimethylbutane (neohexane)(6) is classified as tentative. The solubility in 2,2,4,4,6,8,8-heptamethylnonane (13) is rejected because of an impossible fractional value for Henry's law constant.

Butane solubilities at 373.15 K in the high molecular weight (and normally solid) n-alkane solvents from hexadecane to hexatriacontane are shown in Figure 2. Mainly the data of Parcher et al. (15) are available for these solvents. The solvents and sources are: hexadecane (11), octadecane (13), eicosane (11, 15), docosane (15), tetracosane (15), octacosane (15), triacontane (15), dotriacontane (15), tetratriacontane (15) and hexatriacontane (15). These data are all classified as tentative. A regression equation for the solubility of *butane* at 373.15 K in high molecular weight n-alkane solvents is:

$x_{C_4} = 0.06414 + 0.00203\ C_n$ Correlation coefficient = 0.980

The solubility of *butane* in 2,6,10,15,19,23-hexamethyltetracosane ($C_{30}H_{62}$)(11), as observed for *propane*, is similar to that for an alkane with the same number of carbons. These data are classified as tentative.

There are three sources of data for the solubility of *2-methylpropane* in n-alkane solvents. These are listed by solvent: pentane (9), hexane (6,9), heptane (9), octane (9), nonane (9), and decane (5,9). There are insufficient data for the solubility of *2-methylpropane* alone to assess the reliability of the Jadot data (9); however, based on the erratic nature of the solubilities of *propane* and *butane* by the same worker when compared with those of other workers, these data are also rejected. Only the data of Tilquin et al. (6) in heptane and of Gerrard (5) in decane remain; these are classified as tentative.

The solubility of *2-methylpropane* in eicosane (11) is also classified as tentative.

In all cases the regression equations given in this Critical Evaluation are *approximate* only, because they are based, at least in part, on extrapolated and/or too few data to be highly reliable. Nor is it possible to ascribe useful limits of accuracy to them.

The solubility of the gases *propane*, *2-methylpropane*, and *butane* appear to increase in the order listed, in each of the n-alkane solvents. The order of increasing solubility of gases has been related to the order of increasing normal boiling points of the gases (17) as obtained here.

References

1. Hayduk, W.; Walter, E.B.; Simpson, P. *J. Chem. Eng. Data* 1972, *17*, 59-61.

2. Hayduk, W.; Castañeda, R. *Can. J. Chem. Eng.* 1973, *51*, 353-358.

COMPONENTS:	EVALUATOR:
(1) Propane; C_3H_8; [74-98-6] Butane; C_4H_{10}; [101-97-8] 2-Methylpropane; C_4H_{10}; [75-28-5] (2) Alkane solvents	Walter Hayduk Department of Chemical Engineering University of Ottawa Ottawa, Canada K1N 9B4 January, 1984

CRITICAL EVALUATION: continued

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9. Jadot, R. *J. Chim. Phys.* 1972, *69*, 1036-1040.
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15. Parcher, J.F.; Weiner, P.H.; Hussey, C.L.; Westlake, T.N. *J. Chem. Eng. Data* 1975, *20*, 145-151.
16. Gerrard, W. *Solubility of Gases and Liquids, Plenum Press, New York* 1976, Chapter 12.
17. Blais, C.; Hayduk, W. *J. Chem. Eng. Data* 1983, *28*, 181-183.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Propane; C_3H_8; [74-98-6] (2) Pentane; C_5H_{12}; [109-66-0] or Hexane; C_6H_{14}; [110-54-3]	Jadot, R. *J. Chim. Phys.* 1972, *69*, 1036-40
VARIABLES:	PREPARED BY:
T/K: 298.15 P/kPa: 101.3	C.L. Young

EXPERIMENTAL VALUES:

T/K	Henry's Law Constant, H /atm	Mole fraction$^+$ at partial pressure of 101.3 kPa, $x_{C_3H_8}$	#ΔH^∞ /cal mol^{-1} (/J mol^{-1})
		Pentane; C_5H_{12}; [109-66-0]	
298.15	9.916	0.1008	-
		Hexane; C_6H_{14}; [110-54-3]	
298.15	8.924	0.1121	200 (837)

+ Calculated by compiler assuming $x_{C_3H_8} = 1/H$

Excess partial molar enthalpy of solution at infinite dilution.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The conventional gas chromatographic technique was used. The carrier gas was helium. The value of Henry's law constant was calculated from the retention time. The value applies to very low partial pressures of gas and there may be a substantial difference from that measured at 1 atm. pressure. There is also considerable uncertainty in the value of Henry's constant since no allowance was made for surface adsorption.

SOURCE AND PURITY OF MATERIALS:

No details given.

ESTIMATED ERROR:

$\delta T/K = \pm 0.05$; $\delta H = \pm 2\%$

REFERENCES:

COMPONENTS:

(1) Propane; C_3H_8; [74-98-6]

(2) Hexane; C_6H_{14}; [110-54-3]

ORIGINAL MEASUREMENTS:

Hayduk, W.; Walter, E.B.; Simpson, P.
J. Chem. Eng. Data 1972, *17*,
59-61.

VARIABLES:

T/K: 298.15

P/kPa: 101.325

PREPARED BY:

W. Hayduk

EXPERIMENTAL VALUES:

T/K	Ostwald Coefficient[1] $L/\text{cm}^3\ \text{cm}^{-3}$	Bunsen Coefficient[2] $\alpha/\text{cm}^3\ (\text{STP})\,\text{cm}^{-3}\text{atm}^{-1}$	Mole Fraction[1] x_1
298.15	23.75	21.76	0.115

[1] Original data.

[2] Calculated by compiler.

[3] ΔG° calculated by compiler:

$$\Delta G°/\text{J mol}^{-1} = -RT \ln x_1 = 5.361$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

A volumetric method using a glass apparatus was employed. Degassed solvent contacted the gas while flowing as a thin film, at a constant rate, through an absorption spiral into a solution buret. A constant solvent flow was obtained by means of a calibrated syringe pump. The solution at the end of the spiral was considered saturated. Dry gas was maintained at atmospheric pressure in a gas buret by mechanically raising the mercury level in the buret at an adjustable rate. The solubility was calculated from the constant slope of volume of gas dissolved and volume of solvent injected.

Degassing was accomplished using a two stage vacuum process described by Clever et al.(1).

SOURCE AND PURITY OF MATERIALS:

1. Matheson Co. Specified as instrument grade of minimum purity 99.5 per cent.
2. Canlab. Chromatoquality grade of minimum specified purity 99.9 per cent.

ESTIMATED ERROR:

δT/K = 0.1

$\delta x_1/x_1$ = 0.01

REFERENCES:

1. Clever, H.L.; Battino, R.; Saylor, J.H.; Gross, P.M. *J. Phys. Chem.* 1971, *61*, 1078.

COMPONENTS:

(1) Propane; C_3H_8; [74-98-6]

(2) Hexane; C_6H_{14}; [110-54-3]

ORIGINAL MEASUREMENTS:

Hayduk, W.; Castañeda, R.

Can. J. Chem. Eng. 1973, *51*, 353-358.

VARIABLES:

T/K: 298.15

P/kPa: 101.325

PREPARED BY:

W. Hayduk

EXPERIMENTAL VALUES:

T/K	Ostwald Coefficient[1] L/cm³ cm⁻³	Bunsen Coefficient[2] α/cm³ (STP)cm⁻³atm⁻¹	Mole fraction[1] x_1	ΔG°[3] /J mol⁻¹
298.15	24.0	22.0	0.1166	5327.0

[1] Original data.

[2] Calculated by compiler.

[3] Calculated by compiler from the following equation:

$$\Delta G^\circ/\text{J mol}^{-1} = -RT \ln x_1$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

A volumetric method using a glass apparatus was employed. Degassed solvent contacted the gas while flowing as a thin film, at a constant rate, through an absorption spiral into a solution buret. A constant solvent flow was obtained by means of a calibrated syringe pump. The solution at the end of the spiral was considered saturated. Dry gas was maintainted at atmospheric pressure in a gas buret by mechanically raising the mercury level in the buret at an adjustable rate. The solubility was calculated from the constant slope of volume of gas dissolved and volume of solvent injected.

Degassing was accomplished using a two stage vacuum process described by Clever et al. (1).

SOURCE AND PURITY OF MATERIALS:

1. Matheson Co. Specified as instrument grade of minimum purity 99.5 per cent.
2. Canlab. Specified minimum purity 99.0 per cent.

ESTIMATED ERROR:

δT/K = 0.1

$\delta x_1/x_1$ = 0.01

REFERENCES:

1. Clever, H.L.; Battino, R.; Saylor, J.H.; Gross, P.M. *J. Phys. Chem.* 1971, *61*, 1078.

COMPONENTS:

(1) Propane; C_3H_8; [74-98-6]

(2) Hexane; C_6H_{14}; [110-54-3]

ORIGINAL MEASUREMENTS:

Thomsen, E.S.; Gjaldbaek, J.C.

Acta Chem. Scand. 1963, *17*, 134-138.

VARIABLES:

T/K: 298.15

P/kPa: 101.325

PREPARED BY:

E.S. Thomsen, W. Hayduk

EXPERIMENTAL VALUES:

T/K	Ostwald Coefficient[2] L/cm^3 cm^{-3}	Bunsen Coefficient[1] α/cm^3 (STP) cm^{-3}atm^{-1}	Mole Fraction[2] x_1
298.15	23.7	21.6	0.115

[1] Original data.

[2] Calculated by compilers using a real gas molar volume.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The method utilizes a combined glass manometer and bulb enclosed in an air thermostat which is shaken until equilibrium is established. Mercury is used for calibrating the volumes and as the confining liquid. Details in reference 1.

The absorbed gas volume is calculated from the initial dry gas, and final solvent vapor-saturated gas volume. The amount of solvent is determined by measuring the mass of mercury displaced.

SOURCE AND PURITY OF MATERIALS:

1. Phillips Petroleum Co. Specified as research grade and GC analysis indicated 0.1 per cent air and 0.03 per cent ethane impurities.
2. Merck. Purity not given.

ESTIMATED ERROR:

δT/K = 0.05

$\delta x_1/x_1$ = 0.015

REFERENCES:

1. Gjaldbaek, J.C. *Acta Chem. Scand.* 1952, *6*, 623.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Propane; C_3H_8; [74-98-6] (2) Hexane; C_6H_{14}; [110-54-3]	Tilquin, B.; Decanniere, L.; Fontaine, R.; Claes, P. *Ann. Soc. Sc. Bruxelles (Belgium)* 1967, *81*, 191-199.
VARIABLES:	**PREPARED BY:**
T/K: 288.15 p/kPa: 5.04-7.31	W. Hayduk

EXPERIMENTAL VALUES:

t/°C	T/K	Ostwald coefficient[1] L/cm³cm⁻³	Mole fraction[2] /x_1	Henry's constant[2] H/atm
15.0	288.15	29.3	0.1382	27.2

[1] Original data at low pressure reported as a distribution coefficient; if Henry's law and ideal gas law apply, the distribution coefficient is equivalent to the Ostwald coefficient as shown here.

[2] Calculated by compiler for a gas partial pressure of 101.325 kPa assuming that Henry's law and ideal gas law apply.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

An all glass apparatus was used at a very low gas partial pressure. It contained a replaceable degassed solvent ampule equipped with a breakable point which could be broken by means of a magnetically activated plunger. The quantity of gas fed into the system was determined by measuring the pressure change in a known volume. The quantity of liquid was measured by weight. The pressure change was observed after the solvent was released.

Experimental details are described by Rzad and Claes.

SOURCE AND PURITY OF MATERIALS:

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

ESTIMATED ERROR:

T/K = 0.05 (estimated by compiler)
$\delta x_1/x_1$ = 0.01

REFERENCES:

1. Rzad, S.; Claes, P. *Bull. Soc. Chim. Belges*, 1964, *73*, 689.

COMPONENTS:

(1) Propane; C_3H_8; [74-98-6]

(2) Hexane; C_6H_{14}; [110-54-3]

ORIGINAL MEASUREMENTS:

Fleury, D.; Hayduk, W.

Can. J. Chem. Eng. 1975, *53*, 195-199.

VARIABLES:

T/K: 258.15-323.15

P/kPa: 101.325

PREPARED BY:

W. Hayduk

EXPERIMENTAL VALUES:

T/K	Ostwald Coefficient[1] L/cm^3 cm^{-3}	Bunsen Coefficient[2] α/cm^3 (STP)cm^{-3}atm^{-1}	Mole Fraction[1] x_1
258.15	83.4	88.2	0.336 (0.3352)[3]
278.15	40.4	41.2	0.188 (0.1894)
298.15	23.6	21.6	0.116 (0.1154)
323.15	13.9	11.7	0.0675 (0.0676)

[1] Original data.

[2] Calculated by compiler.

[3] The mole fraction solubility of the original data was used to determine the following equations for ΔG° and ln x_1 and table of smoothed values:

$$\Delta G°/\text{J mol}^{-1} = 61.609\ T + 2.0476\ T \ln T - 16494$$

$$\ln x_1 = 1983.9/T - 0.24628 \ln T - 7.4103$$

Std. deviation for ΔG° = 12.3 J mol^{-1}

T/K	ΔG°/J mol^{-1}	x_1	T/K	ΔG°/J mol^{-1}	x_1
258.15	2346	0.3352	298.15	5353	0.1154
273.15	3472	0.2168	303.15	5730	0.1030
283.15	4224	0.1662	313.15	6484	0.0829
293.15	4976	0.1298	323.15	7238	0.0676

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

A volumetric method using a glass apparatus was employed. Degassed solvent contacted the gas while flowing as a thin film, at a constant rate, through an absorption spiral into a solution buret. A constant solvent flow was obtained by means of a calibrated syringe pump. The solution at the end of the spiral was considered saturated. Dry gas was maintained at atmospheric pressure in a gas buret by mechanically raising the mercury level in the buret at an adjustable rate. The solubility was calculated from the constant slope of volume of gas dissolved and volume of solvent injected.

Degassing was accomplished using a two stage vacuum process described by Clever et al. (1).

SOURCE AND PURITY OF MATERIALS:

1. Matheson Co. Specified as instrument grade of minimum purity 99.5 per cent.

2. Phillips Petroleum. Specified minimum purity 99.0 per cent.

ESTIMATED ERROR:

δT/K = 0.1

$\delta x_1/x_1$ = 0.01

REFERENCES:

1. Clever, H.L.; Battino, R.; Saylor, J.H.; Gross, P.M. *J. Phys. Chem.* 1971, *61*, 1078.

COMPONENTS:

(1) Propane; C_3H_8; [74-98-6]

(2) 2-Methylpentane; C_6H_{14}; [107-83-5]

ORIGINAL MEASUREMENTS:

Fleury, D.; Hayduk, W.

Can. J. Chem. Eng. 1975, *53*, 195-199

VARIABLES:

T/K: 258.15-323.15

P/kPa: 101.325

PREPARED BY:

W. Hayduk

EXPERIMENTAL VALUES:

T/K	Ostwald Coefficient[1] L/cm^3 cm^{-3}	Bunsen Coefficient[2] α/cm^3 (STP) cm^{-3}atm^{-1}	Mole Fraction[1] x_1
258.15	84.5	89.4	0.342 (0.339)[3]
278.15	40.4	39.7	0.190 (0.192)
298.15	24.0	22.0	0.118 (0.118)
323.15	14.1	11.9	0.0695 (0.0694)

[1] Original data.

[2] Calculated by compiler.

[3] The mole fraction solubility of the original data was used to determine the following equations for ΔG° and ln x_1 and table of smoothed values:

$$\Delta G°/\text{J mol}^{-1} = -RT \ln x_1 = 74.596\,T - 16937$$

$$\ln x_1 = 2037/T - 8.972$$

Std. deviation for ΔG° = 19.8 J mol^{-1}; Correlation coefficient = 0.9999

T/K	ΔG°/J mol^{-1}	x_1	T/K	ΔG°/J mol^{-1}	x_1
258.15	2320	0.339	298.15	5304	0.118
273.15	3439	0.220	303.15	5677	0.105
283.15	4185	0.169	313.15	6423	0.0848
293.15	4931	0.132	323.15	7169	0.0694

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

A volumetric method using a glass apparatus was employed. Degassed solvent contacted the gas while flowing as a thin film, at a constant rate, through an absorption spiral into a solution buret. A constant solvent flow was obtained by means of a calibrated syringe pump. The solution at the end of the spiral was considered saturated. Dry gas was maintained at atmospheric pressure in a gas buret by mechanically raising the mercury level in the buret at an adjustable rate. The solubility was calculated from the constant slope of volume of gas dissolved and volume of solvent injected.

Degassing was accomplished using a two stage vacuum process described by Clever et al. (1).

SOURCE AND PURITY OF MATERIALS:

1. Matheson Co. Specified as instrument grade of minimum purity 99.5 per cent.
2. Phillips Petroleum. Specified minimum purity 99.0 per cent.

ESTIMATED ERROR:

δT/K = 0.1

$\delta x_1/x_1$ = 0.01

REFERENCES:

1. Clever, H.L.; Battino, R.; Saylor, J.H.; Gross, P.M. *J. Phys. Chem.* 1971, *61*, 1078.

COMPONENTS:

(1) Propane; C_3H_8; [74-98-6]

(2) 3-Methylpentane; C_6H_{14}; [96-14-0]

ORIGINAL MEASUREMENTS:

Fleury, D.; Hayduk, W.

Can. J. Chem. Eng. 1975, *53*, 195-199

VARIABLES:

T/K: 258.15-323.15

P/kPa: 101.325

PREPARED BY:

W. Hayduk

EXPERIMENTAL VALUES:

T/K	Ostwald Coefficient[1] L/cm^3 cm^{-3}	Bunsen Coefficient[1] α/cm^3 (STP)cm^{-3}atm^{-1}	Mole Fraction[1] x_1
258.15	84.2	89.1	0.338 (0.339)[3]
278.15	42.2	41.4	0.193 (0.190)
298.15	23.3	21.3	0.113 (0.115)
323.15	13.8	11.7	0.0673 (0.0669)

[1] Original data.

[2] Calculated by compiler.

The mole fraction solubility of the original data was used to determine the following equations for ΔG° and ln x_1 and table of smoothed values:

$$\Delta G°/\text{J mol}^{-1} = -RT \ln x_1 = 76.094\ T - 17324$$

$$\ln x_1 = 2083.7/T - 9.1525$$

Std. deviation for ΔG° = 33.7 J/ mol^{-1}; Correlation coefficient = 0.9999

T/K	ΔG°/J mol^{-1}	x_1	T/K	ΔG°/J mol^{-1}	x_1
258.15	2319	0.339	298.15	5363	0.115
273.15	3460	0.218	303.15	5743	0.102
283.15	4221	0.166	313.15	6504	0.0822
293.15	4982	0.130	323.15	7265	0.0669

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

A volumetric method using a glass apparatus was employed. Degassed solvent contacted the gas while flowing as a thin film, at a constant rate, through an absorption spiral into a solution buret. A constant solvent flow was obtained by means of a calibrated syringe pump. The solution at the end of the spiral was considered saturated. Dry gas was maintained at atmospheric pressure in a gas buret by mechanically raising the mercury level in the buret at an adjustable rate. The solubility was calculated from the constant slope of volume of gas dissolved and volume of solvent injected.

Degassing was accomplished using a two stage vacuum process described by Clever et al. (1).

SOURCE AND PURITY OF MATERIALS:

1. Matheson Co. Specified as instrument grade of minimum purity 99.5 per cent.
2. Phillips Petroleum. Specified minimum purity 99.0 per cent.

ESTIMATED ERROR:

δT/K = 0.1

$\delta x_1/x_1$ = 0.01

REFERENCES:

1. Clever, H.L.; Battino, R.; Saylor, J.H.; Gross, P.M. *J. Phys. Chem.* 1971, *61*, 1078.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Propane; C_3H_8; [74-98-6] (2) 2,2'-Dimethylbutane (Neo-hexane); C_6H_{14}; [75-83-2]	Tilquin, B.; Decanniere, L.; Fontaine, R.; Claes, P. *Ann. Soc. Sc. Bruxelles (Belgium)* 1967, *81*, 191-199.
VARIABLES: T/K: 288.15 P/kPa: 2.15-2.47	PREPARED BY: W. Hayduk

EXPERIMENTAL VALUES:

t/°C	T/K	Ostwald coefficient[1] L/cm^{3}cm^{-3}	Mole fraction[2] x_1	Henry's constant[2] H/atm
15.0	288.15	37.0	0.1735	35.0

[1] Original data at low pressure reported as a distribution coefficient; if Henry's law and ideal gas law apply, the distribution coefficient is equivalent to the Ostwald coefficient as shown here.

[2] Calculated by compiler for a gas parital pressure of 101.325 kPa assuming that Henry's law and ideal gas law apply.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

An all glass apparatus was used at a very low gas partial pressure. It contained a replaceable degassed solvent ampule equipped with a breakable point which could be broken by means of a magnetically activated plunger. The quantity of gas fed into the system was determined by measuring the pressure change in a known volume. The quantity of liquid was measured by weight. The pressure change was observed after the solvent was released.

Experimental details are described by Rzad and Claes(1).

SOURCE AND PURITY OF MATERIALS:

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

ESTIMATED ERROR:

T/K = 0.05 (estimated by compiler)

$\delta x_1/x_1$ = 0.01

REFERENCES:

1. Rzad, S.; Claes, P. *Bull. Soc. Chim. Belges*, 1964, *73*, 689.

COMPONENTS:

(1) Propane; C_3H_8; [74-98-6]

(2) 2,2-Dimethylbutane; C_6H_{14}; [75-83-2]

ORIGINAL MEASUREMENTS:

Fleury, D.; Hayduk, W.

Can. J. Chem. Eng. 1975, *53*, 195-199.

VARIABLES:

T/K: 258.15-313.15

P/kPa: 101.325

PREPARED BY:

W. Hayduk

EXPERIMENTAL VALUES:

T/K	Ostwald Coefficient[1] L/cm^{3}cm^{-3}	Bunsen Coefficient[2] α/cm^3 (STP)cm^{-3}atm^{-1}	Mole Fraction[1] x_1
258.15	86.7	91.7	0.346 (0.3467)[3]
278.15	41.9	41.1	0.195 (0.1954)
298.15	23.8	21.8	0.116 (0.1146)
313.15	15.6	13.6	0.0779 (0.0786)

[1] Original data.

[2] Calculated by compiler.

[3] The mole fraction solubility of the original data was used to determine the following equations for ΔG° and ln x_1 and table of smoothed values:

$$\Delta G°/\text{J mol}^{-1} = -RT \ln x_1 = 63.901\ T \ln T - 346.07\ T$$

$$\ln x_1 = 41.6253 - 7.6860 \ln T$$

Std. deviation for ΔG° = 18.9 J mol^{-1}; Correlation coefficient = 0.9999

T/K	ΔG°/J mol^{-1}	x_1	T/K	ΔG°/J mol^{-1}	x_1
258.15	2273	0.3467	293.15	4963	0.1305
273.15	3391	0.2246	298.15	5370	0.1146
278.15	3776	0.1954	303.15	5783	0.1008
283.15	4166	0.1704	313.15	6623	0.0786

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

A volumetric method using a glass apparatus was employed. Degassed solvent contacted the gas while flowing as a thin film, at a constant rate, through an absorption spiral into a solution buret. A constant solvent flow was obtained by means of a calibrated syringe pump. The solution at the end of the spiral was considered saturated. Dry gas was maintained at atmospheric pressure in a gas buret by mechanically raising the mercury level in the buret at an adjustable rate. The solubility was calculated from the constant slope of volume of gas dissolved and volume of solvent injected.

Degassing was accomplished using a two stage vacuum process described by Clever et al. (1).

SOURCE AND PURITY OF MATERIALS:

1. Matheson Co. Specified as instrument grade of minimum purity 99.5 per cent.
2. Phillips Petroleum. Specified minimum purity 99.0 per cent.

ESTIMATED ERROR:

δT/K = 0.1

$\delta x_1/x_1$ = 0.01

REFERENCES:

1. Clever, H.L.; Battino, R.; Saylor, J.H.; Gross, P.M. *J. Phys. Chem.* 1971, *61*, 1078.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Propane; C_3H_8; [74-98-6] (2) 2,3-Dimethylbutane; C_6H_{14}; [79-29-8]	Fleury, D.; Hayduk, W. *Can. J. Chem. Eng.* 1975, *53*, 195-199.

VARIABLES:	PREPARED BY:
T/K: 258.15-318.15 P/kPa: 101.325	W. Hayduk

EXPERIMENTAL VALUES:

T/K	Ostwald Coefficient[1] L/cm^3 cm^{-3}	Bunsen Coefficient[2] α/cm^3 (STP)$cm^{-3}atm^{-1}$	Mole Fraction[1] x_1
258.15	86.3	91.3	0.341 (0.344)[3]
278.15	41.9	41.1	0.191 (0.190)
298.15	24.2	22.2	0.115 (0.114)
318.15	14.7	12.6	0.0718 (0.0724)

[1] Original data.

[2] Calculated by compiler.

[3] The mole fraction solubility of the original data was used to determine the following equations for ΔG° and ln x_1 and table of smoothed values:

$$\Delta G°/\text{J mol}^{-1} = -RT \ln x_1 = 77.533\ T - 17724$$

$$\ln x_1 = 2131.8/T - 9.3256$$

Std. deviation for ΔG° = 26./J mol^{-1}; Correlation coefficient = 0.9999

T/K	ΔG°/J mol^{-1}	x_1	T/K	ΔG°/J mol^{-1}	x_1
258.15	2291	0.344	298.15	5392	0.114
273.15	3454	0.219	303.15	5780	0.101
283.15	4229	0.166	313.15	6555	0.0806
293.15	5004	0.128	318.15	6943	0.0724

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

A volumetric method using a glass apparatus was employed. Degassed solvent contacted the gas while flowing as a thin film, at a constant rate, through an absorption spiral into a solution buret. A constant solvent flow was obtained by means of a calibrated syringe pump. The solution at the end of the spiral was considered saturated. Dry gas was maintained at atmospheric pressure in a gas buret by mechanically raising the mercury level in the buret at an adjustable rate. The solubility was calculated from the constant slope of volume of gas dissolved and volume of solvent injected.

Degassing was accomplished using a two stage vacuum process described by Clever et al. (1).

SOURCE AND PURITY OF MATERIALS:

1. Matheson Co. Specified as instrument grade of minimum purity 99.5 per cent.
2. Phillips Petroleum. Specified minimum purity 99.0 per cent.

ESTIMATED ERROR:

δT/K = 0.1

$\delta x_1/x_1$ = 0.01

REFERENCES:

1. Clever, H.L.; Battino, R.; Saylor, J.H.; Gross, P.M. *J. Phys. Chem.* 1971, *61*, 1078.

COMPONENTS:

(1) Propane; C_3H_8; [74-98-6]

(2) Heptane; C_7H_{16}; [142-82-5]

ORIGINAL MEASUREMENTS:

Hayduk, W.; Walter, E.B.; Simpson, P.

J. Chem. Eng. Data 1972, *17*, 59-61.

VARIABLES:

T/K: 298.15-318.15

P/kPa: 101.325

PREPARED BY:

W. Hayduk

EXPERIMENTAL VALUES:

T/K	Ostwald Coefficient[1] L/cm^3 cm^{-3}	Bunsen Coefficient[2] α/cm^3 (STP)cm^{-3}atm^{-1}	Mole Fraction[1] x_1
298.15	21.65	19.8	0.117
308.15	17.30	15.3	0.0942
318.15	14.60	12.5	0.0798

[1] Original data.

[2] Calculated by compiler.

The mole fraction solubility of the original data was used to determine the following equations for $\Delta G°$ and $\ln x_1$ and table of smoothed values:

$$\Delta G°/\text{J mol}^{-1} = -RT \ln x_1 = 68.488\ T - 15085$$

$$\ln x_1 = 1814.4/T - 8.2377$$

Std. deviation for $\Delta G°$ = 28.4 J mol^{-1}; Correlation coefficient = 0.9994

T/K	$\Delta G°$/J mol^{-1}	x_1	T/K	$\Delta G°$/J mol^{-1}	x_1
298.15	5335	0.116	313.15	6362	0.0868
303.15	5677	0.105	318.15	6705	0.0793
308.15	6020	0.0954			

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

A volumetric method using a glass apparatus was employed. Degassed solvent contacted the gas while flowing as a thin film, at a constant rate, through an absorption spiral into a solution buret. A constant solvent flow was obtained by means of a calibrated syringe pump. The solution at the end of the spiral was considered saturated. Dry gas was maintained at atmospheric pressure in a gas buret by mechanically raising the mercury level in the buret at an adjustable rate. The solubility was calculated from the constant slope of volume of gas dissolved and volume of solvent injected.

Degassing was accomplished using a two stage vacuum process described by Clever et al. (1).

SOURCE AND PURITY OF MATERIALS:

1. Matheson Co. Specified as instrument grade of minimum purity 99.5 per cent.
2. Canlab. Chromatoquality grade of minimum specified purity 99.0 per cent.

ESTIMATED ERROR:

δT/K = 0.1

$\delta x_1/x_1$ = 0.01

REFERENCES:

1. Clever, H.L.; Battino, R.; Saylor, J.H.; Gross, P.M. *J. Phys. Chem.* 1971, *61*, 1078.

COMPONENTS:

(1) Propane; C_3H_8; [74-98-6]

(2) Heptane; C_7H_{16}; [142-82-5]

or

Octane; C_8H_{18}; [111-65-9]

ORIGINAL MEASUREMENTS:

Jadot, R.

J. Chim. Phys. 1972, *69*, 1036-40

VARIABLES:

T/K: 298.15

P/kPa: 101.3

PREPARED BY:

C.L. Young

EXPERIMENTAL VALUES:

T/K	Henry's Law Constant, H/atm	Mole fraction+ at partial pressure of 101.3 kPa, $x_{C_3H_8}$	#ΔH^∞ /cal mol^{-1} (/J mol^{-1})
	Heptane; C_7H_{16}; [142-82-5]		
298.15	8.29	0.1206	215 (900)
	Octane; C_8H_{18}; [111-65-9]		
298.15	7.84	0.1276	230 (962)

+ Calculated by compiler assuming $x_{C_3H_8} = 1/H$

Excess partial molar enthalpy of solution at infinite dilution.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The conventional gas chromatographic technique was used. The carrier gas was helium. The value of Henry's law constant was calculated from the retention time. The value applies to very low partial pressures of gas and there may be a substantial difference from that measured at 1 atm. pressure. There is also considerable uncertainty in the value of Henry's constant since no allowance was made for surface adsorption.

SOURCE AND PURITY OF MATERIALS:

No details given.

ESTIMATED ERROR:

$\delta T/K = \pm 0.05$; $\delta H = \pm 2\%$

REFERENCES:

COMPONENTS:

(1) Propane; C_3H_8; [74-98-6]

(2) Octane; C_8H_{18}; [111-65-9]

ORIGINAL MEASUREMENTS:

Thomsen, E.S.; Gjaldbaek, J.C.

Acta Chem. Scand. 1963, *17*, 134-138.

VARIABLES:

T/K: 298.15

P/kPa: 101.325

PREPARED BY:

E.S. Thomsen, W. Hayduk

EXPERIMENTAL VALUES:

T/K	Ostwald Coefficient[2] L/cm³ cm⁻³	Bunsen Coefficient[1] α/cm³ (STP)cm⁻³atm⁻¹	Mole Fraction[2] x_1
298.15	19.86	18.1	0.1191

[1] Original data.

[2] Calculated by compilers using a real gas molar volume.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The method utilizes a combined glass manometer and bulb enclosed in an air thermostat which is shaken until equilibrium is established. Mercury is used for calibrating the volumes and as the confining liquid. Details in reference 1.

The absorbed gas volume is calculated from the initial dry gas, and final solvent vapor-saturated gas volume. The amount of solvent is determined by measuring the mass of mercury displaced.

SOURCE AND PURITY OF MATERIALS:

1. Phillips Petroleum Co. Specified as research grade and GC analysis indicated 0.1 per cent air and 0.03 per cent ethane impurities
2. British Drug House. Fractionation yielded boiling range of 0.02 K. Estimated about 1 per cent impurity.

ESTIMATED ERROR:

δT/K = 0.05

δx_1 x_1 = 0.015

REFERENCES:

1. Gjaldbaek, J.C. *Acta Chem. Scand.* 1952, *6*, 623.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Propane; C_3H_8; [74-98-6] (2) Nonane; C_9H_{20}; [111-84-2] or Decane; $C_{10}H_{22}$; [124-18-5]	Jadot, R. *J. Chim. Phys.* 1972, *69*, 1036-40
VARIABLES:	**PREPARED BY:**
T/K: 298.15 P/kPa: 101.3	C.L. Young

EXPERIMENTAL VALUES:

T/K	Henry's Law Constant, H/atm	Mole fraction$^+$ at partial pressure of 101.3 kPa, $x_{C_3H_8}$	#ΔH^∞ /cal mol^{-1} (/J mol^{-1})
	Nonane; C_9H_{20}; [111-84-2]		
298.15	7.566	0.1322	260 (1088)
	Decane; $C_{10}H_{22}$; [124-18-5]		
298.15	7.058	0.1417	270 (1130)

\+ Calculated by compiler assuming $x_{C_3H_8} = 1/H$

\# Excess partial molar enthalpy of solution at infinite dilution.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The conventional gas chromatographic technique was used. The carrier gas was helium. The value of Henry's law constant was calculated from the retention time. The value applies to very low partial pressures of gas and there may be a substantial difference from that measured at 1 atm. pressure There is also considerable uncertainty in the value of Henry's constant since no allowance was made for surface adsorption.

SOURCE AND PURITY OF MATERIALS:

No details given.

ESTIMATED ERROR:

$\delta T/K = \pm 0.05$; $\delta H = \pm 2\%$

REFERENCES:

COMPONENTS:

(1) Propane; C_3H_8; [74-98-6]
(2) Decane; $C_{10}H_{22}$; [124-18-5]

ORIGINAL MEASUREMENTS:

Gerrard, W.
J. Appl. Chem. Biotechnol.
1973, *23*, 1-17.

VARIABLES:
T/K: 268.2-298.2
P/kPa: 101.3

PREPARED BY:
C. L. Young

EXPERIMENTAL VALUES:

Total pressure = 101.3 kPa

T/K	Mole ratio	Mole fraction of propane#
268.2	0.355	0.262
273.2	0.322	0.244
278.2	0.303	0.233
283.2	0.287	0.223
293.2	0.266	0.210
298.2	0.258	0.205

Calculated by compiler.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Gas was passed into a known weight of pure liquid in a bubbler tube at a total pressure measured using a manometer assembly. The amount of absorbed gas was estimabed by weighing. The temperature was controlled to within 0.2 K. The apparatus and procedure are described by Gerrard, ref. (1).

SOURCE AND PURITY OF MATERIALS:

No details given except that "all compounds were purified by conventional procedures".

ESTIMATED ERROR:

$\delta T/K = \pm 0.1$; $\delta x/x = \pm 3\%$
(estimated by compiler).

REFERENCES:

1. Gerrard, W.
J. Appl. Chem. Biotechnol.
1972, *22*, 623.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Propane; C_3H_8; [74-98-6] (2) Decane; $C_{10}H_{22}$; [124-18-5]	Monfort, J. P.; Arriaga, J. L. *Chem. Eng. Commun.* 1980, *7*, 17-25.
VARIABLES: T/K: 298.15 P/kPa: 101.325	PREPARED BY: C. L. Young

EXPERIMENTAL VALUES:

T/K	Henry's Law Constant, H/atm	Mole fraction* of propane at 101.3 kPa partial pressure $x_{C_3H_8}$
298.15	8.02	0.125

* Calculated by compiler assuming a linear relationship between $p_{C_3H_8}$ and $x_{C_3H_8}$ (i.e., $x_{C_3H_8}$(1 atm) = $1/H_{C_3H_8}$).

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Chromatographic determination with exponential dilutor. Solvent saturated with gas. A stripping gas was slowly passed through the solution and the concentration of dissolved gas measured using gas chromatography. Details in source.

SOURCE AND PURITY OF MATERIALS:

1. Matheson sample, purity 99 per cent by mass.
2. Merck spectroscopic grade.

ESTIMATED ERROR:

δT/K = ±0.03; δH = ±3%.

REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Propane; C_3H_8; [74-98-6] (2) Dodecane; $C_{12}H_{26}$; [112-40-3]	Hayduk, W.; Walter, E.B.; Simpson, P. *J. Chem. Eng. Data* 1972, *17*, 59-61.
VARIABLES: T/K: 298.15-318.15 P/kPa: 101.325	PREPARED BY: W. Hayduk

EXPERIMENTAL VALUES:

T/K	Ostwald Coefficient[1] L/cm^3 cm^{-3}	Bunsen Coefficient[2] α/cm^3 (STP)cm^{-3}atm^{-1}	Mole Fraction[1] x_1
298.15	14.95	13.70	0.123
308.15	12.24	10.85	0.101
318.15	10.21	8.77	0.0831

[1] Original data.

[2] Calculated by compiler.

The mole fraction solubility of the original data was used to determine the following equations for $\Delta G°$ and ln x_1 and table of smoothed values:

$$\Delta G°/\text{J mol}^{-1} = -RT \ln x_1 = 69.328\,T - 15480$$

$$\ln x_1 = 1861.9/T - 8.3387$$

Std. deviation for $\Delta G°$ = 8.0 J mol^{-1}; Correlation coefficient = 0.9999

T/K	$\Delta G°$/J mol^{-1}	x_1	T/K	$\Delta G°$/J mol^{-1}	x_1
298.15	5190	0.123	313.15	6230	0.0914
303.15	5536	0.111	318.15	6576	0.0832

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

A volumetric method using a glass apparatus was employed. Degassed solvent contacted the gas while flowing as a thin film, at a constant rate, through an absorption spiral into a solution buret. A constant solvent flow was obtained by means of a calibrated syringe pump. The solution at the end of the spiral was considered saturated. Dry gas was maintained at atmospheric pressure in a gas buret by mechanically raising the mercury level in the buret at an adjustable rate. The solubility was calculated from the constant slope of volume of gas dissolved and volume of solvent injected.

Degassing was accomplished using a two stage vacuum process described by Clever et al. (1).

SOURCE AND PURITY OF MATERIALS:

1. Matheson Co. Specified as instrument grade of minimum purity 99.5 per cent.
2. Canlab. Specified olefin-free and of minimum purity 99.0 per cent.

ESTIMATED ERROR:

δT/K = 0.1

$\delta x_1/x_1$ = 0.01

REFERENCES:

1. Clever, H.L.; Battino, R.; Saylor, J.H.; Gross, P.M. *J. Phys. Chem.* 1971 *61*, 1078.

COMPONENTS:

(1) Propane; C_3H_8; [74-98-6]

(2) Tetradecane; $C_{14}H_{30}$; [629-59-4]

ORIGINAL MEASUREMENTS:

King, M.B.; Al-Najjar, H.

Chem. Eng. Sci. 1977, *32*, 1241-1246.

VARIABLES:

T/K: 303.15-343.15

P/kPa: 101.325

PREPARED BY:

W. Hayduk, C.L. Young

EXPERIMENTAL VALUES:

T/K	Ostwald Coefficient[2] L/cm^3 cm^{-3}	Bunsen Coefficient[2] α/cm^3 (STP)cm^{-3}atm^{-1}	Mole Fraction[1] x_1
303.15	12.36	11.07	0.117 (0.117)[3]
323.15	8.71	7.30	0.0817(0.0817)
343.15	6.47	5.10	0.0596(0.0596)

[1] Original data.

[2] Calculated by compiler.

[3] The mole fraction solubility of the original data was used to determine the following equations for ΔG° and ln x_1 and table of smoothed values:

$$\Delta G°/\text{J mol}^{-1} = -RT \ln x_1 = 65.955\ T - 14585.2$$

$$\ln x_1 = 1754.29/T - 7.9330 \quad \text{Correlation coefficient} = 0.9999$$

T/K	ΔG°/J mol^{-1}	x_1	*T*/K	ΔG°/J mol^{-1}	x_1
303.15	5408.4	0.1170	333.15	7387.0	0.0695
313.15	6068.0	0.0972	343.15	8046.6	0.0596
323.15	6727.5	0.0817			

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The apparatus consists of a gas burette, an absorption spiral, a degassing chamber, a solution pipette and a magnetic stirrer. The solvent is degassed by spraying into an evacuated chamber. The solvent is then displaced by continuously injecting mercury, forcing the solvent into the absorption spiral which is also connected to the gas burette. Absorption takes place in the spiral while mixing is provided in the solution pipette at the gas-liquid interface to ensure that equilibrium is achieved. The volume of solution collected and and corresponding volume of dry gas expelled from the gas burette are used in the calculation of solubility.

SOURCE AND PURITY OF MATERIALS:

1. Source not specified. Impurities not exceeding 0.6%.
2. Source and purity not specified.

ESTIMATED ERROR:

δT/K = 0.1

$\delta x_1/x_1$ = 0.013 (authors)

REFERENCES:

COMPONENTS:

(1) Propane; C_3H_8; [74-98-6]

(2) Hexadecane; $C_{16}H_{34}$; [544-76-3]

ORIGINAL MEASUREMENTS:

Hayduk, W.; Walter, E.B.; Simpson, P.

J. Chem. Eng. Data 1972, *17*, 59-61.

VARIABLES:

T/K: 298.15-318.15

P/kPa: 101.325

PREPARED BY:

W. Hayduk

EXPERIMENTAL VALUES:

T/K	Ostwald Coefficient[1] L/cm^3 cm^{-3}	Bunsen Coefficient[2] α/cm^3 (STP)cm^{-3}atm^{-1}	Mole Fraction[1] x_1
298.15	12.65	11.59	0.133
308.15	10.25	9.09	0.109
318.15	8.58	7.37	0.0896

[1] Original data.

[2] Calculated by compiler.

The mole fraction solubility of the original data was used to determine the following equations for ΔG° and ln x_1 and table of smoothed values:

$$\Delta G°/\text{J mol}^{-1} = -RT \ln x_1 = 69.053\ T - 15592$$

$$\ln x_1 = 1875.4/T - 8.3056$$

Std. deviation for ΔG° = 7.3 J mol^{-1}; Correlation coefficient = 0.9999

T/K	ΔG°/J mol^{-1}	x_1	T/K	ΔG°/J mol^{-1}	x_1
298.15	4996	0.133	313.15	6032	0.0986
303.15	5342	0.120	318.15	6377	0.0897

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

A volumetric method using a glass apparatus was employed. Degassed solvent contacted the gas while flowing as a thin film, at a constant rate, through an absorption spiral into a solution buret. A constant solvent flow was obtained by means of a calibrated syringe pump. The solution at the end of the spiral was considered saturated. Dry gas was maintained at atmospheric pressure in a gas buret by mechanically raising the mercury level in the buret at an adjustable rate. The solubility was calculated from the constant slope of volume of gas dissolved and volume of solvent injected.

Degassing was accomplished using a two stage vacuum process described by Clever et al. (1).

SOURCE AND PURITY OF MATERIALS:

1. Matheson Co. Specified as instrument grade of minimum purity 99.5 per cent.
2. Canlab. Specified olefin-free and of minimum purity 99.0 per cent.

ESTIMATED ERROR:

δT/K = 0.1

$\delta x_1/x_1$ = 0.01

REFERENCES:

1. Clever, H.L.; Battino, R.; Saylor, J.H.; Gross, P.M. *J. Phys. Chem.* 1971, *61*, 1078.

COMPONENTS:

(1) Propane; C_3H_8; [74-98-6]

(2) Hexadecane; $C_{16}H_{34}$; [544-76-3]

ORIGINAL MEASUREMENTS:

Hayduk, W.; Castañeda, R.

Can. J. Chem. Eng. 1973, *51*, 353-358.

VARIABLES:

T/K: 298.15

P/kPa: 101.325

PREPARED BY:

W. Hayduk

EXPERIMENTAL VALUES:

T/K	Ostwald Coefficient[1] L/cm^3 cm^{-3}	Bunsen Coefficient[2] α/cm (STP) cm^{-3}atm^{-1}	Mole Fraction[1] x_1	$\Delta G°$[3] /J mol^{-1}
298.15	12.93	11.85	0.1370	4927.3

[1] Original data.

[2] Calculated by compiler.

[3] Calculated by compiler from the following equation:

$$\Delta G°/\text{J mol}^{-1} = -RT \ln x_1$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

A volumetric method using a glass apparatus was employed. Degassed solvent contacted the gas while flowing as a thin film, at a constant rate, through an absorption spiral into a solution buret. A constant solvent flow was obtained by means of a calibrated syringe pump. The solution at the end of the spiral was considered saturated. Dry gas was maintained at atmospheric pressure in a gas buret by mechanically raising the mercury level in the buret at an adjustable rate. The solubility was calculated from the constant slope of volume of gas dissolved and volume of solvent injected.

Degassing was accomplished using a two stage vacuum process described by Clever et al. (1).

SOURCE AND PURITY OF MATERIALS:

1. Matheson Co. Specified as instrument grade of minimum purity 99.5 per cent.
2. Canlab. Specified minimum purity 99.0 per cent.

ESTIMATED ERROR:

δT/K = 0.1

$\delta x_1/x_1$ = 0.01

REFERENCES:

1. Clever, H.L.; Battino, R.; Saylor, J.H.; Gross, P.M. *J. Phys. Chem.* 1971, *61*, 1078.

COMPONENTS:

(1) Propane; C_3H_8; [74-98-6]

(2) Hexadecane; $C_{16}H_{34}$; [544-76-3]

ORIGINAL MEASUREMENTS:

King, M.B.; Al-Najjar, H.

Chem. Eng. Sci. 1977, *32*, 1241-1246.

VARIABLES:

T/K: 303.15-343.15

P/kPa: 101.325

PREPARED BY:

W. Hayduk, C.L. Young

EXPERIMENTAL VALUES:

T/K	Ostwald Coefficient[2] L/cm^3 cm^{-3}	Bunsen Coefficient[2] α/cm^3 (STP)cm^{-3}atm^{-1}	Mole Fraction[1] x_1
303.15	11.86	10.62	0.125 (0.1246)[3]
323.15	8.25	6.91	0.0865(0.0871)
343.15	6.06	4.77	0.0625(0.0623)

[1] Original data.

[2] Calculated by compiler.

[3] The mole fraction solubility of the original data was used to determine the following equations for $\Delta G°$ and $\ln x_1$ and table of smoothed values:

$$\Delta G°/\mathrm{J\ mol^{-1}} = -RT \ln x_1 = 46.512\ T \ln T - 248.46\ T$$

$$\ln x_1 = 29.883 - 5.5941 \ln T,$$ Correlation coefficient = 0.9998

T/K	$\Delta G°$/J mol^{-1}	x_1	T/K	$\Delta G°$/J mol^{-1}	x_1
303.15	5249.8	0.1246	333.15	7231.7	0.0735
313.15	5895.9	0.1039	343.15	7920.9	0.0623
323.15	6556.6	0.0871			

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The apparatus consists of a gas burette, an absorption spiral, a degassing chamber, a solution pipette and a magnetic stirrer. The solvent is degassed by spraying into an evacuated chamber. The solvent is then displaced by continuously injecting mercury, forcing the solvent into the absorption spiral which is also connected to the gas burette. Absorption takes place in the spiral while mixing is provided in the solution pipette at the gas-liquid interface to ensure that equilibrium is achieved. The volume of solution collected and corresponding volume of dry gas expelled from the gas burette are used in the calculation of solubility.

SOURCE AND PURITY OF MATERIALS:

1. Source not specified. Impurities not exceeding 0.6%.
2. Source and purity not specified.

ESTIMATED ERROR:

δT/K = 0.1

$\delta x_1/x_1$ = 0.013 (authors)

REFERENCES:

COMPONENTS:

(1) Propane; C_3H_8; [74-98-6]

(2) Hexadecane; $C_{16}H_{34}$; [544-76-3]

ORIGINAL MEASUREMENTS:

Chappelow, C.C.; Prausnitz, J.M.

A.I.Ch.E.J. 1974, *20*, 1097-1104.

VARIABLES:

T/K: 300-475

P/kPa: 101.325

PREPARED BY:

C.L. Young

EXPERIMENTAL VALUES:

T/K	Henry's Constant[a] *H* /atm	Mole fraction[b] of propane at 1 atm. partial pressure, $x_{C_3H_8}$
300	8.34	0.120
325	12.9	0.0775
350	18.6	0.0538
375	25.4	0.0394
400	33.2	0.0301
425	41.6	0.0240
450	50.1	0.0200
475	58.4	0.0171

[a] Authors stated measurements were made at several pressures and values of solubility used were all within the Henry's law region.

[b] Calculated by compiler assuming linear relationship between mole fraction and pressure.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

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

SOURCE AND PURITY OF MATERIALS:

Solvent degassed, no other details given.

ESTIMATED ERROR:

$\delta T/\mathrm{K} = \pm 0.1$; $\delta x_{C_3H_8} = \pm 1\%$

REFERENCES:

1. Dymond, J.; Hildebrand, J.H. *Ind. Eng. Chem. Fundam.* 1967, *6*, 130.
2. Cukor, P.M.; Prausnitz, J.M. *Ind. Eng. Chem. Fundam.* 1971, *10*, 638.

COMPONENTS:

(1) Propane; C_3H_8; [74-98-6]

(2) Hexadecane; $C_{16}H_{34}$; [544-76-3]
or
Heptadecane; $C_{17}H_{36}$; [629-78-7]

ORIGINAL MEASUREMENTS:

Lenoir, J-Y.; Renault, P.; Renon, H.

J. Chem. Eng. Data, 1971, *16*, 340-2

VARIABLES:

T/K: 298.2,323.2

P/kPa: 101.3

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	Henry's constant $H_{C_3H_8}$/atm	Mole fraction at 1 atm* $x_{C_3H_8}$
	Hexadecane; $C_{16}H_{34}$; [544-76-3]	
298.2	7.41	0.135
	Heptadecane; $C_{17}H_{36}$; [629-78-7]	
323.2	12.5	0.080

* Calculated by compiler assuming a linear function of $p_{C_3H_8}$ vs $x_{C_3H_8}$, i.e., $x_{C_3H_8}$(1 atm) = $1/H_{C_3H_8}$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

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

SOURCE AND PURITY OF MATERIALS:

(1) L'Air Liquide sample, minimum purity 99.9 mole per cent.

(2) Touzart and Matignon or Serlabo sample, purity 99 mole per cent.

ESTIMATED ERROR:

δT/K = ±0.1; δH/atm = ±6% (estimated by compiler).

REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Propane; C_3H_8; [74-98-6] (2) Hexadecane; $C_{16}H_{34}$; [544-76-3] or Octadecane; $C_{18}H_{38}$; [593-45-3]	Richon, D.; Renon, H. *J. Chem. Eng. Data* 1980, *25*, 59-60.
VARIABLES: T/K: 298.15, 323.15 P/kPa: 101.3	PREPARED BY: C.L. Young

EXPERIMENTAL VALUES:

T/K	Limiting value of Henry's constant, H^{∞}/atm	Mole fraction of propane, * $x_{C_3H_8}$
	Hexadecane	
298.15	7.45	0.134
	Octadecane	
323.15	11.3	0.0885

* Calculated by compiler assuming mole fraction is a linear function of pressure up to 1 atm.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Inert gas stripping plus gas chromatographic method. Details given in ref. (1). Method based on passing constant stream of inert gas through dissolved gas-solvent mixture and periodically injecting mixture into gas chromatograph. Henry's law constant determined from variation of gas peak area with time.

SOURCE AND PURITY OF MATERIALS:

1. L'Air Liquide sample, purity 99.5 mole per cent.
2. Hexadecane was a Merck sample, Octadecane was a Fluka sample, both had purities of not less than 99 mole per cent.

ESTIMATED ERROR:

$\delta T/K = \pm 0.05$; $\delta x_{C_3H_8} = \pm 4\%$ (estimated by compiler).

REFERENCES:

1. Leroi, J. C.; Masson, J. C.; Renon, H.; Fabries, J. F.; Sannier, H. *Ind. Eng. Chem. Process. Des. Develop.* 1977, *16*, 139.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Propane; C_3H_8; [74-98-6] (2) 2,2,4,4,6,8,8-Heptamethyl nonane; $C_{16}H_{34}$; [4390-04-9]	Richon, D.; Renon, H. *J. Chem. Eng. Data* 1980, *25*, 59-60.

VARIABLES:	PREPARED BY:
T/K: 298.15 P/kPa: 101.3	C. L. Young

EXPERIMENTAL VALUES:

T/K	Limiting value of Henry's constant, H^{∞}/atm
298.15	2.01

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Inert gas stripping plus gas chromatographic method. Details given in ref. (1). Method based on passing constant stream of inert gas through dissolved gas-solvent mixture and periodically injecting mixture into gas chromatograph. Henry's law constant determined from variation of gas peak area with time.

SOURCE AND PURITY OF MATERIALS:

1. L'Air Liquide sample, purity 99.5 mole per cent.
2. Sigma sample, purity not less than 99 mole per cent.

ESTIMATED ERROR:

δT/K = ±0.05; δH^{∞} = ±4% (estimated by compiler).

REFERENCES:

1. Leroi, J. C.; Masson, J. C.; Renon, H.; Fabries, J. F.; Sannier, H. *Ind. Eng. Chem. Process. Des. Develop.* 1977, *16*, 139.

COMPONENTS:

(1) Propane; C_3H_8; [74-98-6]

(2) Octadecane; $C_{18}H_{38}$; [593-45-3]

ORIGINAL MEASUREMENTS:

Ng. S.; Harris, H.G.; Prausnitz, J.M.

J. Chem. Eng. Data. 1969, *14*, 482-3.

VARIABLES:

T/K: 308.2-423.2

P/kPa: 101.325

PREPARED BY:

C.L. Young

EXPERIMENTAL VALUES:

T/K	Henry's Constant, H/atm.	Mole fraction$^+$ of propane in liquid, $x_{C_3H_8}$
308.2	8.0	0.125
323.2	10.7	0.0935
343.2	15.1	0.0662
363.2	20.6	0.0485
373.2	23.1	0.0433
423.2	39.2	0.0255

\+ At 1 atmosphere partial pressure, calculated by compiler assuming mole fraction equals $1/H$.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Gas chromatographic method. Solvent supported on Chromosorb P in 6m column. Gas injected as sample, helium used as carrier gas. Henry's law constant calculated from knowledge of retention time and flow rate.

SOURCE AND PURITY OF MATERIALS:

1. Matheson sample, purity greater than 99 mole per cent.
2. Matheson, Coleman and Bell sample, m.pt. 27-28.5°C.

ESTIMATED ERROR:

$\delta T/K = \pm 0.1$; $\delta H/\text{atm} = \pm 5\%$.

REFERENCES:

COMPONENTS:

(1) Propane; C_3H_8; [74-98-6]

(2) Eicosane; $C_{20}H_{42}$; [112-95-8]

ORIGINAL MEASUREMENTS:

Chappelow, C.C.; Prausnitz, J.M.

A.I.Ch.E.J. 1974, *20*, 1097-1104.

VARIABLES:

T/K: 325-475

P/kPa: 101.325

PREPARED BY:

C.L. Young

EXPERIMENTAL VALUES:

T/K	Henry's Constant[a] H/atm	Mole fraction[b] of propane at 1 atm. partial pressure, $x_{C_3H_8}$
325	12.7	0.0787
350	18.3	0.0546
375	25.6	0.0391
400	34.1	0.0293
425	43.1	0.0232
450	52.0	0.0192
475	60.3	0.0166

[a] Authors stated measurements were made at several pressures and values of solubility used were all within the Henry's law region.

[b] Calculated by compiler assuming linear relationship between mole fraction and pressure.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

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

SOURCE AND PURITY OF MATERIALS:

Solvent degassed; no other details given.

ESTIMATED ERROR:

δT/K = ±0.1; $\delta x_{C_3H_8}$ = ±1%

REFERENCES:

1. Dymond, J.; Hildebrand, J.H. *Ind. Eng. Chem. Fundam.* 1967, *6*, 130.
2. Cukor, P.M.; Prausnitz, J.M. *Ind. Eng. Chem. Fundam.* 1971, *10*, 638.

COMPONENTS:

(1) Propane; C_3H_8; [74-98-6]

(2) Eicosane; $C_{20}H_{42}$; [112-95-8]

ORIGINAL MEASUREMENTS:

Ng. S.; Harris, H.G., Prausnitz, J.M.

J. Chem. Eng. Data, 1969, *14*, 482-3.

VARIABLES:

T/K: 323.2-413.2

P/kPa: 101.325

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	Henry's Constant, H/atm	Mole fraction of propane in liquid, $x_{C_3H_8}$ *
323.2	10.6	0.0943
343.2	14.9	0.0671
373.2	22.9	0.0437
393.2	28.9	0.0346
413.2	36.3	0.0275

* At 1 atmosphere partial pressure, calculated by compiler assuming mole fraction equals $1/H$.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Gas chromatographic method. Solvent supported on Chromosorb P in 6 m column. Gas injected as sample, helium used as carrier gas. Henry's law constant claculated from knowledge of retention time and flow rate.

SOURCE AND PURITY OF MATERIALS:

1. Matheson sample, purity greater than 99 mole per cent.

2. Matheson, Coleman and Bell sample, m.pt. 35-36.5°C.

ESTIMATED ERROR:

$\delta T/K = \pm 0.1$; $\delta H/\text{atm} = \pm 5\%$

REFERENCES:

COMPONENTS:

(1) Propane; C_3H_8; [74-98-6]

(2) Docosane; $C_{22}H_{46}$; [629-97-0]

ORIGINAL MEASUREMENTS:

Ng, S.; Harris, H.G.; Prausnitz, J.M.

J. Chem. Eng. Data, 1969, *14*, 482-3.

VARIABLES:

T/K: 333.2-473.2

P/kPa: 101.325

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	Henry's Constant, H H/atm	Mole fraction of propane* in liquid, $x_{C_3H_8}$
333.2	12.3	0.0813
383.2	24.9	0.0402
408.2	33.6	0.0298
433.2	44.0	0.0227
453.2	48.9	0.0204
473.2	60.5	0.0165

* At 1 atmosphere partial pressure, calculated by compiler assuming mole fraction equals $1/H$.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Gas chromatographic method. Solvent supported on Chromosorb P in 6 m column. Gas injected as sample, helium used as carried gas. Henry's law constant calculated from knowledge of retention time and flow rate.

SOURCE AND PURITY OF MATERIALS:

1. Metheson sample; purity greater than 99 mole per cent.

2. Matheson, Coleman and Bell sample, m.pt. 43-45^{o}C.

ESTIMATED ERROR:

$\delta T/K = \pm 0.1$; $\delta H/\text{atm} = \pm 5\%$

REFERENCES:

COMPONENTS:

(1) Propane; C_3H_8; [74-98-6]

(2) 2,6,10,15,19,23-Hexamethyltetracosane, (squalane); $C_{30}H_{62}$; [111-01-3]

ORIGINAL MEASUREMENTS:

Chappelow, C.C.; Prausnitz, J.M.

A.I.Ch.E.J. 1974, *20*, 1097-1104.

VARIABLES:

T/K: 300-475

P/kPa: 101.325

PREPARED BY:

C.L. Young

EXPERIMENTAL VALUES:

T/K	Henry's Constant[a] H/atm	Mole fraction[b] of propane at 1 atm. partial pressure, $x_{C_3H_8}$
300	5.66	0.177
325	8.83	0.113
350	13.0	0.0769
375	17.9	0.0559
400	23.5	0.0426
425	29.6	0.0338
450	35.9	0.0279
475	41.7	0.0240

[a] Authors stated measurements were made at several pressures and values of solubility used were all within the Henry's law region.

[b] Calculated by compiler assuming linear relationship between mole fraction and pressure.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

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

SOURCE AND PURITY OF MATERIALS:

Solvent degassed; no other details given.

ESTIMATED ERROR:

$\delta T/\text{K} = \pm 0.1$; $\delta x_{C_3H_8} = \pm 1\%$

REFERENCES:

1. Dymond, J.; Hildebrand, J.H. *Ind. Eng. Chem. Fundam.* 1967, *6*, 130.
2. Cukor, P.M.; Prausnitz, J.M. *Ind. Eng. Chem. Fundam.* 1971, *10*, 638.

COMPONENTS:

(1) Propane; C_3H_8; [74-98-6]

(2) Hexadecane; $C_{16}H_{34}$; [544-76-3]
Octacosane; $C_{28}H_{58}$; [630-02-4]
Hexatriacontane; $C_{36}H_{74}$; [630-06-8]

ORIGINAL MEASUREMENTS:

Lin, P. J.; Parcher, J. F.

J. Chromatog. Sci.

1982, *20*, 33-38.

VARIABLES:

T/K: 298.2-413.2

P_1/kPa: 101.325

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	Henry's law constant, H/atm	Mole fraction at a partial pressure of 1 atmosphere $x_{C_3H_8}$
	Hexadecane; $C_{16}H_{34}$; [544-76-3]	
298.2	7.99	0.125
313.2	10.1	0.0990
328.2	13.4	0.0746
	Octacosane; $C_{28}H_{58}$; [630-02-4]	
353.2	15.4	0.0649
373.2	19.3	0.0518
393.2	24.7	0.0405
	Hexatriacontane; $C_{36}H_{74}$; [630-06-8]	
353.2	12.7	0.0787
373.2	16.5	0.0606
393.2	21	0.0476
413.2	25.7	0.0389

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

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

SOURCE AND PURITY OF MATERIALS:

No details given.

ESTIMATED ERROR:

$\delta T/K = \pm 0.1$; $\delta x_{C_3H_8} = \pm 5\%$

(estimated by compiler).

REFERENCES:

COMPONENTS:

(1) Butane; C_4H_{10}; [106-97-8]

(2) Pentane; C_5H_{12}; [109-66-0]
or
Hexane; C_6H_{14}; [110-54-3]

ORIGINAL MEASUREMENTS:

Jadot, R.

J. Chim. Phys. 1972, *69*, 1036-40

VARIABLES:

T/K: 298.15

P/kPa: 101.3

PREPARED BY:

C.L. Young

EXPERIMENTAL VALUES:

T/K	Henry's Law Constant, H/atm	Mole fraction$^+$ at partial pressure of 101.3 kPa, $x_{C_4H_{10}}$	#ΔH^∞ /cal mol^{-1} (/J mol^{-1})
		Pentane; C_5H_{12}; [109-66-0]	
298.15	2.594	0.3858	-
		Hexane; C_6H_{14}; [110-54-3]	
298.15	2.524	0.3962	150 (628)

\+ Calculated by compiler assuming $x_{C_4H_{10}} = 1/H$.

\# Excess partial molar enthalpy of solution at infinite dilution.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The conventional gas chromatographic technique was used. The carrier gas was helium. The value of Henry's law constant was calculated from the retention time. The value applies to very low partial pressures of gas and there may be a substantial difference from that measured at 1 atm. pressure. There is also considerable uncertainty in the value of Henry's constant since no allowance was made for surface adsorption.

SOURCE AND PURITY OF MATERIALS:

No details given.

ESTIMATED ERROR:

$\delta T/K = \pm 0.05$; $\delta H = \pm 2\%$

REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Butane; C_4H_{10}; [106-97-8] (2) Hexane; C_6H_{14}; [110-54-3]	Hayduk, W., Castañeda, R. *Can. J. Chem.* 1973, *51*, 353-358.
VARIABLES: T/K: 278.15-323.15 P/kPa: 101.325	**PREPARED BY:** W. Hayduk

EXPERIMENTAL VALUES:

T/K	Ostwald Coefficient[1] $L/\text{cm}^3\ \text{cm}^{-3}$	Bunsen Coefficient[2] $\alpha/\text{cm}^3\ (\text{STP})\text{cm}^{-3}\text{atm}^{-1}$	Mole Fraction[1] x_1
278.15	480.3	471.7	0.737 (0.732)[3]
298.15	113.4	103.9	0.386 (0.390)
323.15	47.4	40.1	0.199 (0.198)

[1] Original data.

[2] Calculated by compiler.

[3] The mole fraction solubility of the original data was used to determine the following equations for ΔG° and ln x_1 and table of smoothed values:

$$\Delta G°/\text{J mol}^{-1} = -RT \ln x_1 = 80.652\ T - 21713$$

$$\ln x_1 = 2611.6/T - 9.7007$$

Std. deviation for ΔG° = 22.9 J mol^{-1}; Correlation coefficient = 0.9999

T/K	$\Delta G°/\text{J mol}^{-1}$	x_1	T/K	$\Delta G°/\text{J mol}^{-1}$	x_1
278.15	720.2	0.732	303.15	2737	0.338
283.15	1124	0.621	313.15	3543	0.256
293.15	1930	0.453	323.15	4350	0.198
298.15	2333	0.390			

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

A volumetric method using a glass apparatus was employed. Degassed solvent contacted the gas while flowing as a thin film, at a constant rate, through an absorption spiral into a solution buret. A constant solvent flow was obtained by means of a calibrated syringe pump. The solution at the end of the spiral was considered saturated. Dry gas was maintained at atmospheric pressure in a gas buret by mechanically raising the mercury level in the buret at an adjustable rate. The solubility was calculated from the constant slope of volume of gas dissolved and volume of solvent injected.

Degassing was accomplished using a two stage vacuum process described by Clever et al. (1).

SOURCE AND PURITY OF MATERIALS:

1. Matheson Co. Specified as instrument grade of minimum purity 99.5 per cent.
2. Canlab. Specified minimum purity 99.0 per cent.

ESTIMATED ERROR:

δT/K = 0.1

$\delta x_1/x_1$ = 0.01

REFERENCES:

1. Clever, H.L.; Battino, R.; Saylor, J.H.; Gross, P.M. *J. Phys. Chem.* 1971, *61*, 1078.

COMPONENTS:

(1) Butane; C_4H_{10}; [106-97-8]

(2) Hexane; C_6H_{14}; [110-54-3]

ORIGINAL MEASUREMENTS:

Tilquin, B.; Decanniere, L.; Fontaine, R.; Claes, P.

Ann. Soc. Sc. Bruxelles (Belgium) 1967, *81*, 191-199.

VARIABLES:

T/K: 288.15

P/kPa: 7.97-8.11

PREPARED BY:

W. Hayduk

EXPERIMENTAL VALUES:

t/°C	T/K	Ostwald Coefficient[1] L/cm^{3}cm^{-3}	Mole fraction[2] /x_1	Henry's constant[2] H/atm
15.0	288.15	142.1	0.441	2.267

[1] Original data at low pressure reported as a distribution coefficient; if Henry's law and ideal gas law apply, the distribution coefficient is equivalent to the Ostwald coefficient as shown here.

[2] Calculated by compiler for a gas partial pressure of 101.325 kPa assuming that Henry's law and ideal gas law apply.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

An all glass apparatus was used at a very low gas partial pressure. It contained a replaceable degassed solvent ampule equipped with a breakable point which could be broken by means of a magnetically activated plunger. The quantity of gas fed into the system was determined by measuring the pressure change in a known volume. The quantity of liquid was measured by weight. The pressure change was observed after the solvent was released.

Experimental details are described by Rzad and Claes(1).

SOURCE AND PURITY OF MATERIALS:

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

ESTIMATED ERROR:

T/K = 0.05 (estimated by compiler)

$\delta x_1/x_1$ = 0.01

REFERENCES:

1. Rzad, S.; Claes, P.
Bull. Soc. Chim. Belges, 1964, *73*, 689.

COMPONENTS:

(1) Butane; C_4H_{10}; [106-97-8]

(2) 2,2'-Dimethylbutane (Neo-hexane); C_6H_{14}; [75-83-2]

ORIGINAL MEASUREMENTS:

Tilquin, B.; Decanniere, L.; Fontaine, R.; Claes, P.

Ann. Soc. Sc. Bruxelles (Belgium) 1967, *81*, 191-199.

VARIABLES:

T/K: 288.15

P/kPa: 3.68-3.71

PREPARED BY:

W. Hayduk

EXPERIMENTAL VALUES:

t/°C	T/K	Ostwald coefficient[1] L	Mole Fraction[2] $/x_1$	Henry's constant[2] H/atm
15.0	288.15	70.4	0.290	3.448

[1] Original data at low pressure reported as a distribution coefficient; if Henry's law and ideal gas law apply, the distribution coefficient is equivalent to the Ostwald coefficient as shown here.

[2] Calculated by compiler for a gas partial pressure of 101.325 kPa assuming that Henry's law and ideal gas law apply.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

An all glass apparatus was used at a very low gas partial pressure. It contained a replaceable degassed solvent ampule equipped with a breakable point which could be broken by means of a magnetically activated plunger. The quantity of gas fed into the system was determined by measuring the pressure change in a known volume. The quantity of liquid was measured by weight. The pressure change was observed after the solvent was released.

Experimental details are described by Rzad and Claes (1).

SOURCE AND PURITY OF MATERIALS:

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

ESTIMATED ERROR:

T/K = 0.05 (estimated by compiler)

$\delta x_1/x_1$ = 0.01

REFERENCES:

1. Rzad, S.; Claes, P.
Bull. Soc. Chim. Belges, 1964, *73*, 689.

COMPONENTS:

(1) Butane; C_4H_{10}; [106-97-8]

(2) Heptane; C_7H_{16}; [142-82-5]

ORIGINAL MEASUREMENTS:

Hayduk, W.; Castañeda, R.

Can. J. Chem. Eng. 1973, *51*, 353-358.

VARIABLES:

T/K: 278.15-323.15

P/kPa: 101.325

PREPARED BY:

W. Hayduk

EXPERIMENTAL VALUES:

T/K	Ostwald Coefficient[1] L/cm^3 cm^{-3}	Bunsen Coefficient[2] α/cm^3 (STP)cm^{-3}atm^{-1}	Mole Fraction[1] x_1
278.15	582	572	0.794 (0.795)[3]
298.15	118.2	108.3	0.423 (0.423)
323.15	46.4	39.2	0.214 (0.214)

[1] Original data.

[2] Calculated by compiler.

[3] The mole fraction solubility of the original data was used to determine the following equations for ΔG° and ln x_1 and table of smoothed values:

$$\Delta G°/\text{J mol}^{-1} = -RT \ln x_1 = 80.213\ T - 21780$$

$$\ln x_1 = 2619.7/T - 9.6479$$

Std. deviation for ΔG° = 2.7 J mol^{-1}; Correlation coefficient = 0.9999

T/K	ΔG°/J mol^{-1}	x_1	T/K	ΔG°/J mol^{-1}	x_1
278.15	531.6	0.795	303.15	2537	0.366
283.15	932.7	0.673	313.15	3339	0.277
293.15	1735	0.491	323.15	4141	0.214
298.15	2136	0.423			

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

A volumetric method using a glass apparatus was employed. Degassed solvent contacted the gas while flowing as a thin film, at a constant rate, through an absorption spiral into a solution buret. A constant solvent flow was obtained by means of a calibrated syringe pump. The solution at the end of the spiral was considered saturated. Dry gas was maintained at atmospheric pressure in a gas buret by mechanically raising the mercury level in the buret at an adjustable rate. The solubility was calculated from the constant slope of volume of gas dissolved and volume of solvent injected.

Degassing was accomplished using a two stage vacuum process described by Clever et al. (1).

SOURCE AND PURITY OF MATERIALS:

1. Matheson Co. Specified as instrument grade of minimum purity 99.5 per cent.
2. Canlab. Specified minimum purity 99.0 per cent.

ESTIMATED ERROR:

δT/K = 0.1

$\delta x_1/x_1$ = 0.01

REFERENCES:

1. Clever, H.L.; Battino, R.; Saylor, J.H.; Gross, P.M. *J. Phys. Chem.* 1971, *61*, 1078.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Butane; C_4H_{10}; [106-97-8] (2) Heptane; C_7H_{16}; [142-82-5] or Octane; C_8H_{18}; [111-65-9]	Jadot, R. *J. Chim. Phys.* 1972, *69*, 1036-40.
VARIABLES:	**PREPARED BY:**
T/K: 298.15 *P*/kPa: 101.3	C.L. Young

EXPERIMENTAL VALUES:

T/K	Henry's Law Constant, *H*/atm	Mole fraction$^+$ at partial pressure of 101.3 kPa, $x_{C_4H_{10}}$	#ΔH^∞ /cal mol^{-1} (/J mol^{-1})
		Heptane; C_7H_{16}; [142-82-5]	
298.15	2.280	0.4386	160 (669)
		Octane; C_8H_{18}; [111-65-9]	
298.15	2.21	0.452	180 (753)

+ Calculated by compiler assuming $x_{C_4H_{10}} = 1/H$

Excess partial molar enthalpy of solution at infinite dilution.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The conventional gas chromatographic technique was used. The carrier gas was helium. The value of Henry's law constant was calculated from the retention time. The value applies to very low partial pressures of gas and there may be a substantial difference from that measured at 1 atm. pressure. There is also considerable uncertainty in the value of Henry's constant since no allowance was made for surface adsorption.

SOURCE AND PURITY OF MATERIALS:

No details given.

ESTIMATED ERROR:

$\delta T/K = \pm 0.05$; $\delta H = \pm 2\%$

REFERENCES.

COMPONENTS:

(1) Butane; C_4H_{10}; [106-97-8]

(2) Octane; C_8H_{18}; [111-65-9]

ORIGINAL MEASUREMENTS:

Hayduk, W.; Castañeda, R.

Can. J. Chem. Eng. 1973, *51*, 353-358.

VARIABLES:

T/K: 278.15-323.15

P/kPa: 101.325

PREPARED BY:

W. Hayduk

EXPERIMENTAL VALUES:

T/K	Ostwald Coefficient[1] L/cm^3 cm^{-3}	Bunsen Coefficient[2] α/cm^3 (STP)cm^{-3}atm^{-1}	Mole Fraction[1] x_1
278.15	545	535	0.799 (0.801)[3]
298.15	110.3	101.1	0.432 (0.430)
323.15	43.4	36.7	0.220 (0.220)

[1] Original data.

[2] Calculated by compiler.

[3] The mole fraction solubility of the original data was used to determine the following equations for ΔG° and ln x_1 and table of smoothed values:

$$\Delta G°/\text{J mol}^{-1} = -RT \ln x_1 = 78.904\ T - 21434$$

$$\ln x_1 = 2578.1/T - 9.4905$$

Std. deviation for ΔG° = 9.1 J mol^{-1}; Correlation coefficient = 0.9999

T/K	ΔG°/J mol^{-1}	x_1	T/K	ΔG°/J mol^{-1}	x_1
278.15	513.0	0.801	303.15	2485	0.373
283.15	907.5	0.680	313.15	3275	0.284
293.15	1697	0.499	323.15	4064	0.220
298.15	2091	0.430			

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

A volumetric method using a glass apparatus was employed. Degassed solvent contacted the gas while flowing as a thin film, at a constant rate, through an absorption spiral into a solution buret. A constant solvent flow was obtained by means of a calibrated syringe pump. The solution at the end of the spiral was considered saturated. Dry gas was maintained at atmospheric pressure in a gas buret by mechanically raising the mercury level in the buret at an adjustable rate. The solubility was calculated from the constant slope of volume of gas dissolved and volume of solvent injected.

Degassing was accomplished using a two stage vacuum process described by Clever et al. (1).

SOURCE AND PURITY OF MATERIALS:

1. Matheson Co. Specified as instrument grade of minimum purity 99.5 per cent.
2. Canlab. Specified minimum purity 99.0 per cent

ESTIMATED ERROR:

δT/K = 0.1

$\delta x_1/x_1$ = 0.01

REFERENCES:

1. Clever, H.L.; Battino, R.; Saylor, J.H.; Gross, P.M. *J. Phys. Chem.* 1971, *61*, 1078.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Butane; C_4H_{10}; [106-97-8] (2) Nonane; C_9H_{20}; [111-84-2] or Decane; $C_{10}H_{22}$; [124-18-5]	Jadot, R. *J. Chim. Phys.* 1972, *69*, 1036-40

VARIABLES:	PREPARED BY:
T/K: 298.15 P/kPa: 101.3	C.L. Young

EXPERIMENTAL VALUES:

T/K	Henry's Law Constant, H/atm	Mole fraction$^+$ at partial pressure of 101.3 kPa, $x_{C_4H_{10}}$	#ΔH^∞ /cal mol^{-1} (/J mol^{-1})
	Nonane; C_9H_{20}; [111-84-2]		
298.15	2.12	0.472	205 (858)
	Decane; $C_{10}H_{22}$; [124-18-5]		
298.15	2.0	0.4888	210 (879)

+ Calculated by compiler assuming $x_{C_4H_{10}} = 1/H$

Excess partial molar enthalpy of solution at infinite dilution.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The conventional gas chromatographic technique was used. The carrier gas was helium. The value of Henry's law constant was calculated from the retention time. The value applies to very low partial pressures of gas and there may be a substantial difference from that measured at 1 atm. pressure. There is also considerable uncertainty in the value of Henry's constant since no allowance was made for surface adsorption.

SOURCE AND PURITY OF MATERIALS:

No details given.

ESTIMATED ERROR:

δT/K = ±0.05; δH = ±2%

REFERENCES:

COMPONENTS:

(1) Butane; C_4H_{10}; [106-97-8]

(2) Decane; $C_{10}H_{22}$; [124-18-5]

ORIGINAL MEASUREMENTS:

Monfort, J. P.; Arriaga, J. L.
Chem. Eng. Commun.
1980, *7*, 17-25.

VARIABLES:

T/K: 298.15
P/kPa: 101.325

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	Henry's Law Constant, H/atm	Mole fraction$^+$, $x_{C_4H_{10}}$
298.15	2.03	0.4926

$^+$ Calculated by compiler assuming $x_{C_4H_{10}} = 1/H$.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Chromatographic determination with exponential dilutor. Solvent saturated with gas. A stripping gas was slowly passed through the solution and the concentration of dissolved gas measured using gas chromatography. Details in source.

SOURCE AND PURITY OF MATERIALS:

1. Matheson sample, purity 99 per cent by mass.

2. Merck spectroscopic grade.

ESTIMATED ERROR:

$\delta T/K = \pm 0.03$; $\delta H = \pm 3\%$.

REFERENCES:

COMPONENTS:

(1) Butane; C_4H_{10}; [106-97-8]

(2) Decane; $C_{10}H_{22}$; [124-18-5]

ORIGINAL MEASUREMENTS:

Gerrard, W.

J. Appl. Chem. Biotechnol.

1973, *23*, 1-17.

VARIABLES:

T/K: 268.2-298.2

P/kPa: 73.3, 101.3

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	p^*/mmHg	P^*/kPa	Mole ratio	Mole fraction of propane #
268.2	550	73.3	7.33	0.880
278.2	760	101.3	4.23	0.809
283.2	760	101.3	2.334	0.700
293.2	760	101.3	1.040	0.510
298.2	760	101.3	0.810	0.448

* Total pressure.

Calculated by compiler.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Gas was passed into a known weight of pure liquid in a bubbler tube at a total pressure measured using a manometer assembly. The amount of absorbed gas was estimated by weighing. The temperature was controlled to within 0.2 K. The apparatus and procedure are described by Gerrard, ref. (1).

SOURCE AND PURITY OF MATERIALS:

No details given except that "all compounds were purified by conventional procedures".

ESTIMATED ERROR:

$\delta T/K = \pm 0.1$; $\delta x/x = \pm 3\%$ (estimated by compiler).

REFERENCES:

1. Gerrard, W.
J. Appl. Chem. Biotechnol.
1972, *22*, 623.

COMPONENTS:

(1) Butane; C_4H_{10}; [106-97-8]

(2) Dodecane; $C_{12}H_{26}$; [112-40-3]

ORIGINAL MEASUREMENTS:

Monfort, J. P.; Arriaga, J. L.
Chem. Eng. Commun.
1980, *7*, 17-25.

VARIABLES:

T/K: 278.15, 298.15
P/kPa: 101.325

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	Henry's Law Constant, H/atm	Mole fraction$^+$, $x_{C_4H_{10}}$
278.15	1.02	0.9804
298.15	2.04	0.4902

$^+$ Calculated by compiler assuming $x_{C_4H_{10}} = 1/H$.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Chromatographic determination with exponential dilutor. Solvent saturated with gas. A stripping gas was slowly passed through the solution and the concentration of dissolved gas measured using gas chromatography. Details in source.

SOURCE AND PURITY OF MATERIALS:

1. Matheson sample; purity 99 per cent by mass.

2. Merck spectroscopic grade.

ESTIMATED ERROR:

δT/K = ±0.03; δH = ±3%.

REFERENCES:

COMPONENTS:

(1) Butane; C_4H_{10}; [106-97-8]

(2) Dodecane; $C_{12}H_{26}$; [112-40-3]

ORIGINAL MEASUREMENTS:

Hayduk, W.; Castañeda, R.

Can. J. Chem. Eng. 1973, *51*, 353-358.

VARIABLES:

T/K: 278.15-323.15

P/kPa: 101.325

PREPARED BY:

W. Hayduk

EXPERIMENTAL VALUES:

T/K	Ostwald Coefficient[1] L/cm^3 cm^{-3}	Bunsen Coefficient[2] α/cm^3 (STP) cm^{-3}atm^{-1}	Mole Fraction[1] x_1
278.15	429	421.3	0.814 (0.0810)[3]
298.15	83.8	76.8	0.443 (0.447)
323.15	34.1	28.8	0.236 (0.235)

[1] Original data.

[2] Calculated by compiler.

[3] The mole fraction solubility of the original data was used to determine the following equations for ΔG° and ln x_1 and table of smoothed values:

$$\Delta G°/\text{J mol}^{-1} = -RT \ln x_1 = 75.594\ T - 20540$$

$$\ln x_1 = 2470.5/T - 9.0924$$

Std. deviation for ΔG° = 17.1 J mol^{-1}; Correlation coefficient = 0.9999

T/K	ΔG°/J mol^{-1}	x_1	T/K	ΔG°/J mol^{-1}	x_1
278.15	486.7	0.180	303.15	2377	0.390
283.15	864.7	0.693	313.15	3133	0.300
293.15	1621	0.514	323.15	3888	0.235
298.15	1999	0.447			

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

A volumetric method using a glass apparatus was employed. Degassed solvent contacted the gas while flowing as a thin film, at a constant rate, through an absorption spiral into a solution buret. A constant solvent flow was obtained by means of a calibrated syringe pump. The solution at the end of the spiral was considered saturated. Dry gas was maintained at atmospheric pressure in a gas buret by mechanically raising the mercury level in the buret at an adjustable rate. The solubility was calculated from the constant slope of volume gas dissolved and volume of solvent injected.

Degassing was accomplished using a two stage vacuum process described by Clever et al. (1).

SOURCE AND PURITY OF MATERIALS:

1. Matheson Co. Specified as instrument grade of minimum purity 99.5 per cent.
2. Canlab. Specified minimum purity 99.0 per cent.

ESTIMATED ERROR:

δT/K = 0.1

$\delta x_1/x_1$ = 0.01

REFERENCES:

1. Clever, H.L.; Battino, R.; Saylor, J.H.; Gross, P.M.

   J. Phys. Cehm. 1971, *61*, 1078.

COMPONENTS:

(1) Butane; C_6H_{14}; [106-97-8]

(2) Hexadecane; $C_{16}H_{34}$; [544-76-3]

ORIGINAL MEASUREMENTS:

Hayduk, W.; Castañeda, R.

Can. J. Chem. Eng. 1973, *61*, 353-358.

VARIABLES:

T/K: 298.15-323.15

P/kPa: 101.325

PREPARED BY:

W. Hayduk

EXPERIMENTAL VALUES:

T/K	Ostwald Coefficient[1] L/cm^3 cm^{-3}	Bunsen Coefficient[2] α/cm^3 (STP)cm^{-3}atm^{-1}	Mole Fraction[1] x_1
298.15	68.8	63.0	0.460
323.15	28.5	24.1	0.249

[1] Original data.

[2] Calculated by compiler.

The mole fraction solubility of the original data was used to determine the following equations for ΔG° and ln x_1 and table of smoothed values:

$$\Delta G°/\text{J mol}^{-1} = -RT \ln x_1 = 72.417\ T - 19666$$

$$\ln x_1 = 2365.4/T - 8.7102$$

T/K	ΔG°/J mol^{-1}	x_1
298.15	1925	0.460
303.15	2287	0.404
313.15	3011	0.315
323.15	3736	0.249

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

A volumetric method using a glass apparatus was employed. Degassed solvent contacted the gas while flowing as a thin film, at a constant rate, through an absorption spiral into a solution buret. A constant solvent flow was obtained by means of a calibrated syringe pump. The solution at the end of the spiral was considered saturated. Dry gas was maintained at atmospheric pressure in a gas buret by mechanically raising the mercury level in the buret at an adjustable rate. The solubility was calculated from the constant slope of volume of gas dissolved and volume of solvent injected.

Degassing was accomplished using a two stage vacuum process described by Clever et al. (1).

SOURCE AND PURITY OF MATERIALS:

1. Matheson Co. Specified as instrument grade of minimum purity 99.5 per cent.
2. Canlab. Specified minimum purity 99.0 per cent.

ESTIMATED ERROR:

δT/K = 0.1

$\delta x_1/x_1$ = 0.01

REFERENCES:

1. Clever, H.L.; Battino, R.; Saylor, J.H.; Gross, P.M. *J. Phys. Chem.* 1971, *61*, 1078.

COMPONENTS:

(1) Butane; C_4H_{10}; [106-97-8]

(2) Hexadecane; $C_{16}H_{34}$; [544-76-3]

ORIGINAL MEASUREMENTS:

Chappelow, C.C., Prausnitz, J.M.

A.I.Ch.E.J. 1974, *20*, 1097-1104.

VARIABLES:

T/K: 300-475

P/kPa: 101.325

PREPARED BY:

C.L. Young

EXPERIMENTAL VALUES:

T/K	Henry's Constant[a] H/atm	Mole fraction[b] of butane at 1 atm. partial pressure, $x_{C_4H_{10}}$
300	2.60	0.3846
325	4.18	0.2392
350	7.08	0.1412
375	10.8	0.0925
400	15.4	0.0649
425	20.8	0.0481
450	26.8	0.0373
475	33.1	0.0302

[a] Authors stated measurements were made at several pressures and values of solubility used were all within the Henry's law region.

[b] Calculated by compiler assuming linear relationship between mole fraction and pressure.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

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

SOURCE AND PURITY OF MATERIALS:

Solvent degassed; no other details given.

ESTIMATED ERROR:

$\delta T/\mathrm{K} = \pm 0.1$; $\delta x_{C_4H_{10}} = \pm 1\%$

REFERENCES:

1. Dymond, J.; Hildebrand, J.H. *Ind. Eng. Chem. Fundam.* 1967, *6*, 130.
2. Cukor, P.M.; Prausnitz, J.M. *Ind. Eng. Chem. Fundam.* 1971, *10*, 638.

COMPONENTS: (1) Butane; C_4H_{10}; [106-97-8] (2) 2,2,4,4,6,8,8-Heptamethyl nonane; $C_{16}H_{34}$; [4390-04-9]	ORIGINAL MEASUREMENTS: Richon, D.; Renon, H. *J. Chem. Eng. Data* 1980, *25*, 59-60.
VARIABLES: T/K: 298.15 P/kPa: 101.3	PREPARED BY: C. L. Young

EXPERIMENTAL VALUES:

T/K	Limiting value of Henry's constant, H^{∞}/atm
298.15	0.56_6

Evaluator's note: Value for Henry's law constant as it is found here and original reference appears incorrect because it cannot be less than one (giving a mole fraction solubility greater than one); hence this value is rejected.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Inert gas stripping plus gas chromatographic method. Details given in ref. (1). Method based on passing constant stream of inert gas through dissolved gas-solvent mixture and periodically injecting mixture into gas chromatograph. Henry's law constant determined from variation of gas peak area with time.

SOURCE AND PURITY OF MATERIALS:

1. L'Air Liquide sample, purity 99 mole per cent.
2. Sigma sample, purity not less than 99 mole per cent.

ESTIMATED ERROR:

$\delta T/K = \pm 0.05$; $\delta H^{\infty} = \pm 4\%$ (estimated by compiler).

REFERENCES:

1. Leroi, J. C.; Masson, J. C.; Renon, H.; Fabries, J. F.; Sannier, H. *Ind. Eng. Chem. Process. Des. Develop.* 1977, *16*, 139.

COMPONENTS:

(1) Butane; C_4H_{10}; [106-97-8]

(2) Hexadecane; $C_{16}H_{34}$; [544-76-3]
or
Octadecane; $C_{18}H_{38}$; [593-45-3]

ORIGINAL MEASUREMENTS:

Richon, D.; Renon, H.

J. Chem. Eng. Data 1980, *25*, 59-60.

VARIABLES:

T/K: 298.15, 323.15

P/kPa: 101.3

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	Limiting value of Henry's constant, H^{∞}/atm
	Hexadecane
298.15	2.01
	Octadecane
323.15	3.72

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Inert gas stripping plus gas chromatographic method. Details given in ref. (1). Method based on passing constant stream of inert gas through dissolved gas-solvent mixture and periodically injecting mixture into gas chromatograph. Henry's law constant determined from variation of gas peak area with time.

SOURCE AND PURITY OF MATERIALS:

1. L'Air Liquide sample, purity 99 mole per cent.
2. Hexadecane was a Merck sample, Octadecane was a Fluka sample, both had purities of not less than 99 mole per cent.

ESTIMATED ERROR:

$\delta T/K = \pm 0.05$; $\delta H^{\infty} = \pm 4\%$ (estimated by compiler).

REFERENCES.

1. Leroi, J. C.; Masson, J. C.; Renon, H.; Fabries, J. F.; Sannier, H. *Ind. Eng. Chem. Process. Des. Develop.* 1977, *16*, 139.

COMPONENTS:

(1) Butane; C_4H_{10}; [106-97-8]

(2) Eicosane; $C_{20}H_{42}$; [112-95-8]

ORIGINAL MEASUREMENTS:

Chappelow, C.C.; Prausnitz, J.M.

A.I.Ch.E.J. 1974, *20*, 1097-1104.

VARIABLES:

T/K: 325-475

P/kPa: 101.325

PREPARED BY:

C.L. Young

EXPERIMENTAL VALUES:

T/K	Henry's Constant[a] H/atm	Mole fraction[b] of butane at 1 atm. partial pressure, $x_{C_4H_{10}}$
325	3.90	0.2564
350	6.30	0.1587
375	9.88	0.1012
400	14.0	0.0714
425	18.8	0.0532
450	24.8	0.0403
475	29.4	0.0340

[a] Authors stated measurements were made at several pressures and values of solubility used were all within the Henry's law region.

[b] Calculated by compiler assuming linear relationship between mole fraction and pressure.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

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

SOURCE AND PURITY OF MATERIALS:

Solvent degassed; no other details given.

ESTIMATED ERROR:

$\delta T/\mathrm{K} = \pm 0.1$; $\delta x_{C_4H_{10}} = \pm 1\%$

REFERENCES:

1. Dymond, J.; Hildebrand, J.H. *Ind. Eng. Chem. Fundam.* 1967, *6*, 130.
2. Cukor, P.M.; Prausnitz, J.M. *Ind. Eng. Chem. Fundam.* 1971, *10*, 638.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Butane; C_4H_{10}; [106-97-8] (2) Eicosane; $C_{20}H_{42}$; [112-95-8] or Docosane; $C_{22}H_{46}$; [629-97-0]	Parcher, J. F.; Weiner, P. H.; Hussey, C. L.; Westlake, T. N. *J. Chem. Eng. Data* 1975, *20*, 145-151.

VARIABLES:	PREPARED BY:
T/K: 353.2-393.2 P_1/kPa: 101.325	C. L. Young

EXPERIMENTAL VALUES:

T/K	Specific retention volume /$cm^3\ g^{-1}$	Henry's law Constant [a] H/atm	Mole fraction at a partial pressure of 1 atm [b]
	Eicosane; $C_{20}H_{42}$; [112-95-8]		
353.2	11.48	6.91	0.145
	Docosane; $C_{22}H_{46}$; [629-97-0]		
353.2	10.69	6.75	0.148
373.2	7.42	9.72	0.103
393.2	5.63	12.82	0.0780

[a] Calculated by compiler using equation given by authors (see below).

[b] Calculated by compiler assuming Henry's law is valid up to 1 atmosphere.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Gas chromatographic method in which butane was used as injected solute and long chain alkane as stationary liquid. Thermal conductivity detector used. Calculation of mole fraction at 1 atmosphere pressure involves considerable approximation. No allowance was made for the presence of the carrier gas when estimating gas phase imperfection contribution to Henry's law constant. Henry's law constant given by

$$H = \frac{273.15R}{MW_{solvent} \times \text{Specific retention volume}}$$

SOURCE AND PURITY OF MATERIALS:

2. No impurity detected when analysed by GC on SE-30 column.

ESTIMATED ERROR:

δT/K = ±0.1; δH/atm = ±1.0%
(estimated by compiler).

REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Butane; C_4H_{10}; [106-97-8] (2) Tetracosane; $C_{24}H_{50}$; [646-31-1] or Octacosane; $C_{28}H_{58}$; [630-02-4]	Parcher, J. F.; Weiner, P. H.; Hussey, C. L.; Westlake, T. N. *J. Chem. Eng. Data* 1975, *20*, 145-151.

VARIABLES:	PREPARED BY:
T/K: 353.2-393.2 P/kPa: 101.325	C. L. Young

EXPERIMENTAL VALUES:

T/K	Specific retention volume /cm^3 g^{-1}	Henry's law Constant [a] H/atm	Mole fraction at a partial pressure of 1 atm [b]
	Tetracosane; $C_{24}H_{50}$; [646-31-1]		
353.2	10.34	6.40	0.156
373.2	7.82	8.46	0.118
	Octacosane; $C_{28}H_{58}$; [630-02-4]		
353.2	9.95	5.71	0.175
373.2	6.84	8.30	0.120
393.2	5.00	11.35	0.0881

[a] Calculated by compiler using equation given by authors (see below).

[b] Calculated by compiler assuming Henry's law is valid up to 1 atmosphere.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Gas chromatographic method in which butane was used as injected solute and long chain alkane as stationary liquid. Thermal conductivity detector used. Calculation of mole fraction at 1 atmosphere pressure involves considerable approximation. No allowance was made for the presence of the carrier gas when estimating gas phase imperfection contribution to Henry's law constant. Henry's law constant given by

$$H = \frac{273.15R}{MW_{solvent} \times \text{Specific retention volume}}$$

SOURCE AND PURITY OF MATERIALS:

2. No impurity detected when analysed by GC on SE-30 column.

ESTIMATED ERROR:

δT/K = ±0.1; δH/atm = ±1.0% (estimated by compiler).

REFERENCES:

COMPONENTS:

(1) Butane; C_4H_{10}; [106-97-8]

(2) 2,6,10,15,19,23-Hexamethyltetracosane, (squalane); $C_{30}H_{62}$; [111-01-3]

ORIGINAL MEASUREMENTS:

Chappelow, C.C.; Prausnitz, J.M.

A.I.Ch.E.J. 1974, *20*, 1097-1104.

VARIABLES:

T/K: 300-475

P/kPa: 101.325

PREPARED BY:

C.L. Young

EXPERIMENTAL VALUES:

T/K	Henry's Constant[a] H/atm	Mole fraction[b] of butane at 1 atm. partial pressure, $x_{C_4H_{10}}$
300	2.10	0.4762
325	2.95	0.3390
350	5.15	0.1942
375	8.34	0.1199
400	12.2	0.0820
425	16.3	0.0613
450	20.3	0.0493
475	24.0	0.0417

[a] Authors stated measurements were made at several pressures and values of solubility used were all within the Henry's law region.

[b] Calculated by compiler assuming linear relationship between mole fraction and pressure.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

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

SOURCE AND PURITY OF MATERIALS:

Solvent degassed; no other details given.

ESTIMATED ERROR:

δT/K = ±0.1; $\delta x_{C_4H_{10}}$ = ±1%

REFERENCES:

1. Dymond, J.; Hildebrand, J.H. *Ind. Eng. Chem. Fundam.* 1967, *6*, 130.
2. Cukor, P.M.; Prausnitz, J.M. *Ind. Eng. Chem. Fundam.* 1971, *10*, 638.

COMPONENTS:

(1) Butane; C_4H_{10}; [106-97-8]

(2) Triacontane; $C_{30}H_{62}$; [638-68-6]

or Dotriacontane; $C_{32}H_{66}$; [544-85-4]

ORIGINAL MEASUREMENTS:

Parcher, J. F.; Weiner, P. H.; Hussey, C. L.; Westlake, T. N.

J. Chem. Eng. Data

1975, *20*, 145-151.

VARIABLES:

T/K: 353.2-393.2

P/kPa: 101.325

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	Specific retention volume /$cm^3\ g^{-1}$	Henry's law Constant [a] *H*/atm	Mole fraction at a partial pressure of 1 atm [b]
	Triacontane; $C_{30}H_{62}$; [638-68-6]		
353.2	9.29	5.71	0.175
393.2	4.81	11.02	0.0907
	Dotriacontane; $C_{32}H_{66}$; [544-85-4]		
353.2	9.57	5.19	0.193
373.2	6.31	7.88	0.127
393.2	4.78	10.40	0.0962

[a] Calculated by compiler using equation given by authors (see below).

[b] Calculated by compiler assuming Henry's law is valid up to 1 atmopshere.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Gas chromatographic method in which butane was used as injected solute and long chain alkane as stationary liquid. Thermal conductivity detector used. Calculation of mole fraction at 1 atmosphere pressure involves considerable approximation. No allowance was made for the presence of the carrier gas when estimating gas phase imperfection contribution to Henry's law constant. Henry's law constant given by

$$H = \frac{273.15R}{MW_{solvent} \times \text{Specific retention volume}}$$

SOURCE AND PURITY OF MATERIALS:

2. No impurity detected when analysed by GC on SE-30 column.

ESTIMATED ERROR:

$\delta T/K = \pm 0.1$; $\delta H/\text{atm} = \pm 1.0\%$ (estimated by compiler).

REFERENCES:

COMPONENTS:

(1) Butane; C_4H_{10}; [106-97-8]

(2) Tetratriacontane; $C_{34}H_{70}$; [14167-59-0]

or Hexatriacontane; $C_{36}H_{74}$; [630-06-8]

ORIGINAL MEASUREMENTS:

Parcher, J. F.; Weiner, P. H.; Hussey, C. L.; Westlake, T. N.

J. Chem. Eng. Data

1975, *20*, 145-151.

VARIABLES:

K/K: 353.2-393.2

P/kPa: 101.325

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	Specific retention volume /cm^3 g^{-1}	Henry's law Constant [a] *H*/atm	Mole fraction at a partial pressure of 1 atm [b]
	Tetratriacontane; $C_{34}H_{70}$; [14167-59-0]		
353.2	9.22	5.08	0.197
373.2	6.18	7.57	0.132
393.2	4.69	9.98	0.100
	Hexatriacontane; $C_{36}H_{74}$; [630-06-8]		
353.2	9.05	4.88	0.205
373.2	6.19	7.14	0.140
393.2	4.55	9.72	0.103

[a] Calculated by compiler using equation given by authors (see below).

[b] Calculated by compiler assuming Henry's law is valid up to 1 atmosphere.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Gas chromatographic method in which butane was used as injected solute and long chain alkane as stationary liquid. Thermal conductivity detector used. Calculation of mole fraction at 1 atmosphere pressure involves considerable approximation. No allowance was made for the presence of the carrier gas when estimating gas phase imperfection contribution to Henry's law constant. Henry's law constant given by

$$H = \frac{273.15R}{MW_{\text{solvent}} \times \text{Specific retention volume}}$$

SOURCE AND PURITY OF MATERIALS:

2. No impurity detected when analysed by GC on SE-30 column.

ESTIMATED ERROR:

$\delta T/K = \pm 0.1$; $\delta H/\text{atm} = \pm 1.0\%$ (estimated by compiler).

REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) 2-Methylpropane; C_4H_{10}; [75-28-5] (2) Pentane; C_5H_{12}; [109-66-0] or Hexane; C_6H_{14}; [110-54-3]	Jadot, R. *J. Chim. Phys.* <u>1972</u>, *69*, 1036-40.
VARIABLES:	**PREPARED BY:**
T/K: 298.15 P/kPa: 101.325	C.L. Young

EXPERIMENTAL VALUES:

T/K	Henry's Law Constant, H/atm	Mole fraction$^+$ at partial pressure of 101.3 kPa, $x_{C_4H_{10}}$	#ΔH^∞ /cal mol^{-1} (/J mol^{-1})
		Pentane; C_5H_{12}; [109-66-0]	
298.15	3.744	0.2650	-
		Hexane; C_6H_{14}; [110-54-3]	
298.15	3.600	0.2778	230 (962)

\+ Calculated by compiler assuming $x_{C_4H_{10}} = 1/H$.

\# Excess partial molar enthalpy of solution at infinite dilution.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The conventional gas chromatographic technique was used. The carrier gas was helium. The value of Henry's law constant was calculated from the retention time. The value applies to very low partial pressures of gas and there may be a substantial difference from that measured at 1 atm. pressure. There is also considerable uncertainty in the value of Henry's constant since no allowance was made for surface adsorption.

SOURCE AND PURITY OF MATERIALS:

No details given.

ESTIMATED ERROR:

$\delta T/K = \pm 0.05$; $\delta H = \pm 2\%$

REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) 2-Methylpropane (isobutane); C_4H_{10}; [75-28-5] (2) Hexane; C_6H_{14}; [110-54-3]	Tilquin, B.; Decanniere, L.; Fontaine, R.; Claes, P. *Ann. Soc. Sc. Bruxelles (Belgium)* <u>1967</u>, *81*, 191-199.

VARIABLES:	PREPARED BY:
T/K: 288.15 P/kPa: 5.04-5.17	W. Hayduk

EXPERIMENTAL VALUES:

t/°C	T/K	Ostwald coefficient[1] L/cm^{3}cm^{-3}	Mole fraction[2] x_1	Henry's constant[2] H/atm
15.0	288.15	82.0	0.313	3.195

[1] Original data at low pressure reported as a distribution coefficient; if Henry's law and ideal gas law apply, the distribution coefficient is equivalent to the Ostwald coefficient as shown here.

[2] Calculated by compiler for a gas partial pressure of 101.325 kPa assuming that Henry's law and ideal gas law apply.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

An all glass apparatus was used at a very low gas partial pressure. It contained a replaceable degassed solvent ampule equipped with a breakable point which could be broken by means of a magnetically activated plunger. The quantity of gas fed into the system was determined by measuring the pressure change in a known volume. The quantity of liquid was measured by weight. The pressure change was observed after the solvent was released.

Experimental details are described by Rzad and Claes(1).

SOURCE AND PURITY OF MATERIALS:

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

ESTIMATED ERROR:

δT/K = 0.05 (estimated by compiler)

$\delta x_1/x_1$ = 0.01

REFERENCES:

1. Rzad, S.; Claes, P. *Bull. Soc. Chim. Belges*, <u>1964</u>, *73*, 689.

COMPONENTS:

(1) 2-Methylpropane (isobutane); C_4H_{10}; [75-28-5]

(2) 2,2'-Dimethylbutane (Neo-hexane); C_6H_{14}; [75-83-2]

ORIGINAL MEASUREMENTS:

Tilquin, B.; Decanniere, L.; Fontaine, R.; Claes, P.

Ann. Soc. Sc. Bruxelles (Belgium) 1967, *81*, 191-199.

VARIABLES:

T/K: 288.15

P/kPa: 2.11-3.03

PREPARED BY:

W. Hayduk

EXPERIMENTAL VALUES:

t/°C	T/K	Ostwald coefficient[1] L/cm^{3}cm^{-3}	Mole fraction[2] x_1	Henry's constant[2] H/atm
15.0	288.15	125.9	0.420	2.381

[1] Original data at low pressure reported as a distribution coefficient; if Henry's law and ideal gas law apply, the distribution coefficient is equivalent to the Ostwald coefficient as shown here.

[2] Calculated by compiler for a gas partial pressure of 101.325 kPa assuming that Henry's law and ideal gas law apply.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

An all glass apparatus was used at a very low gas partial pressure. It contained a replaceable degassed solvent ampule equipped with a breakable point which could be broken by means of a magnetically activated plunger. The quantity of gas fed into the system was determined by measuring the pressure change in a known volume. The quantity of liquid was measured by weight. The pressure change was observed after the solvent was released.

Experimental details are described by Rzad and Claes(1).

SOURCE AND PURITY OF MATERIALS:

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

ESTIMATED ERROR:

T/K = 0.05

$\delta x_1/x_1$ = 0.01

(estimated by compiler)

REFERENCES:

1. Rzad, S.; Claes, P. *Bull. Soc. Chim. Belges*, 1964, *73*, 689.

COMPONENTS: (1) 2-Methylpropane; C_4H_{10}; [75-28-5] (2) Heptane; C_7H_{16}; [142-82-5] or Octane; C_8H_{18}; [111-65-9]	ORIGINAL MEASUREMENTS: Jadot, R. *J. Chim. Phys.* 1972, *69*, 1036-40.
VARIABLES: T/K: 298.15 P/kPa: 101.325	PREPARED BY: C.L. Young

EXPERIMENTAL VALUES:

T/K	Henry's Law Constant, H/atm	Mole fraction$^+$ at partial pressure of 101.3 kPa, $x_{C_4H_{10}}$	#ΔH^∞ /cal mol^{-1} (/J mol^{-1})
	Heptane; C_7H_{16}; [142-82-5]		
298.15	3.352	0.2983	415 (1736)
	Octane; C_8H_{18}; [111-65-9]		
298.15	3.109	0.3216	550 (2301)

\+ Calculated by compiler assuming $x_{C_4H_{10}} = 1/H$.

\# Excess partial molar enthalpy of solution at infinite dilution.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The conventional gas chromatographic technique was used. The carrier gas was helium. The value of Henry's law constant was calculated from the retention time. The value applies to very low partial pressures of gas and there may be a substantial difference from that measured at 1 atm. pressure. There is also considerable uncertainty in the value of Henry's constant since no allowance was made for surface adsorption.

SOURCE AND PURITY OF MATERIALS:

No details given.

ESTIMATED ERROR:

$\delta T/K = \pm 0.05$; $\delta H = \pm 2\%$

REFERENCES:

COMPONENTS:

(1) 2-Methylpropane, (isobutane) C_4H_{10}; [75-28-5]

(2) Decane; $C_{10}H_{22}$; [124-18-5]

ORIGINAL MEASUREMENTS:

Gerrard, W.

Solubility of Gases and Liquids, Plenum, New York, 1976, Chapter 12.

VARIABLES:

T/K: 273.15

P/kPa: 13.3-101.3

PREPARED BY:

C.L. Young

EXPERIMENTAL VALUES:

T/K	P/mmHg	P/kPa	Mole fraction of 2-methyl propane in liquid, $x_{C_4H_{10}}$
273.15	100	13.3	0.093
	200	26.7	0.180
	300	40.0	0.270
	400	53.3	0.345
	500	66.7	0.438
	600	80.0	0.520
	700	93.3	0.600
	760	101.3	0.645

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Gas was passed into a known weight of pure liquid in a bubbler tube at a total pressure measured by a manometer assembly. The amount of absorbed gas was estimated by weighing The temperature was manually controlled to within 0.2K. The apparatus and procedure are described by Gerrard (1,2).

SOURCE AND PURITY OF MATERIALS:

No details given.

ESTIMATED ERROR:

$\delta T/K = \pm 0.1$; $\delta x/x = \pm 3\%$

(estimated by compiler)

REFERENCES:

1. Gerrard, W.
J. Appl. Chem. Biotechnol. 1972 *22*, 623-650.

2. Gerrard, W.
Solubility of Gases and Liquids, Plenum Press, New York, 1976 Chapter 1.

COMPONENTS:

(1) 2-Methylpropane; C_4H_{10}; [75-28-5]

(2) Nonane; C_9H_{10}; [111-84-2]
or
Decane; $C_{10}H_{22}$; [124-18-5]

ORIGINAL MEASUREMENTS:

Jadot, R.

J. Chim. Phys. 1972, *69*, 1036-40.

VARIABLES:

T/K: 298.15

P/kPa: 101.325

PREPARED BY:

C.L. Young

EXPERIMENTAL VALUES:

T/K	Henry's Law Constant, H/atm	Mole fraction$^+$ at partial pressure of 101.3kPa, $x_{C_4H_{10}}$	#ΔH∞ /cal mol^{-1} (/J mol^{-1})
		Nonane; C_9H_{20}; [111-84-2]	
298.15	2.984	0.3351	700 (2929)
		Decane; $C_{10}H_{22}$; [124-18-5]	
298.15	2.880	0.3472	790 (3305)

+ Calculated by compiler assuming $x_{C_4H_{10}} = 1/H$.

Excess partial molar enthalpy of solution at infinite dilution.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The conventional gas chromatographic technique was used. The carrier gas was helium. The value of Henry's law constant was calculated from the retention time. The value applies to very low partial pressures of gas and there may be a substantial difference from that measured at 1 atm pressure. There is also considerable uncertainty in the value of Henry's constant since no allowance was made for surface adsorption.

SOURCE AND PURITY OF MATERIALS:

No details given.

ESTIMATED ERROR:

$\delta T/K = \pm 0.05$; $\delta H = \pm 2\%$

REFERENCES.

COMPONENTS:

(1) 2-Methylpropane; (isobutane), C_4H_{10}; [75-28-5]

(2) Eicosane; $C_{20}H_{42}$; [112-95-8]

ORIGINAL MEASUREMENTS:

Chappelow, C.C.; Prausnitz, J.M.,

A.I.Ch.E.J. 1974, *20*, 1097-1104.

VARIABLES:

T/K: 325-475

P/kPa: 101.325

PREPARED BY:

C.L. Young

EXPERIMENTAL VALUES:

T/K	Henry's Constant[a] H/atm	Mole fraction of 2-methyl propane at 1 atm. partial pressure, $x_{C_4H_{10}}$
325	5.80	0.1724
350	9.15	0.1093
375	13.3	0.0752
400	18.1	0.0552
425	23.6	0.0424
450	29.8	0.0336
475	36.0	0.0278

[a] Authors stated measurements were made at several pressures and values of solubility used were all within the Henry's law region.

[b] Calculated by compiler assuming linear relationship between mole fraction and pressure.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

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

SOURCE AND PURITY OF MATERIALS:

Solvent degassed; no other details given.

ESTIMATED ERROR:

δT/K = ±0.1; $\delta x_{C_4H_{10}}$ = ±1%

REFERENCES:

1. Dymond, J.; Hildebrand, J.H. *Ind. Eng. Chem. Fundam.* 1967, *6*, 130.
2. Cukor, P.M.; Prausnitz, J.M. *Ind. Eng. Chem. Fundam.* 1971, *10*, 638.

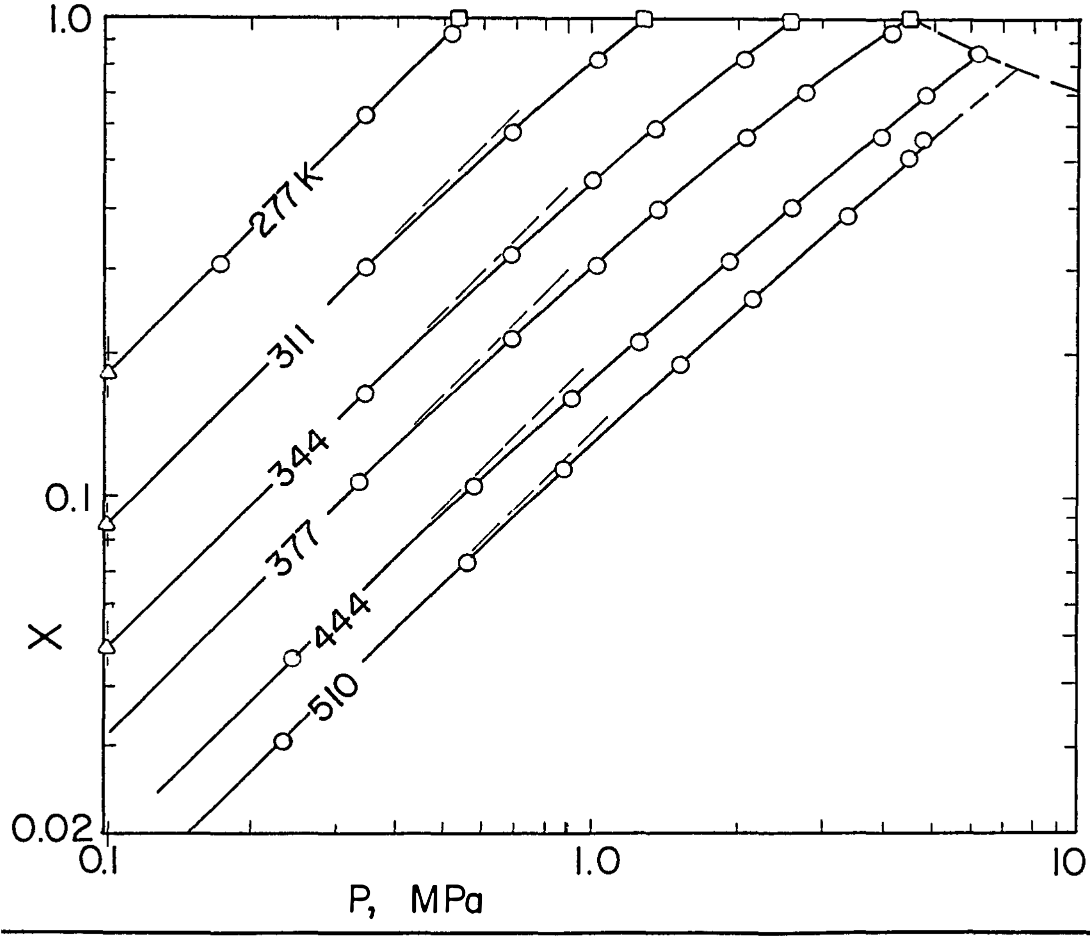
COMPONENTS:	EVALUATOR:
(1) Propane; C_3H_8; [74-98-6] Butane; C_4H_{10}; [106-97-8] 2-Methylpropane; C_4H_{10}; [75-28-5] (2) Alkane solvents at high pressure	Walter Hayduk Department of Chemical Engineering University of Ottawa Ottawa, Canada K1N 9B4 July, 1984

CRITICAL EVALUATION:

The solubility of *propane* is available for pressures above 101.325 kPa (1 atm) in butane and 2-methylpropane solvents (1). These data may also be considered as vapor-liquid equilibria because of the closeness of the boiling points of the solute and solvents. *Propane* solubilities are available in pentane for temperatures up to 110 K (2) and decane (3). The solubility of *butane* is also available in decane over a wide temperature and pressure range (4). These data appear highly consistent although there are no two sources for any of them; they are all classified as tentative.

The above-mentioned data were tested for consistency by plotting the mole fraction solubility of solute versus the solute partial pressure on log scales. On such a graph the solubility-pressure relation is nearly linear; at low pressure, the lines are linear with a slope of unity for solubilities expressed by Henry's law. Hence, the solubility at 101.325 kPa pressure can usually be obtained from such a graph by extrapolation of data in the low pressure region. Similarly, by extrapolation to high pressures, the pure solute vapor pressure is obtained at the particular temperature. An example of the consistency test is shown in Figure 1 representing some of the solubility data of Reamer and Sage for *propane* dissolved in decane (3). A slope of one for the data at relatively low pressures indicates that for that pressure range Henry's law is obeyed. Estimated values for solubilities in decane at 101.325 kPa are based on

Figure 1. Solubility of *propane* in decane at high pressure (3).



COMPONENTS:	EVALUATOR:
(1) Propane; C_3H_8; [74-98-6] Butane; C_4H_{10}; [106-97-8] 2-Methylpropane; C_4H_{10}; [75-28-5] (2) Alkane solvents at high pressure	Walter Hayduk Department of Chemical Engineering University of Ottawa Ottawa, Canada K1N 9B4 July, 1984

CRITICAL EVALUATION:

solubilities in dodecane (see Alkane Solvents) and adjusted by a constant factor. It is also apparent that in each case the *propane* vapor pressure represents a termination of the solubility relation with the exception that at high pressures, exceeding the *propane* critical pressure, the solution critical pressure is reached. Thus such a diagram is useful to check the consistency of high pressure solubility data because it utilizes parameters and relationships which are independently known.

The dew point and bubble point data of Kay and Kay et al. for *propane* in butane, pentane (5) and octane (6) solvents as well as that of Kay and Kay et al. for *butane* in heptane (7) and octane (6) cannot readily be used to determine gas solubility. Hence, these data are simply unclassified. While they may be of interest to research workers who are measuring solubilities at high pressure, they cannot be used for actual comparisons of data.

There are no solubility data reported for *2-methylpropane* as a solute in alkane solvents at high pressure.

References

1. Skripka, V.G.; Nikitina, I.E.; Zhdanovich, L.A.; Sirotin, A.G.; Benyaminovich, O.A. *Gasov. Prom.* 1970, *15*, 35-36.
2. Vjrosta, J.; Wichterle, I. *Coll. Czech. Chem. Comm.* 1974, *39*, 1246-8.
3. Reamer, H.H.; Sage, B.H. *J. Chem. Eng. Data* 1966, *11*, 17-24.
4. Reamer, H.H.; Sage, B.H.; Lacey, W.N. *Ind. Eng. Chem.* 1946, *38*, 986-9.
5. Kay, W.B. *J. Chem. Eng. Data* 1970, *15*, 46-52.
6. Kay, W.B.; Genco, J.; Fichtner, D.A. *J. Chem. Eng. Data* 1974, *19*, 275-280.
7. Kay, W.B. *Ind. Eng. Chem.* 1941, *33*, 590-4.

COMPONENTS:

(1) Propane; C_3H_8; [74-98-6]

(2) Butane; C_4H_{10}; [106-97-8]

ORIGINAL MEASUREMENTS:

Kay, W. B.,

J. Chem. Eng. Data 1970, *15*, 46-52.

VARIABLES:

T/K: 342.8-418.0

P/MPa: 1.55-4.29

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	$P/10^5$Pa	Mole fraction of propane in liquid, $x_{C_3H_8}$	in vapor, $y_{C_3H_8}$	T/K	$P/10^5$Pa	Mole fraction of propane in liquid, $x_{C_3H_8}$	in vapor, $y_{C_3H_8}$
363.05	15.51	0.1468	-	417.05	37.92	-	0.1468
368.75	17.24	0.1468	-	417.95	38.61	-	0.1468
378.45	20.68	0.1468	-	418.35	38.96	-	0.1468
387.25	24.13	0.1468	-	418.55	39.13	-	0.1468
395.25	27.58	0.1468	-	418.65	39.30	-	0.1468
402.65	31.03	0.1468	-	358.05	17.24	0.3085	-
409.15	34.47	0.1468	-	367.95	20.68	0.3085	-
412.35	36.20	0.1468	-	376.65	24.13	0.3085	-
414.25	37.23	0.1468	-	384.65	27.58	0.3085	-
415.55	37.92	0.1468	-	391.85	31.03	0.3085	-
416.75	38.61	0.1468	-	398.45	34.47	0.3085	-
417.35	38.96	0.1468	-	401.75	36.20	0.3085	-
417.65	39.13	0.1468	-	404.75	37.92	0.3085	-
418.05	39.30	0.1468	-	405.95	38.61	0.3085	-
368.95	15.51	-	0.1468	407.15	39.30	0.3085	-
374.25	17.24	-	0.1468	408.35	39.99	0.3085	-
383.15	20.68	-	0.1468	409.05	40.33	0.3085	-
391.45	24.13	-	0.1468	409.95	40.68	0.3085	-
398.95	27.58	-	0.1468	367.25	17.24	-	0.3085
405.65	31.03	-	0.1468	376.55	20.68	-	0.3085
411.75	34.47	-	0.1468	384.15	24.13	-	0.3085
414.55	36.20	-	0.1468	391.05	27.58	-	0.3085
416.05	37.23	-	0.1468	397.35	31.03	-	0.3085

(cont.)

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Sample of known composition confined in thick-walled glass tube over mercury. Temperature measured with thermocouple and pressure with Bourdon gauge. Dew point and bubble point determined.

SOURCE AND PURITY OF MATERIALS:

1. and 2. Phillips Petroleum samples purity better than 99.9 mole per cent.

ESTIMATED ERROR:

$\delta T/K = \pm 0.02$; $\delta P/10^5 Pa = \pm 0.07$; $\delta x_{C_3H_8}$, $\delta y_{C_3H_8} = \pm 0.0002$.

REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Propane; C_3H_8; [74-98-6]	Kay, W. B.,
(2) Butane; C_4H_{10}; [106-97-8]	*J. Chem. Eng. Data* 1970, *15*, 46-52.

EXPERIMENTAL VALUES: (concluded)

T/K	$P/10^5$Pa	Mole fraction of propane		T/K	$P/10^5$Pa	Mole fraction of propane	
		in liquid, $x_{C_3H_8}$	in vapor, $y_{C_3H_8}$			in liquid, $x_{C_3H_8}$	in vapor, $y_{C_3H_8}$
403.05	34.47	-	0.3085	382.85	41.37	0.7545	-
405.65	36.20	-	0.3085	383.95	42.06	0.7545	-
407.95	37.92	-	0.3085	384.45	42.40	0.7545	-
408.85	38.61	-	0.3085	385.15	42.75	0.7545	-
409.75	39.30	-	0.3085	385.55	42.92	0.7545	-
410.65	39.99	-	0.3085	351.35	20.68	-	0.7545
410.95	40.33	-	0.3085	358.45	24.13	-	0.7545
411.05	40.68	-	0.3085	365.05	27.58	-	0.7545
344.15	17.24	0.5211	-	371.05	31.03	-	0.7545
354.95	20.68	0.5211	-	376.35	34.47	-	0.7545
363.55	24.13	0.5211	-	378.75	36.20	-	0.7545
371.25	27.58	0.5211	-	381.15	37.92	-	0.7545
378.25	31.03	0.5211	-	382.95	39.30	-	0.7545
384.85	34.47	0.5211	-	384.55	40.68	-	0.7545
388.05	36.20	0.5211	-	385.25	41.37	-	0.7545
391.05	37.92	0.5211	-	385.95	42.06	-	0.7545
393.45	39.30	0.5211	-	386.25	42.40	-	0.7545
395.85	40.68	0.5211	-	386.45	42.75	-	0.7545
395.15	41.37	0.5211	-	386.51	42.02	-	0.7545
397.75	41.71	0.5211	-	342.75	24.13	0.9258	-
398.50	42.06	0.5211	-	349.75	27.58	0.9258	-
399.65	42.39	0.5211	-	356.25	31.03	0.9258	-
355.95	17.24	-	0.5211	361.95	34.47	0.9258	-
364.85	20.68	-	0.5211	364.75	36.20	0.9258	-
372.55	24.13	-	0.5211	367.15	37.92	0.9258	-
379.35	27.58	-	0.5211	369.55	39.30	0.9258	-
385.45	31.03	-	0.5211	371.55	40.68	0.9258	-
390.95	34.47	-	0.5211	372.55	41.37	0.9258	-
393.45	36.20	-	0.5211	373.55	42.06	0.9258	-
395.85	37.92	-	0.5211	374.05	42.40	0.9258	-
397.55	39.30	-	0.5211	374.55	42.75	0.9258	-
399.15	40.68	-	0.5211	346.05	24.13	-	0.9258
399.75	41.37	-	0.5211	352.75	27.58	-	0.9258
400.05	41.71	-	0.5211	358.65	31.03	-	0.9258
400.25	42.06	-	0.5211	364.15	34.47	-	0.9258
343.05	20.68	0.7545	-	366.65	36.20	-	0.9258
351.05	24.13	0.7545	-	369.15	37.92	-	0.9258
358.65	27.58	0.7545	-	370.95	39.30	-	0.9258
365.45	31.03	0.7545	-	372.75	40.68	-	0.9258
371.55	34.47	0.7545	-	373.55	41.37	-	0.9258
374.55	36.20	0.7545	-	374.35	42.06	-	0.9258
377.35	37.92	0.7545	-	374.75	42.40	-	0.9258
379.55	39.30	0.7545	-	375.05	42.75	-	0.9258
381.75	40.68	0.7545	-				

COMPONENTS:

(1) Propane; C_3H_8; [74-98-6]

(2) Butane; C_4H_{10}; [106-97-8]

ORIGINAL MEASUREMENTS:

Skripka, V. G.; Nikitina, I. E.; Zhdanovich, L. A.; Sirotin, A. G.; Benyaminovich, O. A.

Gazov. Prom.

1970, *15*, 35-36.

VARIABLES:

T/K: 253.2-273.2

P/MPa: 0.045-0.472

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K (T/°C)	Bubble pt. pressure P/kg f cm^{-2}	Bubble pt. pressure P/MPa	Dew pt. pressure P/kg f cm^{-2}	Dew pt. pressure P/MPa	Mole fraction $x_{C_3H_8}$
253.2	0.46	0.045	0.46	0.045	0.00
(-20)	0.55	0.054	0.49	0.048	0.05
	0.84	0.082	0.57	0.056	0.20
	1.21	0.119	0.73	0.072	0.40
	1.62	0.159	0.91	0.089	0.60
	2.04	0.200	1.21	0.119	0.80
	2.36	0.231	2.02	0.198	0.95
	2.46	0.241	2.46	0.241	1.00
263.2	0.71	0.070	0.71	0.070	0.00
(-10)	0.84	0.082	0.74	0.073	0.05
	1.21	0.119	0.88	0.086	0.20
	1.72	0.169	1.10	0.095	0.40
	2.27	0.223	1.37	0.134	0.60
	2.87	0.281	1.93	0.189	0.80
	3.34	0.328	2.92	0.286	0.95
	3.49	0.342	3.49	0.342	1.00
273.2	1.05	0.103	1.05	0.103	0.00
(0)	1.20	0.118	1.09	0.107	0.05
	1.69	0.166	1.20	0.118	0.20
	2.39	0.234	1.42	0.139	0.40
	3.16	0.310	1.83	0.179	0.60
	3.97	0.389	2.67	0.262	0.80
	4.60	0.451	4.12	0.404	0.95
	4.81	0.472	4.81	0.472	1.00

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Recirculating vapor flow apparatus fitted with magnetic stirrer. Temperature measured with platinum resistance thermometer. Liquid and gas analysed by gas chromatography. Details of apparatus in ref. (1).

SOURCE AND PURITY OF MATERIALS:

1 and 2. Purity 99.5 per cent by volume.

ESTIMATED ERROR:

REFERENCES:

1. Skripka, V. G.; Barsuk, S. D.; Nikitina, I. E.; Ben'yaminovic, O. A.

   Gazov. Prom.

   1964, *14*, 11.

COMPONENTS:

(1) Propane; C_3H_8; [74-98-6]

(2) 2-Methylpropane; C_4H_{10}; [75-28-5]

ORIGINAL MEASUREMENTS:

Skripka, V. G.; Nikitina, I. E.; Zhdanovich, L. A.; Sirotin, A. G.; Benyaminovich, O. A.

Gazov. Prom.

<u>1970</u>, *15*, 35-36.

VARIABLES:

T/K: 253.2-273.2

P/MPa: 0.073-0.472

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K (T/°C)	Bubble pt. pressure P/kg f cm^{-2}	 P/MPa	Dew pt. pressure P/kg f cm^{-2}	 P/MPa	Mole fraction $x_{C_3H_8}$
253.2	0.74	0.073	0.74	0.073	0.00
(-20)	0.81	0.079	0.77	0.076	0.05
	1.06	0.104	0.88	0.086	0.20
	1.39	0.136	1.06	0.104	0.40
	1.74	0.171	1.28	0.126	0.60
	2.10	0.206	1.61	0.158	0.80
	2.37	0.232	2.20	0.216	0.95
	2.46	0.241	2.46	0.241	1.00
263.2	1.10	0.108	1.10	0.108	0.00
(-10)	1.21	0.119	1.13	0.111	0.05
	1.52	0.149	1.27	0.125	0.20
	1.98	0.194	1.47	0.144	0.40
	2.47	0.242	1.76	0.173	0.60
	2.98	0.292	2.36	0.231	0.80
	3.35	0.329	3.17	0.311	0.95
	3.49	0.342	3.49	0.342	1.00
273.2	1.59	0.156	1.59	0.156	0.00
(0)	1.73	0.170	1.64	0.160	0.05
	2.17	0.213	1.80	0.177	0.20
	2.78	0.273	2.10	0.206	0.40
	3.42	0.335	2.64	0.259	0.60
	4.10	0.402	3.41	0.334	0.80
	4.62	0.453	4.40	0.431	0.95
	4.81	0.472	4.81	0.472	1.00

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Recirculating vapor flow apparatus fitted with magnetic stirrer. Temperature measured with platinum resistance thermometer. Liquid and gas analysed by gas chromatography. Details of apparatus in ref. (1)

SOURCE AND PURITY OF MATERIALS:

1 and 2. Purity 99.5 per cent by volume.

ESTIMATED ERROR:

REFERENCES:

1. Skripka, V. G.; Barsuk, S. D.; Nikitina, I. E.; Ben'yaminovic, O. A. *Gazov. Prom.* <u>1964</u>, *14*, 11.

COMPONENTS:

(1) Propane; C_3H_8; [74-98-6]

(2) Pentane; C_5H_{12}; [109-66-0]

ORIGINAL MEASUREMENTS:

Vejrosta, J.; Wichterle, I.,
Coll. Czech. Chem. Comm., 1974,
39, 1246-8.

VARIABLES:

T/K: 63.41-110.0

P/MPa: 0.334-4.076

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	$P/10^5$Pa	Mole fraction of propane in liquid, $x_{C_3H_8}$	in gas, $y_{C_3H_8}$	T/K	$P/10^5$Pa	Mole fraction of propane in liquid, $x_{C_3H_8}$	in gas, $y_{C_3H_8}$
63.41	3.34	0.055	0.299	71.11	22.13	0.854	0.957
	4.94	0.142	0.526		23.29	0.886	0.968
	5.73	0.186	0.590		24.29	0.928	0.980
	7.25	0.270	0.696		25.29	0.964	0.990
	7.93	0.303	0.724		26.00	0.982	0.995
	8.94	0.358	0.765	87.77	5.82	0.051	0.230
	9.67	0.396	0.792		8.05	0.138	0.455
	12.56	0.546	0.864		11.33	0.258	0.640
	15.52	0.695	0.919		12.26	0.292	0.669
	17.67	0.788	0.946		13.78	0.346	0.722
	19.10	0.849	0.962		14.97	0.390	0.752
	20.18	0.890	0.972		19.22	0.536	0.831
	20.94	0.924	0.982		23.85	0.689	0.896
	21.94	0.963	0.991		27.31	0.788	0.924
	22.35	0.982	0.996		29.68	0.846	0.946
71.11	4.00	0.054	0.281		31.17	0.886	0.957
	5.81	0.140	0.508		32.78	0.981	0.970
	8.43	0.263	0.682		34.54	0.962	0.985
	9.15	0.306	0.709		35.28	0.981	0.993
	10.44	0.367	0.767	92.55	6.42	0.050	0.208
	13.60	0.506	0.842		8.77	0.135	0.435
	14.44	0.549	0.861		12.33	0.261	0.614
	17.54	0.676	0.905		15.00	0.352	0.697
	17.91	0.684	0.911		16.16	0.392	0.732

(cont.)

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Static equilibrium cell fitted with magnetically operated mixer which periodically sprays liquid into the vapor phase. Pressure transmitted through a transducer to a Bourdon gauge. Temperature measured with platinum resistance thermometer. Samples analysed by gas chromatography. Details in ref. 1.

SOURCE AND PURITY OF MATERIALS:

1. Fluka research grade purity 99.9 mole per cent.
2. Fluka research grade purity 99.98 mole per cent.

ESTIMATED ERROR:

$\delta T/K = \pm 0.01$; $\delta P/10^5 Pa = \pm 0.05$; $\delta x_{C_3H_8}$, $\delta y_{C_3H_8} = \pm 1\%$.

REFERENCES:

1. Vejrosta, J.; Wichterle, I.; Wicar, S., *Coll. Czech. Chem. Comm.*, 1974, *39*, 206.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Propane; C_3H_8; [74-98-6] (2) Pentane; C_5H_{12}; [109-66-0]	Vejrosta, J.; Wichterle, I., *Coll. Czech. Chem. Comm.*, 1974, *39*, 1246-8.

EXPERIMENTAL VALUES: (concluded)

T/K	$P/10^5$Pa	Mole fraction of propane in liquid, $x_{C_3H_8}$	Mole fraction of propane in gas, $y_{C_3H_8}$	T/K	$P/10^5$Pa	Mole fraction of propane in liquid, $x_{C_3H_8}$	Mole fraction of propane in gas, $y_{C_3H_8}$
92.55	19.01	0.488	0.790	94.52	35.76	0.903	0.955
	25.23	0.667	0.872		36.63	0.923	0.964
	29.46	0.777	0.916		37.66	0.938	0.970
	31.96	0.840	0.938	100.00	13.84	0.251	0.576
	34.64	0.904	0.957		16.82	0.350	0.678
	35.48	0.924	0.965		21.08	0.465	0.762
	37.45	0.961	0.982		28.15	0.664	0.857
	38.33	0.981	0.991		33.52	0.794	0.911
94.52	6.68	0.047	0.202		36.72	0.858	0.928
	9.07	0.133	0.431		39.09	0.902	0.945
	16.68	0.396	0.724		40.76	0.932	0.960
	19.46	0.478	0.781	110.00	16.21	0.251	0.552
	26.00	0.665	0.868		19.62	0.343	0.644
	30.85	0.800	0.918		24.42	0.466	0.736
	32.96	0.843	0.934		32.67	0.658	0.833
	33.70	0.857	0.939		38.83	0.792	0.881

COMPONENTS:

(1) Propane; C_3H_8; [74-98-6]

(2) Pentane; C_5H_{12}; [109-66-0]

ORIGINAL MEASUREMENTS:

Kay, W. B.,

J. Chem. Eng. Data 1970, *15*, 46-52.

VARIABLES:

T/K: 321.35-457.35

P/MPa: 1.034-4.482

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	$P/10^5$Pa	Mole fraction of propane in liquid, $x_{C_3H_8}$	in vapor, $y_{C_3H_8}$	T/K	$P/10^5$Pa	Mole fraction of propane in liquid, $x_{C_3H_8}$	in vapor, $y_{C_3H_8}$
374.15	10.34	0.1470	-	356.85	13.79	0.3873	-
390.15	13.79	0.1470	-	369.85	17.24	0.3873	-
404.65	17.24	0.1470	-	381.55	20.68	0.3873	-
416.55	20.68	0.1470	-	392.25	24.13	0.3873	-
426.35	24.13	0.1470	-	401.45	27.58	0.3873	-
435.25	27.58	0.1470	-	409.95	31.03	0.3873	-
443.95	31.03	0.1470	-	417.95	34.47	0.3873	-
452.35	34.47	0.1470	-	425.95	37.92	0.3873	-
453.95	35.16	0.1470	-	434.35	41.37	0.3873	-
455.65	35.85	0.1470	-	436.45	42.06	0.3873	-
457.35	36.54	0.1470	-	364.05	6.89	-	0.3873
376.55	6.89	-	0.1470	379.95	10.34	-	0.3873
394.35	10.34	-	0.1470	391.65	13.79	-	0.3873
407.95	13.79	-	0.1470	401.25	17.24	-	0.3873
419.65	17.24	-	0.1470	409.85	20.68	-	0.3873
428.95	20.68	-	0.1470	417.15	24.13	-	0.3873
437.55	24.13	-	0.1470	424.35	27.58	-	0.3873
445.15	27.58	-	0.1470	430.05	31.03	-	0.3873
452.15	31.03	-	0.1470	435.15	34.47	-	0.3873
457.85	34.47	-	0.1470	439.65	37.92	-	0.3873
458.95	35.16	-	0.1470	441.55	41.37	-	0.3873
459.75	35.85	-	0.1470	440.85	42.06	-	0.3873
460.35	36.54	-	0.1470	321.35	10.34	0.6162	-
341.05	10.34	0.3873	-				

(cont.)

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Samples of known composition confined in thick-walled glass tube over mercury. Temperature measured with thermocouple and pressure with Bourdon gauge. Dew point and bubble point determined.

SOURCE AND PURITY OF MATERIALS:

1. and 2. Phillips Petroleum sample, purity better than 99.9 mole per cent.

ESTIMATED ERROR:

$\delta T/K = \pm 0.02$; $\delta P/kPa = \pm 7$;

$\delta x_{C_3H_8}$, $\delta y_{C_3H_8} = \pm 0.0002$.

REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Propane; C_3H_8; [74-98-6] (2) Pentane; C_5H_{12}; [109-66-0]	Kay, W. B., *J. Chem. Eng. Data* 1970, *15*, 46-52.

EXPERIMENTAL VALUES: (concluded)

T/K	$P/10^5$Pa	Mole fraction of propane in liquid, $x_{C_3H_8}$	in vapor, $y_{C_3H_8}$	T/K	$P/10^5$Pa	Mole fraction of propane in liquid, $x_{C_3H_8}$	in vapor, $y_{C_3H_8}$
335.45	13.79	0.6162	-	395.95	44.82	0.7862	-
347.65	17.24	0.6162	-	344.35	10.34	-	0.7862
358.45	20.68	0.6162	-	354.75	13.79	-	0.7862
368.25	24.13	0.6162	-	363.35	17.24	-	0.7862
376.65	27.58	0.6162	-	370.65	20.68	-	0.7862
384.65	31.03	0.6162	-	377.15	24.13	-	0.7862
391.95	34.47	0.6162	-	382.95	27.58	-	0.7862
399.35	37.92	0.6162	-	388.35	31.03	-	0.7862
406.05	41.37	0.6162	-	393.05	34.47	-	0.7862
413.95	44.82	0.6162	-	397.15	37.92	-	0.7862
353.25	6.89	-	0.6162	400.25	41.37	-	0.7862
366.65	10.34	-	0.6162	401.65	44.82	-	0.7862
376.35	13.79	-	0.6162	330.05	17.24	0.8778	-
384.75	17.24	-	0.6162	339.45	20.68	0.8778	-
391.35	20.68	-	0.6162	347.65	24.13	0.8778	-
397.75	24.13	-	0.6162	355.35	27.58	0.8778	-
407.95	31.03	-	0.6162	362.35	31.03	0.8778	-
412.55	34.47	-	0.6162	368.55	34.47	0.8778	-
416.35	37.92	-	0.6162	374.45	37.92	0.8778	-
419.35	41.37	-	0.6162	380.25	41.37	0.8778	-
419.95	44.82	-	0.6162	386.55	44.82	0.8778	-
325.35	13.79	0.7862	-	352.85	17.24	-	0.8778
336.65	17.24	0.7862	-	359.45	20.68	-	0.8778
346.35	20.68	0.7862	-	365.35	24.13	-	0.8778
354.75	24.13	0.7862	-	370.15	27.58	-	0.8778
362.45	27.58	0.7862	-	375.25	31.03	-	0.8778
369.65	31.03	0.7862	-	379.65	34.47	-	0.8778
376.35	34.47	0.7862	-	383.65	37.92	-	0.8778
382.95	37.92	0.7862	-	387.05	41.37	-	0.8778
389.05	41.37	0.7862	-	388.65	44.82	-	0.8778

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Propane; C_3H_8; [74-98-6] (2) Octane; C_8H_{18}; [111-65-9]	Kay, W. B.; Genco, J.; Fichtner, D. A., *J. Chem. Eng. Data* <u>1974</u>, *19*, 275-280.

EXPERIMENTAL VALUES: (concluded)

T/K	$P/10^5$Pa	Mole fraction of propane in liquid, $x_{C_3H_8}$	Mole fraction of propane in vapor, $y_{C_3H_8}$	T/K	$P/10^5$Pa	Mole fraction of propane in liquid, $x_{C_3H_8}$	Mole fraction of propane in vapor, $y_{C_3H_8}$
385.65	27.58	0.5729	-	492.05	48.26	-	0.7175
407.15	31.03	0.5729	-	489.65	51.71	-	0.7175
417.35	34.47	0.5729	-	485.15	55.16	-	0.7175
427.45	37.92	0.5729	-	481.45	56.54	-	0.7175
437.65	41.37	0.5729	-	475.95	57.92	-	0.7175
447.65	44.82	0.5729	-	342.15	20.68	0.8640	-
458.15	48.26	0.5729	-	351.65	24.13	0.8640	-
469.65	51.71	0.5729	-	359.85	27.58	0.8640	-
475.15	53.09	0.5729	-	367.55	31.03	0.8640	-
478.15	53.78	0.5729	-	374.55	34.47	0.8640	-
498.65	53.78	0.5729	-	381.75	37.92	0.8640	-
481.65	54.47	0.5729	-	387.95	41.37	0.8640	-
495.15	54.47	0.5729	-	394.65	44.82	0.8640	-
488.45	54.05	0.5729	-	401.15	48.26	0.8640	-
479.15	17.24	-	0.5729	408.05	51.71	0.8640	-
487.65	20.68	-	0.5729	416.15	55.16	0.8640	-
495.15	24.13	-	0.5729	420.85	56.54	0.8640	-
500.65	27.58	-	0.5729	437.65	24.13	-	0.8640
505.15	31.03	-	0.5729	441.95	27.58	-	0.8640
508.65	34.47	-	0.5729	445.65	31.03	-	0.8640
511.65	37.92	-	0.5729	448.65	34.44	-	0.8640
512.85	41.37	-	0.5729	450.95	37.92	-	0.8640
513.15	44.82	-	0.5729	452.45	41.37	-	0.8640
511.35	48.26	-	0.5729	452.65	44.82	-	0.8640
505.65	51.71	-	0.5729	452.65	48.26	-	0.8640
502.15	53.09	-	0.5729	451.55	51.71	-	0.8640
329.15	13.79	0.7175	-	449.25	55.16	-	0.8640
343.65	17.24	0.7175	-	447.65	56.54	-	0.8640
356.65	20.68	0.7175	-	443.15	57.92	-	0.8640
367.45	24.13	0.7175	-	438.15	57.92	-	0.8640
377.15	27.58	0.7175	-	435.95	58.47	-	0.8640
386.15	31.03	0.7175	-	334.75	20.68	0.9589	-
394.35	34.47	0.7175	-	343.15	24.13	0.9589	-
402.65	37.92	0.7175	-	350.25	27.58	0.9589	-
410.65	41.37	0.7175	-	356.65	31.03	0.9589	-
418.75	44.82	0.7175	-	362.95	34.44	0.9589	-
427.15	48.26	0.7175	-	369.05	37.92	0.9589	-
435.35	51.71	0.7175	-	374.95	41.37	0.9589	-
444.25	55.16	0.7175	-	380.55	44.82	0.9589	-
449.15	56.54	0.7175	-	387.15	48.26	0.9589	-
455.45	57.92	0.7175	-	388.15	24.13	-	0.9589
458.65	58.61	0.7175	-	395.75	31.03	-	0.9589
471.15	58.61	0.7175	-	400.65	34.44	-	0.9589
466.35	58.94	0.7175	-	403.15	37.92	-	0.9589
450.15	13.79	-	0.7175	404.95	41.37	-	0.9589
458.75	17.24	-	0.7175	405.05	44.82	-	0.9589
466.15	20.68	-	0.7175	403.55	48.26	-	0.9589
472.15	24.13	-	0.7175	403.15	48.95	-	0.9589
478.15	27.58	-	0.7175	391.25	49.64	-	0.9589
484.15	31.03	-	0.7175	402.35	49.64	-	0.9589
488.75	34.47	-	0.7175	393.45	50.33	-	0.9589
491.65	37.92	-	0.7175	401.15	50.33	-	0.9589
492.75	41.37	-	0.7175	398.05	50.91	-	0.9589
492.75	44.82	-	0.7175				

COMPONENTS:

(1) Propane; C_3H_8; [74-98-6]

(2) Octane; C_8H_{18}; [111-65-9]

ORIGINAL MEASUREMENTS:

Kay, W. B.; Genco, J.;

Fichtner, D. A.,

J. Chem. Eng. Data 1974, *19*,

275-280.

VARIABLES:

T/K: 329.15-550.45

P/MPa: 0.689-4.32

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	$P/10^5$Pa	Mole fraction of propane in liquid, $x_{C_3H_8}$	in vapor, $y_{C_3H_8}$	T/K	$P/10^5$Pa	Mole fraction of propane in liquid, $x_{C_3H_8}$	in vapor, $y_{C_3H_8}$
371.15	6.89	0.2143	-	422.65	20.68	0.3306	-
400.65	10.34	0.2143	-	439.15	24.13	0.3306	-
426.15	13.79	0.2143	-	454.65	27.58	0.3306	-
447.15	17.24	0.2143	-	469.15	31.03	0.3306	-
467.15	20.68	0.2143	-	483.15	34.47	0.3306	-
483.15	24.13	0.2143	-	497.15	37.92	0.3306	-
500.15	27.58	0.2143	-	512.05	41.37	0.3306	-
515.65	31.03	0.2143	-	515.85	42.06	0.3306	-
531.15	34.47	0.2143	-	533.65	42.06	0.3306	-
535.15	35.16	0.2143	-	520.15	42.75	0.3306	-
539.65	35.85	0.2143	-	531.15	42.75	0.3306	-
547.15	35.85	0.2143	-	526.15	43.21	0.3306	-
543.15	36.25	0.2143	-	516.65	20.68	-	0.3306
520.55	17.24	-	0.2143	524.15	24.13	-	0.3306
530.15	20.68	-	0.2143	530.65	27.58	-	0.3306
538.85	24.13	-	0.2143	536.15	31.03	-	0.3306
545.65	27.58	-	0.2143	539.65	34.47	-	0.3306
550.45	31.03	-	0.2143	539.65	37.92	-	0.3306
549.85	34.47	-	0.2143	535.65	41.37	-	0.3306
549.15	35.16	-	0.2143	344.95	13.79	0.5729	-
365.65	10.34	0.3306	-	360.15	17.24	0.5729	-
386.15	13.79	0.3306	-	373.65	20.68	0.5729	-
405.65	17.24	0.3306	-	385.15	24.13	0.5729	-

(cont.)

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Samples of known composition confined in thick-walled glass tube over mercury. Temperature measured with thermocouple and pressure with Bourdon gauge. Dew point and bubble point determined.

SOURCE AND PURITY OF MATERIALS:

1. and 2. Phillips Petroleum samples purity better than 99.9 mole per cent.

ESTIMATED ERROR:

$\delta T/K = \pm 0.02$; $\delta P/10^5\text{Pa} = \pm 0.07$;

$\delta x_{C_3H_8}$, $\delta y_{C_3H_8} = \pm 0.0002$.

REFERENCES:

COMPONENTS:

(1) Propane; C_3H_8; [74-98-6]

(2) Decane; $C_{10}H_{22}$; [124-18-5]

ORIGINAL MEASUREMENTS:

Reamer, H. H.; Sage, B. H.

J. Chem. Eng. Data

1966, *11*, 17-24.

VARIABLES:

T/K: 277.6-510.9

P/MPa: 0.172-7.09

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K (t/°F)	P/psi	P/MPa	Mole fraction of propane in liquid, $x_{C_3H_8}$	in vapor, $y_{C_3H_8}$
277.59	25	0.172	0.3042	0.9996
(40)	50	0.345	0.6172	0.9998
	75	0.517	0.9463	0.9999
310.93	50	0.345	0.2973	0.9979
(100)	100	0.689	0.5746	0.9989
	150	1.03	0.8253	0.9996
344.26	50	0.345	0.1652	0.9910
(160)	100	0.689	0.3178	0.9948
	150	1.03	0.4584	0.9961
	200	1.38	0.5899	0.9969
	300	2.07	0.8275	0.9985
377.59	50	0.345	0.1077	0.9652
(220)	100	0.689	0.2110	0.9810
	150	1.03	0.3070	0.9863
	200	1.38	0.3971	0.9890
	300	2.07	0.5591	0.9915
	400	2.76	0.7003	0.9923
	600	4.14	0.9167	0.9929
	678[a]	4.67	0.9870	0.9870
	618[b]	4.26	-	0.993

(cont.)

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

PVT cell charged with mixture of known composition. Pressure measured with pressure balance. Temperature measured using resistance thermometer. Bubble and dew points determined for various compositions. Co-existing liquid and gas phase properties determined by graphical means. Details in ref. (1).

SOURCE AND PURITY OF MATERIALS:

1. Phillips Petroleum research grade sample, purity 99.6 mole per cent.
2. Phillips Petroleum Co. sample, purity 99.38 mole per cent.

ESTIMATED ERROR:

$\delta T/K = \pm 0.05$; $\delta P/MPa = \pm 0.01$;

$\delta x_{C_3H_8}$, $\delta y_{C_3H_8} = \pm 0.003$

REFERENCES:

1. Sage, B. H.; Lacey, W. N.; *Trans. Inst. Mining Met. Engnrs.* 1940, *136*, 136.

COMPONENTS:

(1) Propane; C_3H_8; [74-98-6]

(2) Decane; $C_{10}H_{22}$; [124-18-5]

ORIGINAL MEASUREMENTS:

Reamer, H. H.; Sage, B. H.

J. Chem. Eng. Data

1966, *11*, 17-24.

EXPERIMENTAL VALUES: (concluded)

T/K (t/°F)	P/psi	P/MPa	Mole fraction of propane in liquid, $x_{C_3H_8}$	Mole fraction of propane in vapor, $y_{C_3H_8}$
410.93	50	0.345	0.0732	0.8903
(280)	100	0.689	0.1488	0.9403
	150	1.03	0.2195	0.9571
	200	1.38	0.2856	0.9654
	300	2.07	0.4057	0.9737
	400	2.76	0.5139	0.9766
	600	4.14	0.7023	0.9770
	800	5.52	0.8629	0.9671
	873^a	6.02	0.9283	0.9283
	622^b	4.29	-	0.977
444.26	50	0.345	0.0459	0.7147
(340)	100	0.689	0.1051	0.8469
	150	1.03	0.1606	0.8914
	200	1.38	0.2128	0.9128
	300	2.07	0.3099	0.9343
	400	2.76	0.3988	0.9427
	600	4.14	0.5595	0.9463
	800	5.52	0.7043	0.9420
	980^a	6.76	0.8673	0.8673
	628^b	4.33	-	0.946
477.59	50	0.345	0.0190	0.3637
(400)	100	0.689	0.0679	0.6647
	150	1.03	0.1144	0.7645
	200	1.38	0.1588	0.8145
	300	2.07	0.2419	0.8624
	400	2.76	0.3188	0.8827
	600	4.14	0.4615	0.8990
	800	5.52	0.5988	0.8945
	1000	6.89	0.7450	0.8456
	1028^a	7.09	0.7993	0.7993
	640^b	4.41	-	0.900
510.93	100	0.689	0.0311	0.3382
(460)	150	1.03	0.0731	0.5416
	200	1.38	0.1136	0.6432
	300	2.07	0.1890	0.7379
	400	2.76	0.2586	0.7803
	600	4.14	0.3867	0.8129
	800	5.52	0.5168	0.8104
	988^a	6.81	0.7120	0.7120
	650^b	4.48	-	0.814

[a] Estimated critical state.

[b] Estimated maxcondentherm.

COMPONENTS:

(1) Butane; C_4H_{10}; [106-97-8]

(2) Heptane; C_7H_{16}; [142-82-5]

ORIGINAL MEASUREMENTS:

Kay, W. B.
Ind. Eng. Chem.
1941, *33*, 590-594.

VARIABLES:

T/K: 336.5-539.7
P/MPa: 0.689-3.964

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	T/°F	P/MPa (P/psi)	Mole fraction of butane in liquid, $x_{C_4H_{10}}$	T/K	T/°F	P/MPa (P/psi)	Mole fraction of butane in liquid, $x_{C_4H_{10}}$
454.26	358.0	0.689	0.000	422.76	301.3	1.379	0.40
449.3	349	(100)	0.02	410.15	278.6	(200)	0.50
444.54	340.5		0.04	399.21	258.9		0.60
439.54	331.5		0.06	389.26	241.0		0.70
430.4	315		0.10	380.65	225.5		0.80
419.8	296		0.15	373.26	212.2		0.90
410.09	278.5		0.20	367.93	202.6		1.00
393.1	248		0.30	521.04	478.2	2.068	0.00
379.54	223.5		0.40	517.59	472.0	(300)	0.02
368.7	204		0.50	514.09	465.7		0.04
359.8	188		0.60	510.43	459.1		0.06
351.92	173.8		0.70	503.32	446.3		0.10
344.54	160.5		0.80	494.26	430.0		0.15
339.26	151.0		0.90	485.48	414.2		0.20
336.48	146.0		1.00	468.43	383.5		0.30
494.65	430.7	1.379	0.00	452.59	355.0		0.40
490.37	423.0	(200)	0.02	438.26	329.2		0.50
486.48	416.0		0.04	425.93	307.0		0.60
482.37	408.6		0.06	415.26	287.8		0.70
474.43	394.3		0.10	405.37	270.0		0.80
464.59	376.6		0.15	396.48	254.0		0.90
455.09	359.5		0.20	389.26	241.0		1.00
437.82	328.4		0.30				

(cont.)

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Samples of known composition confined in thick-walled glass tube over mercury. Temperature measured with thermocouple and pressure with Bourdon gauge. Dew point and bubble point determined. Details in ref. (1).

SOURCE AND PURITY OF MATERIALS:

1 and 2. Samples purified by distillation and dried. Final purities probably about 99.5 mole per cent.

ESTIMATED ERROR:

δT/K = ±0.02; δP/MPa = ±0.007; $\delta x_{C_4H_{10}}$, $\delta y_{C_4H_{10}}$ = ±0.002 (estimated by compiler).

REFERENCES:

1. Kay, W. B.
Ind. Eng. Chem.
1938, *30*, 459.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Butane; C_4H_{10}; [106-97-8]	Kay, W. B.
	Ind. Eng. Chem.
(2) Heptane; C_7H_{16}; [142-82-5]	1941, *33*, 590-594.

EXPERIMENTAL VALUES: (cont.)

T/K	T/°F	P/MPa (P/psi)	Mole fraction of butane in liquid, $x_{C_4H_{10}}$	T/K	T/°F	P/MPa (P/psi)	Mole fraction of butane in liquid, $x_{C_4H_{10}}$
539.71	511.8	2.758	0.011	441.37	334.8	3.447	0.80
535.37	504.0	(400)	0.04	429.76	313.9	(500)	0.90
532.09	498.1		0.06	425.32	305.9		1.00
525.93	487.0		0.10	500.15	440.6	3.792	0.465
517.59	472.0		0.15	493.71	429.0	(550)	0.50
509.26	457.0		0.20	485.09	413.5		0.55
492.32	426.5		0.30	477.04	399.0		0.60
476.09	397.3		0.40	462.65	373.1		0.70
461.21	370.5		0.50	449.54	349.5		0.80
448.15	347.0		0.60	436.71	326.4		0.90
436.15	325.4		0.70	425.37	306.0		1.00
424.71	304.8		0.80	488.15	419.0	3.964	0.573
414.26	286.0		0.90	482.76	409.3	(575)	0.60
405.93	271.0		1.00	474.82	395.0		0.65
515.93	469.0	3.447	0.30	467.26	381.4		0.70
506.54	452.1	(500)	0.35	453.53	356.7		0.80
497.59	436.0		0.40	440.93	334.0		0.90
481.54	407.1		0.50	438.43	329.5		0.92
467.32	381.5		0.60	436.04	325.2		0.94
453.76	357.1		0.70	435.93	325.0		0.945

T/K	T/°F	P/MPa (P/psi)	Mole fraction of butane in vapor, $y_{C_4H_{10}}$	T/K	T/°F	P/MPa (P/psi)	Mole fraction of butane in vapor, $y_{C_4H_{10}}$
448.43	347.5	0.689	0.10	494.93	431.2	2.068	0.30
442.15	336.2	(100)	0.20	485.54	414.3	(300)	0.40
435.65	324.5		0.30	475.65	396.5		0.50
428.71	312.0		0.40	464.54	376.5		0.60
421.37	298.8		0.50	451.98	353.9		0.70
412.71	283.2		0.60	437.09	327.1		0.80
402.59	265.0		0.70	428.15	311.0		0.85
389.26	241.0		0.80	417.59	292.0		0.90
380.65	225.5		0.85	412.71	283.2		0.92
370.43	207.1		0.90	407.59	274.0		0.94
365.93	199.0		0.92	402.04	264.0		0.96
360.93	190.0		0.94	395.93	253.0		0.98
354.98	179.3		0.96	392.65	247.1		0.99
347.59	166.0		0.98	530.82	495.8	2.758	0.10
342.71	157.2		0.99	521.21	478.5	(400)	0.20
487.54	417.9	1.379	0.10	511.48	461.0		0.30
479.93	404.2	(200)	0.20	501.32	442.7		0.40
472.04	390.0		0.30	490.48	423.2		0.50
463.76	375.1		0.40	478.87	402.3		0.60
454.82	359.0		0.50	465.93	379.0		0.70
444.54	340.5		0.60	450.43	351.1		0.80
432.59	319.0		0.70	441.48	335.0		0.85
418.71	294.0		0.80	431.15	316.4		0.90
410.04	278.4		0.85	426.59	308.2		0.92
399.54	259.5		0.90	421.76	299.5		0.94
394.76	250.9		0.92	416.65	290.3		0.96
389.26	241.0		0.94	411.48	281.0		0.98
383.15	230.0		0.96	405.93	271.0		0.99
375.93	217.0		0.98	516.93	470.8	3.447	0.31
372.04	210.0		0.99	516.71	470.4	(500)	0.32
512.65	463.1	2.068	0.10				
504.09	447.7	(300)	0.20				

(cont.)

COMPONENTS:

(1) Butane; C_4H_{10}; [106-97-8]

(2) Heptane; C_7H_{16}; [142-82-5]

ORIGINAL MEASUREMENTS:

Kay, W. B.
Ind. Eng. Chem.
1941, *33*, 590-594.

EXPERIMENTAL VALUES: (concluded)

T/K	T/°F	P/MPa (P/psi)	Mole fraction of butane in vapor, $y_{C_4H_{10}}$	T/K	T/°F	P/MPa (P/psi)	Mole fraction of butane in vapor, $y_{C_4H_{10}}$
515.76	468.7	3.447	0.34	478.15	401.0	3.792	0.70
514.32	466.1	(500)	0.36	462.82	373.4	(550)	0.80
510.59	459.4		0.40	453.71	357.0		0.85
500.37	441.0		0.50	444.21	339.9		0.90
488.37	419.4		0.60	434.65	322.7		0.95
475.26	395.8		0.70	488.26	419.2	3.964	0.584
459.59	367.6		0.80	487.98	418.7	(575)	0.60
440.43	333.1		0.90	485.98	415.1		0.63
430.04	314.4		0.95	483.21	410.1		0.66
500.32	440.9	3.792	0.469	478.65	401.9		0.70
500.32	440.9	(550)	0.48	471.59	389.2		0.75
499.71	439.8		0.50	463.59	374.8		0.80
497.76	436.3		0.53	454.82	359.0		0.85
495.04	431.4		0.56	445.43	342.1		0.90
490.82	423.8		0.60	437.59	328.0		0.94

COMPONENTS:

(1) Butane; C_4H_{10}; [106-97-8]

(2) Octane; C_8H_{18}; [111-65-9]

ORIGINAL MEASUREMENTS:

Kay, W. B.; Genco, J.;
Fichtner, D. A.
J. Chem. Eng. Data
1974, *19*, 275-280.

VARIABLES:

T/K: 339.5-555.5
P/MPa: 0.689-4.309

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	P/psi	P/MPa	Mole fraction of butane in liquid, $x_{C_4H_{10}}$	Mole fraction of butane in vapor, $y_{C_4H_{10}}$
426.9	100	0.689	0.1823	-
455.9	150	1.034	0.1823	-
478.3	200	1.379	0.1823	-
496.5	250	1.724	0.1823	-
512.1	300	2.068	0.1823	-
526.7	350	2.413	0.1823	-
539.7	400	2.758	0.1823	-
545.0	420	2.896	0.1823	-
547.7	430	2.965	0.1823	-
550.9	440	3.034	0.1823	-
537.9	300	2.068	-	0.1823
546.2	350	2.413	-	0.1823
553.7	400	2.758	-	0.1823
555.5	420	2.896	-	0.1823
555.5	430	2.965	-	0.1823
554.2	440	3.034	-	0.1823
375.9	100	0.689	0.4631	-
400.4	150	1.034	0.4631	-
420.0	200	1.379	0.4631	-
436.8	250	1.724	0.4631	-
451.5	300	2.068	0.4631	-
465.3	350	2.413	0.4631	-
478.0	400	2.758	0.4631	-

(cont.)

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Samples of known composition confined in thick-walled glass tube over mercury. Temperature measured with thermocouple and pressure with Bourdon gauge. Dew point and bubble point determined.

SOURCE AND PURITY OF MATERIALS:

1 and 2. Phillips Petroleum samples, purity better than 99.9 mole per cent.

ESTIMATED ERROR:

$\delta T/K = \pm 0.1$; $\delta P/MPa = \pm 0.007$;
$\delta x_{C_4H_{10}}, \delta y_{C_4H_{10}} = \pm 0.0002$.

REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Butane; C_4H_{10}; [106-97-8] (2) Octane; C_8H_{18}; [111-65-9]	Kay, W. B.; Genco, J.; Fichtner, D. A. *J. Chem. Eng. Data* 1974, *19*, 275-280.

EXPERIMENTAL VALUES: (cont.)

T/K	*P*/psi	*P*/MPa	Mole fraction of butane in liquid, $x_{C_4H_{10}}$	Mole fraction of butane in vapor, $y_{C_4H_{10}}$
490.0	450	3.103	0.4631	-
501.9	500	3.447	0.4631	-
506.8	520	3.585	0.4631	-
512.0	540	3.723	0.4631	-
514.7	550	3.792	0.4631	-
516.4	555	3.827	0.4631	-
518.7	560	3.861	0.4631	-
515.2	300	2.068	-	0.4631
519.8	350	2.413	-	0.4631
524.0	400	2.758	-	0.4631
527.3	450	3.103	-	0.4631
529.5	500	3.447	-	0.4631
529.6	520	3.585	-	0.4631
528.4	540	3.723	-	0.4631
526.7	550	3.792	-	0.4631
525.1	555	3.827	-	0.4631
523.2	560	3.861	-	0.4631
354.5	100	0.689	0.6709	-
376.4	150	1.034	0.6709	-
393.6	200	1.379	0.6709	-
408.2	250	1.724	0.6709	-
421.2	300	2.068	0.6709	-
432.9	350	2.413	0.6709	-
443.7	400	2.758	0.6709	-
453.8	450	3.103	0.6709	-
463.7	500	3.447	0.6709	-
473.4	550	3.792	0.6709	-
484.1	600	4.137	0.6709	-
486.4	610	4.206	0.6709	-
487.7	615	4.240	0.6709	-
487.3	300	2.068	-	0.6709
491.9	350	2.413	-	0.6709
495.8	400	2.758	-	0.6709
499.4	450	3.103	-	0.6709
501.4	500	3.447	-	0.6709
502.6	550	3.792	-	0.6709
500.7	600	4.137	-	0.6709
499.0	610	4.206	-	0.6709
497.1	615	4.240	-	0.6709
347.0	100	0.689	0.8183	-
366.5	150	1.034	0.8183	-
382.0	200	1.379	0.8183	-
394.8	250	1.724	0.8183	-
406.7	300	2.068	0.8183	-
417.0	350	2.413	0.8183	-
426.7	400	2.758	0.8183	-
435.6	450	3.103	0.8183	-
444.1	500	3.447	0.8183	-
452.5	550	3.792	0.8183	-
461.7	600	4.137	0.8183	-
463.7	610	4.206	0.8183	-
466.2	620	4.275	0.8183	-
468.2	625	4.309	0.8183	-

(cont.)

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Butane; C_4H_{10}; [106-97-8] (2) Octane; C_8H_{18}; [111-65-9]	Kay, W. B.; Genco, J.; Fichtner, D. A. *J. Chem. Eng. Data* 1974, *19*, 275-280.

EXPERIMENTAL VALUES: (concluded)

T/K	*P*/psi	*P*/MPa	Mole fraction of butane in liquid, $x_{C_4H_{10}}$	in vapor, $y_{C_4H_{10}}$
457.0	300	2.068	-	0.8183
463.6	350	2.413	-	0.8183
469.1	400	2.758	-	0.8183
473.4	450	3.103	-	0.8183
476.4	500	3.447	-	0.8183
478.6	550	3.792	-	0.8183
478.6	600	4.137	-	0.8183
478	610	4.206	-	0.8183
406	620	4.275	-	0.8183
474.2	625	4.309	-	0.8183
339.5	100	0.689	0.9461	-
357.7	150	1.034	0.9461	-
371.9	200	1.379	0.9461	-
383.8	250	1.724	0.9461	-
394.3	300	2.068	0.9461	-
403.5	350	2.413	0.9461	-
412.0	400	2.758	0.9461	-
419.7	450	3.103	0.9461	-
426.9	500	3.447	0.9461	-
433.8	550	3.792	0.9461	-
436.6	570	3.930	0.9461	-
438.3	580	3.999	0.9461	-
439.5	585	4.033	0.9461	-
440.0	587.3	4.049	0.9461	-
440.7	588.5	4.058	0.9461	-
441.9	589.8	4.067	0.9461	-
424.8	350	2.413	-	0.9461
431.7	400	2.758	-	0.9461
437.1	450	3.103	-	0.9461
440.6	500	3.447	-	0.9461
442.6	550	3.792	-	0.9461
443.4	570	3.930	-	0.9461
443.6	580	3.999	-	0.9461
443.2	585	4.033	-	0.9461
440.0	587.3	4.049	-	0.9461

COMPONENTS:

(1) Butane; C_4H_{10}; [106-97-8]

(2) Decane; $C_{10}H_{22}$; [124-18-5]

ORIGINAL MEASUREMENTS:

Reamer, H. H.; Sage, B. H.;
Lacey, W. N.
Ind. Eng. Chem.
1946, *38*, 986-989.

VARIABLES:

T/K: 310.9-510.9
P/kPa: 0-4.83

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

Smoothed data

T/K (T/°F)	P/MPa	P/psi	Molar volumes /cm^3 mol^{-1}	Molar volumes /ft^3(lb mol)$^{-1}$	Mole fraction of butane, C_4H_{10}
310.93	0.0005	0.07	198.3	3.176	0.0
(100)	0.036	5.1	188.3	3.017	0.1
	0.070	10.1	178.5	2.860	0.2
	0.104	15.1	168.9	2.706	0.3
	0.139	20.1	159.2	2.550	0.4
	0.173	25.1	149.7	2.398	0.5
	0.208	30.2	140.4	2.249	0.6
	0.244	35.4	131.3	2.103	0.7
	0.281	40.7	122.4	1.961	0.8
	0.318	46.1	113.5	1.818	0.9
	0.355	51.5	104.3	1.671	1.0
344.26	0.0028	0.40	205.5	3.292	0.0
(160)	0.083	12.1	195.1	3.126	0.1
	0.164	23.8	185.2	2.966	0.2
	0.243	35.3	175.3	2.808	0.3
	0.321	46.6	165.6	2.652	0.4
	0.400	58.0	156.3	2.503	0.5
	0.479	69.5	147.1	2.357	0.6
	0.561	81.4	138.4	2.217	0.7
	0.647	93.9	129.7	2.078	0.8
	0.738	107.0	121.4	1.944	0.9
	0.832	120.6	113.2	1.813	1.0

(cont.)

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

PVT cell charged with mixture of known composition. Bubble and dew points determined for various compositions. Temperature measured with platinum resistance thermometer, pressure measured with pressure balance. Liquid compositions determined by graphical means. Details in source and ref. (1).

SOURCE AND PURITY OF MATERIALS:

1. Obtained from Phillips Petroleum Co. Analyses indicate less than 0.3 mole per cent 2-methylpropane and negligible amounts of other impurities.
2. Mixture of isomers.

ESTIMATED ERROR:

δT/K = ±0.02; δP/psi = ±3%;
$\delta x_{C_4H_{10}}$ = ±0.01 (estimated by compiler).

REFERENCES:

1. Sage, B. H.; Lacey, W. N. *Trans. Am. Inst. Mining Met. Engnrs.* 1940, *136*, 136.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Butane; C_4H_{10}; [106-97-8] (2) Decane; $C_{10}H_{22}$; [124-18-5]	Reamer, H. H.; Sage, B. H.; Lacey, W. N. *Ind. Eng. Chem.* 1946, *38*, 986-989.

EXPERIMENTAL VALUES: (concluded)

T/K (T/°F)	P/MPa	P/psi	Molar volumes /cm^3 mol^{-1}	 /ft^3(lb mol)$^{-1}$	Mole fraction of butane, $x_{C_4H_{10}}$
377.59	0.011	1.59	213.7	3.423	0.0
(220)	0.157	22.8	203.1	3.254	0.1
	0.305	44.3	192.8	3.089	0.2
	0.454	65.9	182.7	2.927	0.3
	0.603	87.5	173.0	2.771	0.4
	0.752	109.1	163.7	2.622	0.5
	0.905	131.2	155.0	2.483	0.6
	1.067	154.8	146.9	2.353	0.7
	1.246	180.7	139.3	2.231	0.8
	1.443	209.3	132.4	2.121	0.9
	1.663	241.2	126.6	2.028	1.0
410.93	0.035	5.1	222.9	3.571	0.0
(280)	0.259	37.5	212.6	3.406	0.1
	0.486	70.5	202.5	3.243	0.2
	0.723	104.8	192.7	3.087	0.3
	0.969	140.5	183.3	2.936	0.4
	1.229	178.2	174.2	2.790	0.5
	1.509	218.8	165.6	2.652	0.6
	1.813	263	157.8	2.527	0.7
	2.151	312	151.6	2.429	0.8
	2.544	369	149.3	2.391	0.9
	3.006	436	156.1	2.501	1.0
444.26	0.093	13.5	233.6	3.742	0.0
(340)	0.407	59.0	224.1	3.589	0.1
	0.735	106.6	214.8	3.440	0.2
	1.084	157.2	205.5	3.291	0.3
	1.456	211.2	196.5	3.147	0.4
	1.855	269	187.8	3.009	0.5
	2.282	331	180.3	2.888	0.6
	2.772	402	174.2	2.791	0.7
	3.316	481	171.7	2.751	0.8
	3.94	571	178.2	2.854	0.9
477.59	0.215	31.2	247.3	3.962	0.0
(400)	0.623	90.3	238.1	3.814	0.1
	1.064	154.3	229.0	3.669	0.2
	1.531	222.0	220.1	3.526	0.3
	2.05	297	211.8	3.393	0.4
	2.61	379	204.7	3.279	0.5
	3.22	467	200.1	3.205	0.6
	3.87	562	350.8	3.201	0.7
	4.53	657	214.2	3.431	0.8
510.93	0.446	64.7	264.0	4.229	0.0
(460)	0.948	137.5	255.1	4.087	0.1
	1.486	215.5	247.2	3.959	0.2
	2.08	301	239.8	3.841	0.3
	2.72	395	234.0	3.748	0.4
	3.42	496	230.7	3.695	0.5
	4.15	602	232.5	3.724	0.6
	4.83	700	249.8	4.002	0.7

COMPONENTS:

(1) Propane; C_3H_8; [74-98-6]
Butane; C_4H_{10}; [106-97-8]
2-Methylpropane; C_4H_{10}; [75-28-5]

(2) Non-polar solvents excluding alkanes and organohalides

EVALUATOR:

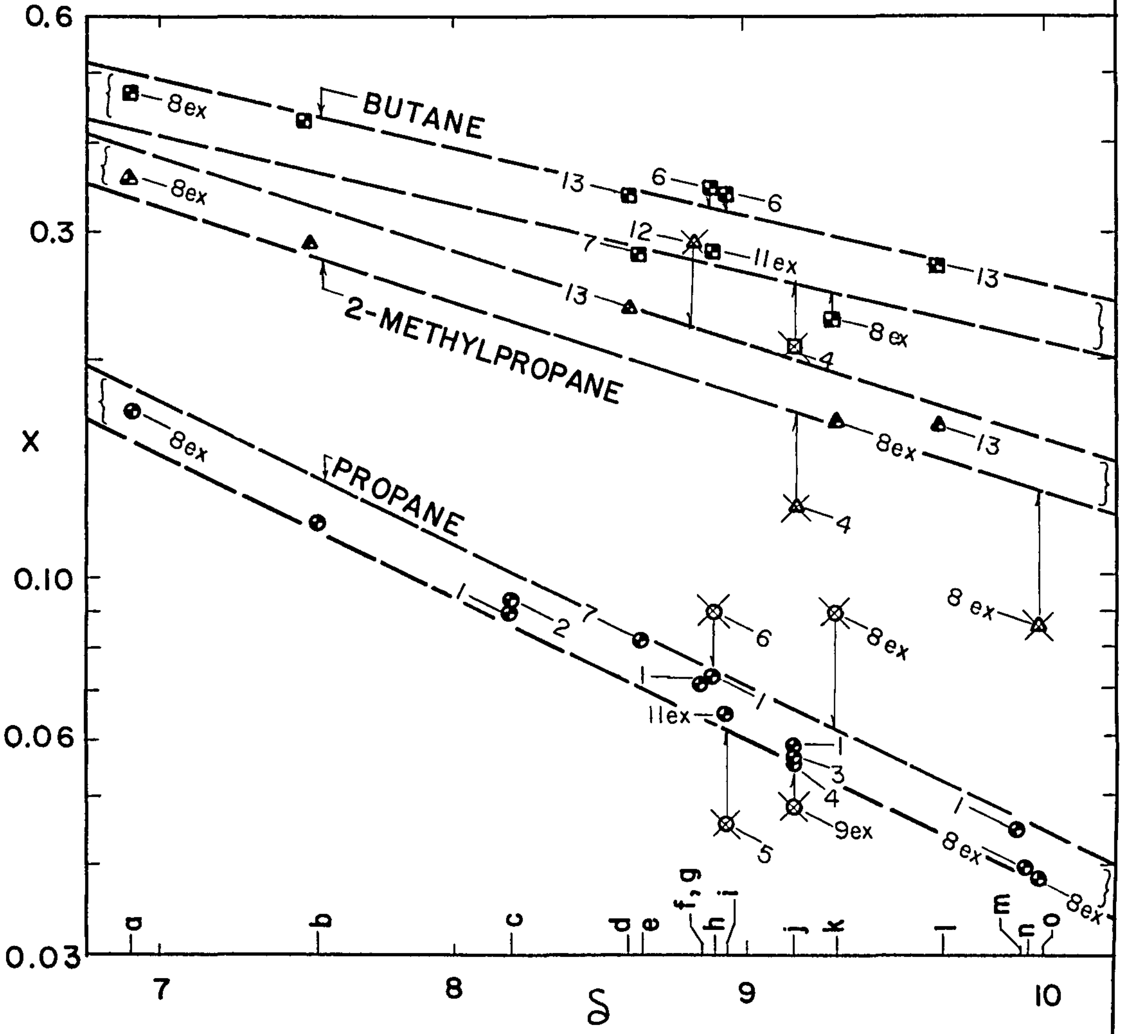
Walter Hayduk
Department of Chemical Engineering
University of Ottawa
Ottawa, Canada K1N 9B4

March, 1984

CRITICAL EVALUATION:

The solubilities of *propane*, *butane* and *2-methylpropane* in non-polar solvents excluding the alkanes and organohalides (dealt with elsewhere in this volume) were tested for consistency using solvent solubility parameters (14). The source of the solubility parameters was mainly that prepared by Martin (15). The consistency test involved plotting the mole fraction solubility on a logarithmic scale as a function of solubility parameter. For solvents which form regular solutions with the solute gases, a consistent relation is expected for each gas. While not expected to indicate the accuracy of particular solubilities, the consistency test is considered helpful in revealing major deviations from normal solubility behavior and hence possible major errors. The diagram below shows the mole fraction solubility at 298.15 K and a gas partial pressure of 101.325 kPa, x, for the three gases as a function of the solvent solubility parameter, δ. When extrapolation was required to a temperature of 298.15 K, "ex" is shown on the diagram next to the reference number. For comparison, the solubility in normal octane, as estimated from data or equations

Solubility at 298.15 K as a function of solubility parameter



COMPONENTS:	EVALUATOR:
(1) Propane; C_3H_8; [74-98-6] Butane; C_4H_{10}; [106-97-8] 2-Methylpropane; C_4H_{10};[75-28-5] (2) Non-polar solvents excluding alkanes and organohalides	Walter Hayduk Department of Chemical Engineering University of Ottawa Ottawa, Canada K1N 9B4 March, 1984

CRITICAL EVALUATION: continued

available for the low molecular weight alkane solvents, are included in the diagram (see Critical Evaluation in alkane solvents). Furthermore, because of the lack of data for solubilities of *butane* and *2-methylpropane*, some additional data, representing solubilities in the organohalides, tetrachloromethane and chlorobenzene (13) were also used. The latter data are discussed in more detail in the Critical Evaluation of solubilities in organohalide solvents.

The sources of data and letter code for reference to the diagram are listed in order of increasing solubility parameter: (a) octamethylcyclotetrasiloxane (OMTS)(8), (b) n-octane, (c) cyclohexane (1,2), (d) tetrachloromethane (13), (e) decahydronaphthalene (decalin)(8), (f) ethylbenzene (1), (g) 1,3,5-trimethylbenzene (mesitylene)(12), (h) 1,3-dimethylbenzene (m-xylene)(1,6), (i) methylbenzene (toluene) (5,6,11), (j) benzene (1,3,4,9), (k) 1,1'-bicyclohexyl (8), (l) chlorobenzene (13), (m) carbon disulfide (1), (n) 1,1'-methylenebisbenzene (diphenylmethane)(8), (o) 1-methylnaphthalene(8) and 1,1'-oxybismethane (diethylether)(9,10).

Because of the scarcity of data, dashed lines, 20% apart, indicate an approximate range of solubilities for the three gases as a function of solubility parameter. There are more data for *propane* solubilities than for the other two gases.

Because the solubility of *propane* in (i) toluene of Waters et al. (5) is much lower than the extrapolated value of Hannaert et al. (11) and those of other solvents of comparable solubility parameter, it is rejected. The solubilities of Gerrard (6,12) involving all three gases in the aromatic solvents (h) m-xylene, (i) toluene and (g) mesitylene appear too high, especially for the *propane* and *2-methylpropane* gases as previously observed for other solubilities reported by that author (see Critical Evaluation in alkane solvents). These data in the latter two solvents are rejected. The data of Jadot (4) for solubilities of *butane* and *2-methylpropane* in benzene are classified as doubtful. The data of Chappelow and Prausnitz (8) for the solubilities of *propane* in bicyclohexyl and of *2-methylpropane* in methylnaphthalene appear much different than would be expected for the particular solvent solubility parameters and are also classified as doubtful. The solubilities of Lebeau (9,10) in diethylether, of historic interest only, appear much too low and are rejected. The solubility of *propane* in benzene by that worker, while rejected, is at least of the correct order.

The remaining data are classified as tentative.

The data of Chappelow and Prausnitz (8) cover a large temperature range, from 300 K to 425 or 475 K. Those workers used high boiling solvents in order to extend the temperature range normally used for solubility measurements.

A summary of the evaluation of the solubility data is given below; included are tentative values for the solubilities at 298.15 K when applicable.

The summary is in the form of a table (next page).

COMPONENTS:

(1) Propane; C_3H_8; [74-98-6]
Butane; C_4H_{10}; [106-97-8]
2-Methylpropane; C_4H_{10};[75-28-5]

(2) Non-polar solvents excluding alkanes and organohalides

EVALUATOR:

Walter Hayduk
Department of Chemical Engineering
University of Ottawa
Ottawa, Canada K1N 9B4

March, 1984

CRITICAL EVALUATION:

Solubilities at 298.15 K

Solvent (Ref.)	*Propane*		*Butane*		*2-Methylpropane*	
	x	class.	x	class.	x	class.
(a) OMCTS(8)	0.170[1]	tentative	0.476[1]	tentative	0.349[1]	tentative
(b) n-octane	0.119	-	0.436	-	0.29[1]	-
(c) Cyclohexane (1,2)	0.0910[2]	tentative	-	-	-	-
(d) Carbon tetrachloride(13)	-	-	0.339	-	0.238	-
(e) Decalin(7)	0.0826	tentative	0.280	tentative	-	-
(f) Ethylbenzene(1)	0.0724	tentative	-	-	-	-
(g) Mesitylene(12)	-	-	-	-	-	rejected
(h) M-xylene(1)	0.0731	tentative	-	-	-	-
M-xylene(6)	-	rejected	0.353[1]	tentative	-	-
(i) Toluene(11)	0.065[1]	tentative	0.285[1]	tentative	-	-
Toluene(15)	-	rejected	-	-	-	-
(j) Benzene(1,3)	0.0573[2]	tentative	-	-	-	-
Benzene(4,9)	-	rejected	-	rejected	-	rejected
(k) Bicyclohexyl(8)	-	rejected	0.226[1]	tentative	0.164[1]	tentative
(l) Chlorobenzene(13)	-	-	0.269	-	0.162	-
(m) Carbon disulfide(1)	0.0446	tentative	-	-	-	-
(n) Diphenylmethane(8)	0.0395[1]	tentative	-	-	-	-
(o) Methylnaphthalene(8)	0.0380[1]	tentative	-	-		rejected
Diethylether (9,10)	-	rejected	-	rejected	-	rejected

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[1] Extrapolated or estimated.

[2] Average value.

COMPONENTS:	EVALUATOR:
(1) Propane; C_3H_8; [74-98-6] Butane; C_4H_{10}; [106-97-8] 2-Methylpropane; C_4H_{10}; [75-28-5] (2) Non-polar solvents excluding alkanes and organohalides	Walter Hayduk Department of Chemical Engineering University of Ottawa Ottawa, Canada K1N 9B4 March, 1984

CRITICAL EVALUATION:

References

1. Fleury, D.; Hayduk, W. *Can. J. Chem. Eng.* 1975, *53*, 195-199.
2. Miller, K.W. *J. Phys. Chem.* 1968, *72*, 2248-2249.
3. Thomsen, E.S.; Gjaldbaek, J.C. *Acta Chem. Scand.* 1963, *17*, 134-138.
4. Jadot, R. *J. Chim. Phys.* 1972, *69*, 1036-1040.
5. Waters, J.A.; Mortimer, G.A.; Clements, H.E. *J. Chem. Eng. Data* 1970, *15*, 174-176.
6. Gerrard, W. *J. Appl. Chem. Biotechnol.* 1973, *23*, 1-17.
7. Lenoir, J.-Y.; Renault, P.; Renon, H. *J. Chem. Eng. Data* 1971, *16*, 340-342.
8. Chappelow, C.C.; Prausnitz, J.M. *A.I.Ch.E.J.* 1974, *20*, 1097-1104.
9. Lebeau, P. *Compt. Rend.* 1905, *140*, 1454-1456 and 1572.
10. Lebeau, P. *Bull. Acad. Roy. Belg.* 1908, 300-304.
11. Hannaert, H.; Haccuria, M.; Mathieu, M.P. *Ind. Chem. Belge* 1967, *32*, 156-164.
12. Gerrard, W. *Solubility of Gases and Liquids*, Plenum Press, New York 1976, Chapter 12.
13. Blais, C.; Hayduk, W. *J. Chem. Eng. Data* 1983, *28*, 181-183.
14. Hildebrand, J.H.; Prausnitz, J.M.; Scott, R.L. *Regular and Related Solutions*, Van Nostrand Reinhold, New York 1970, Chapter 8.
15. Martin, R.A. *Table of Solubility Parameters, Third Ed.*, Union Carbide Corporation, Tarrytown, New York 1975.

COMPONENTS:

(1) Propane; C_3H_8; [74-98-6]

(2) Carbon disulfide; CS_2; [75-15-0]

ORIGINAL MEASUREMENTS:

Fleury, D.; Hayduk, W.

Can. J. Chem. Eng. 1975, *53*. 195-199.

VARIABLES:

T/K: 258.15-308.15

P/kPa: 101.325

PREPARED BY:

W. Hayduk

EXPERIMENTAL VALUES:

T/K	Ostwald Coefficient[1] L/cm^3 cm^{-3}	Bunsen Coefficient[2] α/cm^3 (STP)cm^{-3}atm^{-1}	Mole Fraction[1] x_1
258.15	61.4	65.0	0.146 (0.1440)[3]
273.15	34.3	34.3	0.0842 (0.0862)
298.15	18.4	16.9	0.0446 (0.0435)
308.15	14.5	12.9	0.0345 (0.0348)

[1] Original data.

[2] Calculated by compiler.

[3] The mole fraction solubility of the original data was used to determine the following equations for $\Delta G°$ and ln x_1 and table of smoothed values:

$$\Delta G°/\text{J mol}^{-1} = -RT \ln x_1 = 611.03\ T - 78.581\ T \ln T - 40920$$

$$\ln x_1 = 4921.83/T + 9.45166 \ln T - 73.4939$$

Std. deviation for $\Delta G°$ = 44.4 J mol^{-1}

T/K	$\Delta G°$/J mol^{-1}	x_1	T/K	$\Delta G°$/J mol^{-1}	x_1
258.15	4159	0.1440	293.15	7342	0.0492
263.15	4636	0.1202	298.15	7769	0.0435
273.15	5566	0.0862	303.15	8190	0.0388
283.15	6468	0.0641	308.15	8603	0.0348

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

A volumetric method using a glass apparatus was employed. Degassed solvent contacted the gas while flowing as a thin film, at a constant rate, through an absorption spiral into a solution buret. A constant solvent flow was obtained by means of a calibrated syringe pump. The solution at the end of the spiral was considered saturated. Dry gas was maintained at atmospheric pressure in a gas buret by mechanically raising the mercury level in the buret at an adjustable rate. The solubility was calculated from the constant slope of volume of gas dissolved and volume of solvent injected.

Degassing was accomplished using a two stage vacuum process described by Clever et al. (1).

SOURCE AND PURITY OF MATERIALS:

1. Matheson Co. Specified as instrument grade of minimum purity 99.5 per cent.
2. Fisher Scientific. Specified minimum purity 99.0 per cent.

ESTIMATED ERROR:

δT/K = 0.1

$\delta x_1/x_1$ = 0.01

REFERENCES:

1. Clever, H.L.; Battino, R.; Saylor, J.H.; Gross, P.M. *J. Phys. Chem.* 1971, *61*, 1078.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Propane; C_3H_8; [74-98-6] (2) Cyclohexane; C_6H_{12}; [110-82-7]	Fleury, D.; Hayduk, W. *Can. J. Chem. Eng.* 1975, *53*, 195-199.

VARIABLES:	PREPARED BY:
T/K: 283.15-343.15 P/kPa: 101.325	W. Hayduk

EXPERIMENTAL VALUES:

T/K	Ostwald Coefficient[1] L/cm^3 cm^{-3}	Bunsen Coefficient[2] α/cm^3 (STP) cm^{-3}atm^{-1}	Mole Fraction[1] x_1
283.15	33.5	29.3	0.136 (0.136)[3]
298.15	22.6	20.7	0.0924 (0.0936)
323.15	13.6	11.5	0.0555 (0.0545)
343.15	9.49	7.55	0.0371 (0.0374)

[1] Original data.

[2] Calculated by compiler.

[3] The mole fraction solubility of the original data was used to determine the following equations for ΔG° and ln x_1 and table of smoothed values:

$$\Delta G°/\text{J mol}^{-1} = -RT \ln x_1 = 77.819\ T - 17330$$

$$\ln x_1 = 2084.4/T - 9.3600$$

Std. deviation for ΔG° = 36.9 J mol^{-1}; Correlation coefficient = 0.9998

T/K	ΔG°/J mol^{-1}	x_1	T/K	ΔG°/J mol^{-1}	x_1
283.15	4705	0.1356	313.15	7039	0.0670
293.15	5483	0.1054	323.15	7817	0.0545
298.15	5872	0.0936	333.15	8596	0.0449
303.15	6261	0.0834	343.15	9374	0.0374

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

A volumetric method using a glass apparatus was employed. Degassed solvent contacted the gas while flowing as a thin film, at a constant rate, through an absorption spiral into a solution buret. A constant solvent flow was obtained by means of a calibrated syringe pump. The solution at the end of the spiral was considered saturated. Dry gas was maintained at atmospheric pressure in a gas buret by mechanically raising the mercury level in the buret at an adjustable rate. The solubility was calculated from the constant slope of volume of gas dissolved and volume of solvent injected.

Degassing was accomplished using a two stage vacuum process described by Clever et al. (1).

SOURCE AND PURITY OF MATERIALS:

1. Matheson Co. Specified as instrument grade of minimum purity 99.5 per cent.
2. Fisher Scientific. Specified minimum purity 99.0 per cent.

ESTIMATED ERROR:

δT/K = 0.1

$\delta x_1/x_1$ = 0.01

REFERENCES:

1. Clever, H.L.; Battino, R.; Saylor, J.H.; Gross, P.M. *J. Phys. Chem.* 1971, *61*, 1078.

COMPONENTS:

(1) Propane; C_3H_8; [74-98-6]

(2) Cyclohexane; C_6H_{12}; [110-82-7]

ORIGINAL MEASUREMENTS:

Miller, K. W.

J. Phys. Chem. 1968, *72*, 2248 - 2249.

VARIABLES:

T/K: 280.15 - 305.25

p_1/kPa: 101.325 (1 atm)

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

Temperature t/°C	Temperature T/K	Mol Fraction x_1	Bunsen Coefficient α/cm^3(STP)cm^{-3}atm^{-1}	Ostwald Coefficient L/cm^{3}cm^{-3}
7.0	280.15	0.1318	31.97	32.79
12.8	285.95	0.1155	27.31	28.59
18.7	291.85	0.1016	23.48	25.09
25.0	298.15	0.0896	20.28	22.14
28.5	301.65	0.0833	18.65	20.60
32.1	305.25	0.0776	17.19	19.21

The Bunsen and Ostwald coefficients were calculated by the compiler assuming ideal gas behavior and Henry's law is obeyed.

Smoothed Data: For use between 280.15 and 305.25 K.

$$\ln x_1 = -8.4498 + 17.9925/(T/100\text{K})$$

The standard error about the regression line is 1.75 x 10^{-4}.

T/K	Mol Fraction x_1
283.15	0.1230
288.15	0.1102
293.15	0.0990
298.15	0.0894
303.15	0.0809

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The liquid is saturated with the gas at a partial pressure of one atm.

The apparatus is that described by Dymond and Hildebrand (1). It uses an all-glass pumping system to spray slugs of degassed solvent into the gas. The amount of gas dissolved is calculated from the initial and final gas pressures.

SOURCE AND PURITY OF MATERIALS:

(1) Propane. Phillips Petroleum Co. Research grade. Dried before use.

(2) Cyclohexane. Matheson, Coleman and Bell. "Spectroquality". Used as received.

ESTIMATED ERROR:

REFERENCES:

1. Dymond, J. H.; Hildebrand, J. H. *Ind. Eng. Chem. Fundam.* 1967, *6*, 130.

COMPONENTS:

(1) Propane; C_3H_8; [74-98-6]

(2) Benzene; C_6H_6; [71-43-2]

ORIGINAL MEASUREMENTS:

Thomsen, E.S.; Gjaldbaek, J.C.

Acta Chem. Scand. 1963, *17*, 134-138.

VARIABLES:

T/K: 298.15

P/kPa: 101.325

PREPARED BY:

E.S. Thomsen, W. Hayduk

EXPERIMENTAL VALUES:

T/K	Ostwald Coefficient[2] L/cm^3 cm^{-3}	Bunsen Coefficient[1] α/cm^3 (STP)cm^{-3}atm^{-1}	Mole Fraction[2] x_1
298.15	16.13	14.7	0.0564

[1] Original data.

[2] Calculated by compilers using a real gas molar volume.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The method utilizes a combined glass manometer and bulb enclosed in an air thermostat which is shaken until equilibrium is established. Mercury is used for calibrating the volumes and as the confining liquid. Details in reference 1.

The absorbed gas volume is calculated from the initial dry gas, and final solvent vapor-saturated gas volume. The amount of solvent is determined by measuring the mass of mercury displaced.

SOURCE AND PURITY OF MATERIALS:

1. Phillips Petroleum Co. Specified as research grade and GC analysis indicated 0.1 per cent air and 0.03 per cent ethane impurities.
2. Merck. Purified by freezing and fractionation.

ESTIMATED ERROR:

δT/K = 0.05

$\delta x_1/x_1$ = 0.015

REFERENCES:

1. Gjaldbaek, J.C.
Acta Chem. Scand. 1952, *6*, 623.

COMPONENTS:

(1) Propane; C_3H_8; [74-98-6]

(2) Benzene; C_6H_6; [71-43-2]

ORIGINAL MEASUREMENTS:

Jadot, R.

J. Chim. Phys. 1972, *69*, 1036-40

VARIABLES:

T/K: 298.15

P/kPa: 101.3

PREPARED BY:

C.L. Young

EXPERIMENTAL VALUES:

T/K	Henry's Law Constant, H/atm	Mole fraction$^+$ at partial pressure of 101.3 kPa, $x_{C_3H_8}$	#ΔH^∞ /cal mol^{-1} (/J mol^{-1})
298.15	18.165	0.05505	730 (3054)

\+ Calculated by compiler assuming $x_{C_3H_8} = 1/H$.

\# Excess partial molar enthalpy of solution at infinite dilution.

AUXILIARY INFORMATION

METHOD APPARATUS/PROCEDURE:

The conventional gas chromatographic technique was used. The carrier gas was helium. The value of Henry's law constant was calculated from the retention time. The value applies to very low partial pressures of gas and there may be a substantial difference from that measured at 1 atm. pressure. There is also considerable uncertainty in the value of Henry's constant since no allowance was made for surface adsorption.

SOURCE AND PURITY OF MATERIALS:

No details given.

ESTIMATED ERROR:

$\delta T/K = \pm 0.05$; $\delta H = \pm 2\%$

REFERENCES:

COMPONENTS:

(1) Propane; C_3H_8; [74-98-6]

(2) Benzene; C_6H_6; [71-43-2]

ORIGINAL MEASUREMENTS:

Fleury, D.; Hayduk, W.

Can. J. Chem. Eng. 1975, *53*, 195-199.

VARIABLES:

T/K: 283.15-343.15

P/kPa: 101.325

PREPARED BY:

W. Hayduk

EXPERIMENTAL VALUES:

T/K	Ostwald Coefficient[1] *L*/cm³ cm⁻³	Bunsen Coefficient[2] α/cm (STP) cm⁻³atm⁻¹	Mole Fraction[1] $10^4\ x_1$
283.15	23.0	22.2	813 (815)[3]
298.15	16.6	15.2	581 (586)
323.15	10.8	9.13	370 (361)
343.15	7.61	6.06	255 (258)

[1] Original data.

[2] Calculated by compiler.

[3] The mole fraction solubility of the original data was used to determine the following equations for ΔG° and ln x_1 and table of smoothed values:

$$\Delta G°/\text{J mol}^{-1} = -RT \ln x_1 = 75.483\ T - 15471$$

$$\ln x_1 = 1860.8/T - 9.0790$$

Std. deviation for ΔG° = 44.1 J mol⁻¹; Correlation coefficient = 0.9998

T/K	ΔG°/J mol⁻¹	$10^4 x_1$	*T*/K	ΔG°/J mol⁻¹	$10^4 x_1$
283.15	5902	815	313.15	8166	434
293.15	6657	651	323.15	8921	361
298.15	7034	586	333.15	9676	304
303.15	7412	528	343.15	10430	258

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

A volumetric method using a glass apparatus was employed. Degassed solvent contacted the gas while flowing as a thin film, at a constant rate, through an absorption spiral into a solution buret. A constant solvent flow was obtained by means of a calibrated syringe pump. The solution at the end of the spiral was considered saturated. Dry gas was maintained at atmospheric pressure in a gas buret by mechanically raising the mercury level in the buret at an adjustable rate. The solubility was calculated from the constant slope of volume of gas dissolved and volume of solvent injected.

Degassing was accomplished using a two stage vacuum process described by Clever et al. (1).

SOURCE AND PURITY OF MATERIALS:

1. Matheson Co. Specified as instrument grade of minimum purity 99.5 per cent.
2. Phillips Petroleum. Specified minimum purity 99.0 per cent.

ESTIMATED ERROR:

δ*T*/K = 0.1

$\delta x_1/x_1$ = 0.01

REFERENCES:

1. Clever, H.L.; Battino, R.; Saylor, J.H.; Gross, P.M. *J. Phys. Chem.* 1971, *61*, 1078.

COMPONENTS:

(1) Propane; C_3H_8; [74-98-6]

(2) Water, Benzene, Ethanol, Diethylether, Chloroform, Turpentine

ORIGINAL MEASUREMENTS:

Lebeau, P.

Compt. Rend. 1905, *140*, 1454-6 and 1572.

Bull. Soc. Chim. [*3*] 1905, *33*, 1137-9.

VARIABLES:

T/K = 290.8 - 294.8
p/kPa = 100.4 - 100.9

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

Temperature t/°C	T/K	Pressure[a] p/mmHg	Solubility Volume propane/100 Volumes Solvent
Water; H_2O; [7732-18-5]			
17.8	291.0	753	6.5
Benzene; C_6H_6O; [71-43-2]			
21.5	294.7	757	1452
Ethanol; C_2H_6O; [64-17-5]			
16.6	290.8	754	790
1,1'-Oxybisethane or diethylether; $C_4H_{10}O$; [60-29-7]			
16.6	290.8	757	926
Chloroform or trichloromethane; $CHCl_3$; [67-66-3]			
21.6	294.8	757	1299
Oil of turpentine			
17.7	290.9	757	1587

[a] Not clear whether this is total pressure or propane partial pressure. It is probably total pressure.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Details not given.

The data are reported in both papers.

SOURCE AND PURITY OF MATERIALS:

(1) Propane. Prepared by author from carefully purified propyl iodide by reaction with sodium in liquid ammonia.
Melting point/°C = -195
Boiling point/°C = -44.5
Critical temperature/°C = 102.

(2) Solvents. No information.

ESTIMATED ERROR:

REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Butane; C_4H_{10}; [106-97-8] (2) Benzene; C_6H_6; [71-43-2]	Jadot, R. *J. Chim. Phys.* 1972, *69*, 1036-40
VARIABLES: *T*/K: 298.15 *P*/kPa: 101.3	PREPARED BY: C.L. Young

EXPERIMENTAL VALUES:

T/K	Henry's Law Constant, *H*/atm	Mole fraction$^+$ at partial pressure of 101.3 kPa, $x_{C_4H_{10}}$	#ΔH^∞ /cal mol^{-1} (/J mol^{-1})
298.15	4.82	0.207	850 (3556)

\+ Calculated by compiler assuming $x_{C_4H_{10}} = 1/H$.

\# Excess partial molar enthalpy of solution at infinite dilution.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The conventional gas chromatographic technique was used. The carrier gas was helium. The value of Henry's law constant was calculated from the retention time. The value applies to very low partial pressures of gas and there may be a substantial difference from that measured at 1 atm. pressure. There is also considerable uncertainty in the value of Henry's constant since no allowance was made for surface adsorption.

SOURCE AND PURITY OF MATERIALS:

No details given

ESTIMATED ERROR:

$\delta T/K = \pm 0.05$; $\delta H = \pm 2\%$

REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Propane; C_3H_8; [74-98-6] (2) Methylbenzene (toluene); C_7H_8; [108-88-3]	Waters, J.A.; Mortimer, G.A.; Clements, H.E. *J. Chem. Eng. Data* 1970, *15*, 174-176.

VARIABLES:	PREPARED BY:
T/K: 253.15-298.15 P/kPa: 101.325	W. Hayduk

EXPERIMENTAL VALUES:

T/K	Solubility[1] c_1/ mol dm^{-3}atm^{-1}	Ostwald Coefficient[2] L/cm^{3}cm^{-3}	Bunsen Coefficient[1] [3]α/	Mole Fraction[2] x_1	Method
253.15	3.228	66.61	72.35	0.2473	A
253.15	3.175	65.51	71.16	0.2443	B
273.15	1.107	24.81	24.81	0.1030	A
273.15	1.177	26.38	26.38	0.1089	B
294.15	0.450	10.94	10.09	0.0456	A
296.15	0.452	11.04	10.12	0.0458	B
298.15	0.446	10.99	9.99	0.0454	A

[1] Original data. [3] α/cm^3(STP)cm^{-3}atm^{-1}

[2] Calculated by compiler.

The mole fraction solubility obtained using method A was used to determine equations for $\Delta G°$ and $\ln x$ and table of smoothed values:

$$\Delta G°/\text{J mol}^{-1} = -RT \ln x = 716.83T - 92.18\, T \ln T - 49383.3$$

$$\ln x = 11.088 \ln T + 5939.8/T - 84.2224$$

Standard error of estimate for x is 0.0020; correlation coefficient=.9997

T/K	$\Delta G°$/J mol^{-1}	x_1	T/K	$\Delta G°$/J mol^{-1}	x_1
253.15	2942.6	0.247	283.15	6220.3	0.0712
263.15	4069.7	0.156	293.15	7246.1	0.0512
273.15	5161.9	0.103	298.15	7747.2	0.0439

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Two methods (A and B) were employed. Method A was considered more accurate while method B was utilized mainly as a check on method A.

Method A: A removable 500-cm^3 glass absorption cell was used for the gas solubility measurements. The gas was supplied from a steel reservoir equipped with a pressure gauge and two pressure regulators. The pressure change in the reservoir was used to determine the quantity of gas dissolved. The solvent was degassed in the equilibrium cell. A correction was applied for non-ideality of the gas.

Method B: The increase in mass of the solvent was determined by removing the absorption cell and weighing it before and after a solubility determination.

SOURCE AND PURITY OF MATERIALS:

1. Matheson Co. Research grade; specified as 99.99 mole per cent pure.
2. Fisher Co. Spectrophotometric grade, of unspecified purity.

ESTIMATED ERROR:

δT/K = 0.1

δP/kPa = 0.1

$\delta c_1/c_1$ = 0.02 (compiler for Method A)

REFERENCES:

COMPONENTS:

(1) Propane; C_3H_8; [74-98-6]

(2) Methylbenzene or toluene
Dimethylbenzene

ORIGINAL MEASUREMENTS:

Hannaert, H.; Haccuria, M.;
Mathieu, M. P.

Ind. Chim. Belge 1967, *32*,
156 - 164.

VARIABLES:

T/K = 243.15 - 293.15

PREPARED BY:

E.L. Boozer, H.L. Clever

EXPERIMENTAL VALUES:

Temperature Interval of Measurements T/K	Propane Mol % Range 10^2x_1/mol %	$K\pi\nu$/atm[1] at 293.15 K	Enthalpy of Dissolution ΔH/kcal mol^{-1}	Constant A
Methylbenzene or toluene; C_7H_8; [108-88-3]				
243.15-293.15	1 - 10	12.8	3.79	3.93
Dimethylbenzene mixture; C_8H_{10}; [1330-20-7]				
243.15-293.15	1 - 10	12.5	4.15	4.20

[1] log ($K\pi\nu$/atm) = A - (ΔH/cal mol^{-1})/(2.3R(T/K))

The author's definitions are:

$$K = y_1/x_1 = \frac{\text{mole fraction gas in gas phase}}{\text{mole fraction gas in liquid phase}},$$

π/atm = total pressure,

ν = coefficient of fugacity.

The function, $K\pi\nu$/atm, is equivalent to a Henry's constant in the form $H_{1,2}$/atm = (f_1/atm)/x_1 where f_1 is the fugacity.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The authors describe three methods:

1.A. [Saturat. n° 1]. A measure of the static pressure of saturation in an apparatus which gave a precision of 10 - 15 %.

1.B. [Saturat. n° 2]. A measure of the static pressure of saturation in an apparatus which gave a precision of 2 - 5 %.

2. [Chromato]. A Gas liquid chromatographic method estimated to have a precision of 2 - 5 %.

3. [Anal. directe]. Direct analysis of the gaseous and liquid phases.

Method 1.A. was used for these systems.

SOURCE AND PURITY OF MATERIALS:

(1) Propane. Matheson. C. P. Purified on fractionation column. Purity > 99 %.

(2) Methylbenzene. Qualite UCB. Density ρ^{20}/g cm^{-3} = 0.8689.

Dimethylbenzene. Merck. Mixture of 90% dimethylbenzenes, 5 % methyl benzene, and 5 % ethylbenzene.

ESTIMATED ERROR:

REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Propane; C_3H_8 [74-98-6] (2) Ethylbenzene; C_8H_{10} [100-41-4]	Fleury, D.; Hayduk, W. *Can. J. Chem. Eng.* 1975, *53*, 195-199.

VARIABLES:	PREPARED BY:
T/K: 273.15-323.15 P/kPa: 101.325	W. Hayduk

EXPERIMENTAL VALUES:

T/K	Ostwald Coefficient[1] L/cm^3 cm^{-3}	Bunsen Coefficient[2] α/cm^3 (STP) cm^{-3}atm^{-1}	Mole Fraction[1] x_1
273.15	28.6	28.6	0.134 (0.133)[3]
298.15	15.3	14.0	0.0724 (0.0734)
323.15	9.87	8.34	0.0447 (0.0444)

[1] Original data.

[2] Calculated by compiler.

[3] The mole fraction solubility of the original data was used to determine the following equations for ΔG° and ln x_1 and table of smoothed values:

$$\Delta G°/\text{J mol}^{-1} = -RT \ln x_1 = 75.712\ T - 16099$$

$$\ln x_1 = 1936.4/T - 9.1066$$

Std. deviation for ΔG° = 29.6 J mol^{-1}; Correlation coefficient = 0.9999

T/K	ΔG°/J mol^{-1}	x_1	T/K	ΔG°/J mol^{-1}	x_1
273.15	4852	0.133	303.15	6853	0.0659
283.15	5339	0.104	313.15	7610	0.0538
293.15	6096	0.0820	323.15	8367	0.0444
298.15	6474	0.0734			

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

A volumetric method using a glass apparatus was employed. Degassed solvent contacted the gas while flowing as a thin film, at a constant rate, through an absorption spiral into a solution buret. A constant solvent flow was obtained by means of a calibrated syringe pump. The solution at the end of the spiral was considered saturated. Dry gas was maintained at atmospheric pressure in a gas buret by mechanically raising the mercury level in the buret at an adjustable rate. The solubility was calculated from the constant slope of volume of gas dissolved and volume of solvent injected.

Degassing was accomplished using a two stage vacuum process described by Clever et al. (1).

SOURCE AND PURITY OF MATERIALS:

1. Matheson Co. Specified as instrument grade of minimum purity 99.5 per cent.
2. Phillips Petroleum. Specified minimum purity 99.0 per cent.

ESTIMATED ERROR:

δT/K = 0.1

$\delta x_1/x_1$ = 0.01

REFERENCES:

1. Clever, H.L.; Battino, R.; Saylor, J.H.; Gross, P.M. *J. Phys. Chem.* 1971, *61*, 1078.

COMPONENTS:

(1) Propane; C_3H_8; [74-98-6]

(2) 1,3-Dimethylbenzene (*m*-xylene); C_8H_{10}; [108-38-3]

ORIGINAL MEASUREMENTS:

Fleury, D.; Hayduk, W.

Can. J. Chem. Eng. 1975, *53*, 195-199.

VARIABLES:

T/K: 273.15-323.15

P/kPa: 101.325

PREPARED BY:

W. Hayduk

EXPERIMENTAL VALUES:

T/K	Ostwald Coefficient[1] L/cm^3 cm^{-3}	Bunsen Coefficient[2] α/cm^3, (STP) cm^{-3}atm^{-1}	Mole Fraction[1] x_1
273.15	29.3	29.3	0.136 (0.135)[3]
298.15	15.5	14.2	0.0731 (0.0744)
323.15	9.83	8.31	0.0454 (0.0450)

[1] Original data.

[2] Calculated by compiler.

[3] The mole fraction solubility of the original data was used to determine the following equations for $\Delta G°$ and ln x_1 and table of smoothed values:

$$\Delta G°/\text{J mol}^{-1} = RT \ln x_1 = 75.551\ T - 16084$$

$$\ln x_1 = 1934.6\ T - 9.0872$$

Std. deviation for $\Delta G°$ = 37.6 J mol^{-1}; Correlation coefficient = 0.9999

T/K	$\Delta G°$/J mol^{-1}	x_1	T/K	$\Delta G°$/J mol^{-1}	x_1
273.15	4553	0.1347	303.15	6819	0.0668
283.15	5308	0.1049	313.15	7575	0.0545
293.15	6064	0.0831	323.15	8330	0.0450
298.15	6441	0.0744			

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

A volumetric method using a glass apparatus was employed. Degassed solvent contacted the gas while flowing as a thin film, at a constant rate, through an absorption spiral into a solution buret. A constant solvent flow was obtained by means of a calibrated syringe pump. The solution at the end of the spiral was considered saturated. Dry gas was maintained at atmospheric pressure in a gas buret by mechanically raising the mercury level in the buret at an adjustable rate. The solubility was calculated from the constant slope of volume of gas dissolved and volume of solvent injected.

Degassing was accomplished using a two stage vacuum process described by Clever et al. (1).

SOURCE AND PURITY OF MATERIALS:

1. Matheson Co. Specified as instrument grade of minimum purity 99.5 per cent.
2. Phillips Petroleum. Specified minimum purity 99.0 per cent.

ESTIMATED ERROR:

δT/K = 0.1

$\delta x_1/x_1$ = 0.01

REFERENCES:

1. Clever, H.L.; Battino, R.; Saylor, J.H.; Gross, P.M. *J. Phys. Chem.* 1971, *61*, 1078.

COMPONENTS:

(1) Propane; C_3H_8; [74-98-6]

(2) 1,3-Dimethylbenzene (*m*-xylene); C_8H_{10}; [108-38-3]

ORIGINAL MEASUREMENTS:

Gerrard, W.

J. Appl. Chem. Biotechnol. 1973, *23*, 1-17.

VARIABLES:

T/K: 268.2-293.2

P/kPa: 101.3

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

Total pressure = 101.3 kPa

T/K	Mole ratio	Mole fraction of propane#
268.2	0.190	0.160
278.2	0.169	0.145
283.2	0.154	0.133
293.2	0.113	0.102

Calculated by compiler.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Gas was passed into a known weight of pure liquid in a bubbler tube at a total pressure measured using a manometer assembly. The amount of absorbed gas was estimated by weighing. The temperature was controlled to within 0.2 K. The apparatus and procedure are described by Gerrard, ref. (1).

SOURCE AND PURITY OF MATERIALS:

No details given except that "all compounds were purified by conventional procedures".

ESTIMATED ERROR:

$\delta T/K = \pm 0.1$; $\delta x/x = \pm 3\%$ (estimated by compiler).

REFERENCES:

1. Gerrard, W. *J. Appl. Chem. Biotechnol.* 1972, *22*, 623.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Propane; C_3H_8; [74-98-6] (2) Octamethylcyclotetrasiloxane; $C_8H_{24}O_4Si_4$; [556-67-2]	Chappelow, C.C.; Prausnitz, J.M. *A.I.Ch.E.J.* 1974, *20*, 1097-1104.
VARIABLES: T/K: 300-425 P/kPa: 101.325	**PREPARED BY:** C.L. Young

EXPERIMENTAL VALUES:

T/K	Henry's Constant[a] H/atm	Mole fraction[b] of propane at 1 atm. partial pressure, $x_{C_3H_8}$
300	6.09	0.1642
325	9.72	0.1029
350	14.5	0.0690
375	19.9	0.0503
400	25.2	0.0397
425	30.0	0.0333

[a] Authors stated measurements were made at several pressures and values of solubility used were all within the Henry's law region.

[b] Calculated by compiler assuming linear relationship between mole fraction and pressure.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

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

SOURCE AND PURITY OF MATERIALS:

Solvent degassed; no other details given.

ESTIMATED ERROR:

δT/K = ±0.1; $\delta x_{C_3H_8}$ = ±1%

REFERENCES:

1. Dymond, J.; Hildebrand, J.H. *Ind. Eng. Chem. Fundam.* 1967, *6*, 130.
2. Cukor, P.M.; Prausnitz, J.M. *Ind. Eng. Chem. Fundam.* 1971, *10*, 638.

COMPONENTS:

(1) Propane; C_3H_8; [74-98-6]

(2) Decahydronaphthalene, (Decalin); $C_{10}H_{18}$; [91-17-8]

ORIGINAL MEASUREMENTS:

Lenoir, J.-Y.; Renault, P.; Renon, H.

J. Chem. Eng. Data 1971, *16*, 340-2.

VARIABLES:

T/K: 298,323

P/kPa: 101.325

PREPARED BY:

C.L. Young

EXPERIMENTAL VALUES:

T/K	Henry's constant $H_{C_3H_8}$/atm	Mole fraction at 1 atm* $x_{C_3H_8}$
298	12.1	0.0826
323	16.4	0.0610

* Calculated by compiler assuming a linear function of $p_{C_3H_8}$ vs $x_{C_3H_8}$, i.e., $x_{C_3H_8}$(1 atm) = $1/H_{C_3H_8}$.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

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

SOURCE AND PURITY OF MATERIALS:

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

ESTIMATED ERROR:

δT/K = ±0.1; δH/atm = ±6%

(estimated by compiler).

REFERENCES:

COMPONENTS:

(1) Propane; C_3H_8; [74-98-6]

(2) 1-Methylnaphthalene; $C_{11}H_{10}$; [1321-94-4]

ORIGINAL MEASUREMENTS:

Chappelow, C.C.; Prausnitz, J.M.

A.I.Ch.E.J. 1974, *20*, 1097-1104.

VARIABLES:

T/K: 300-475

K/kPa: 101.325

PREPARED BY:

C.L. Young

EXPERIMENTAL VALUES:

T/K	Henry's Constant[a] H/atm	Mole fraction [b] of propane at 1 atm. partial pressure, $x_{C_3H_8}$
300	27.1	0.0369
325	41.1	0.0243
350	58.0	0.0172
375	77.1	0.0130
400	97.7	0.0102
425	118	0.00847
450	135	0.00741
475	146	0.00685

[a] Authors stated measurements were made at several pressures and values of solubility used were all within the Henry's law region.

[b] Calculated by compiler assuming linear relationship between mole fraction and pressure.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

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

SOURCE AND PURITY OF MATERIALS:

Solvent degassed; no other details given.

ESTIMATED ERROR:

δT/K = ±0.1; $\delta x_{C_3H_8}$ = ±1%

REFERENCES:

1. Dymond, J.; Hildebrand, J.H. *Ind. Eng. Chem. Fundam.* 1967, *6*, 130.
2. Cukor, P.M.; Prausnitz, J.M. *Ind. Eng. Chem. Fundam.* 1971, *10*, 638.

COMPONENTS:

(1) Propane; C_3H_8; [74-98-6]

(2) 1,1'-Bicyclohexyl; $C_{12}H_{22}$; [92-51-3]

ORIGINAL MEASUREMENTS:

Chappelow, C.C.; Prausnitz, J.M.

A.I.Ch.E.J. 1974, *20*, 1097-1104.

VARIABLES:

T/K: 300-475

P/kPa: 101.325

PREPARED BY:

C.L. Young

EXPERIMENTAL VALUES:

T/K	Henry's Constant[a] H/atm	Mole fraction[b] of propane at 1 atm. partial pressure, $x_{C_3H_8}$
300	11.7	0.0855
325	19.0	0.0526
350	28.4	0.0352
375	40.0	0.0250
400	53.1	0.0188
425	66.4	0.0151
450	77.3	0.0129
475	76.6	0.0131

[a] Authors stated measurements were made at several pressures and values of solubility used were all within the Henry's law region.

[b] Calculated by compiler assuming linear relationship between mole fraction and pressure.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

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

SOURCE AND PURITY OF MATERIALS:

Solvent degassed; no other details given.

ESTIMATED ERROR:

$\delta T/\text{K} = \pm 0.1$; $\delta x_{C_3H_8} = \pm 1\%$.

REFERENCES:

1. Dymond, J.; Hildebrand, J.H. *Ind. Eng. Chem. Fundam.* 1967, *6*, 130.

2. Cukor, P.M.; Prausnitz, J.M. *Ind. Eng. Chem. Fundam.* 1971, *10* 638.

COMPONENTS:

(1) Propane; C_3H_8; [74-98-6]

(2) Diphenylmethane, (1,1'-Methylenebisbenzene); $C_{13}H_{12}$; [101-81-5]

ORIGINAL MEASUREMENTS:

Chappelow, C.C.; Prausnitz, J.M.

A.I.Ch.E.J. 1974, *20*, 1097-1104.

VARIABLES:

T/K: 300-475

P/kPa: 101.325

PREPARED BY:

C.L. Young

EXPERIMENTAL VALUES:

T/K	Henry's Constant[a] H/atm	Mole fraction[b] of propane at 1 atm. partial pressure, $x_{C_3H_8}$
300	26.0	0.0385
325	37.4	0.0267
350	51.1	0.0196
375	66.2	0.0151
400	82.1	0.0122
425	98.6	0.0101
450	115	0.00870
475	132	0.00758

[a] Authors stated measurements were made at several pressures and values of solubility used were all within the Henry's law region.

[b] Calculated by compiler assuming linear relationship between mole fraction and pressure.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

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

SOURCE AND PURITY OF MATERIALS:

Solvent degassed; no other details given.

ESTIMATED ERROR:

$\delta T/K = \pm 0.1$; $\delta x_{C_3H_8} = \pm 1\%$

REFERENCES:

1. Dymond, J.; Hildebrand, J.H. *Ind. Eng. Chem. Fundam.* 1967, *6*, 130.
2. Cukor, P.M.; Prausnitz, J.M. *Ind. Eng. Chem. Fundam.* 1971, *10*, 638.

COMPONENTS:

(1) Butane; C_4H_{10}; [106-97-8]

(2) Methylbenzene or toluene or phenylmethane
Dimethylbenzenes

ORIGINAL MEASUREMENTS:

Hannaert, H.; Haccuria, M.; Mathieu, M. P.

Ind. Chim. Belge 1967, *32*, 156-164.

VARIABLES:

T/K = 243.15 - 293.15

PREPARED BY:

E. L. Boozer
H. L. Clever

EXPERIMENTAL VALUES:

Temperature Interval of Measurements T/K	Butane Mol % Range 10^2x_1/mol %	$K\pi\nu$/atm at 293.15 K	Enthalpy of Dissolution ΔH/kcal mol^{-1}	Constant A
Methylbenzene or toluene or phenylmethane; C_7H_8; [108-88-3]				
243.15-293.15	3 - 20	3.0	4.84	4.08
Dimethylbenzenes; C_8H_{10}; [1330-20-7]				
243.15-293.15	3 - 20	3.2	4.94	4.18

[1] log ($K\pi\nu$/atm) = A - (ΔH/cal mol^{-1})/(2.3R(T/K))

The author's definitions are:

$$K = y_1/x_1 = \frac{\text{mole fraction gas in gas phase}}{\text{mole fraction gas in liquid phase}},$$

π/atm = total pressure,

ν = coefficient of fugacity.

The function, $K\pi\nu$/atm, is equivalent to a Henry's constant in the form $H_{1,2}$/atm = (f_1/atm)/x_1 where f_1 is the fugacity.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The authors describe three methods:

1.A. [Saturat. n°1]. A measure of the static pressure of saturation in an apparatus which gave a precision of 10 - 15 %.

1.B. [Saturat. n°2]. A measure of the static pressure of saturation in an apparatus which gave a precision of 2 - 5 %.

2. [Chromato]. A Gas liquid chromatographic method estimated to have a precision of 2 - 5 %.

3. [Anal. directe]. Direct analysis of the gaseous and liquid phases.

Method 1.A. was used for these systems.

SOURCE AND PURITY OF MATERIALS:

(1) Butane. Matheson Co., Inc. Fractionated, purity > 99.5 per cent.

(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:

REFERENCES:

COMPONENTS:

(1) Butane; C_4H_{10}; [106-97-8]

(2) Methylbenzene (toluene); C_7H_8; [108-88-3]

ORIGINAL MEASUREMENTS:

Gerrard, W.

J. Appl. Chem. Biotechnol.

1973, *23*, 1-17.

VARIABLES:

T/K: 283.2

P/kPa: 101.3

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

Total pressure = 101.3 kPa

T/K	Mole ratio	Mole fraction of butane#
283.2	1.45	0.592

Calculated by compiler.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Gas was passed into a known weight of pure liquid in a bubbler tube at a total pressure measured using a manometer assembly. The amount of absorbed gas was estimated by weighing. The temperature was controlled to within 0.2 K. The apparatus and procedure are described by Gerrard, ref. (1).

SOURCE AND PURITY OF MATERIALS:

No details given except that "all compounds were purified by conventional procedures".

ESTIMATED ERROR:

$\delta T/K = \pm 0.1$; $\delta x/x = \pm 3\%$ (estimated by compiler).

REFERENCES:

1. Gerrard, W.
J. Appl. Chem. Biotechnol.
1972, *22*, 623.

COMPONENTS:

(1) Butane; C_4H_{10}; [106-97-8]

(2) 1,3-Dimethylbenzene (*m*-xylene); C_8H_{10}; [108-38-3]

ORIGINAL MEASUREMENTS:

Gerrard, W.

J. Appl. Chem. Biotechnol.

1973, *23*, 1-17.

VARIABLES:

T/K: 278.2-293.2

P/kPa: 101.3

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

Total pressure = 101.3 kPa

T/K	Mole ratio	Mole fraction of butane#
278.2	4.00	0.800
283.2	1.53	0.605
293.2	0.700	0.412

\# Calculated by compiler.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Gas was passed into a known weight of pure liquid in a bubbler tube at a total pressure measured using a manometer assembly. The amount of absorbed gas was estimated by weighing. The temperature was controlled to within 0.2 K. The apparatus and procedure are described by Gerrard, ref. (1).

SOURCE AND PURITY OF MATERIALS:

No details given except that "all compounds were purified by conventional procedures".

ESTIMATED ERROR:

$\delta T/K = \pm 0.1$; $\delta x/x = \pm 3\%$ (estimated by compiler).

REFERENCES:

1. Gerrard, W. *J. Appl. Chem. Biotechnol.* 1972, *22*, 623.

COMPONENTS:

(1) Butane; C_4H_{10}; [106-97-8]

(2) Octamethylcyclotetrasiloxane; $C_8H_{24}O_4Si_4$; [556-67-2]

ORIGINAL MEASUREMENTS:

Chappelow, C.C.; Prausnitz, J.M.

A.I.Ch.E.J. 1974, *20*, 1097-1104.

VARIABLES:

T/K: 300-425

P/kPa: 101.325

PREPARED BY:

C.L. Young

EXPERIMENTAL VALUES:

T/K	Henry's Constant[a] H/atm	Mole fraction[b] of butane at 1 atm. partial pressure, $x_{C_4H_{10}}$
300	2.19	0.4566
325	3.81	0.2625
350	6.32	0.1582
375	9.40	0.1064
400	12.7	0.0787
425	16.0	0.0625

[a] Authors stated measurements were made at several pressures and values of solubility used were all within the Henry's law region.

[b] Calculated by compiler assuming linear relationship between mole fraction and pressure.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

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

SOURCE AND PURITY OF MATERIALS:

Solvent degassed; no other details given.

ESTIMATED ERROR:

δT/K = ±0.1; $\delta x_{C_4H_{10}}$ = ±1%

REFERENCES:

1. Dymond, J.; Hildebrand, J.H. *Ind. Eng. Chem. Fundam.* 1967, *6*, 130.
2. Cukor, P.M.; Prausnitz, J.M. *Ind. Eng. Chem. Fundam.* 1971, *10*, 638.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Butane; C_4H_{10}; [106-97-8] (2) Decahydronaphthalene, (Decalin); $C_{10}H_{18}$; [91-17-8]	Lenior, J-Y.; Renault; P. Renon, H. *J. Chem. Eng. Data* 1971, *16*, 340-2
VARIABLES:	**PREPARED BY:**
T/K: 298.15, 323.15 P/kPa: 101.3	C.L. Young

EXPERIMENTAL VALUES:

T/K	Henry's Constant $H_{C_4H_{10}}$/atm	Mole fraction at 1 atm* $x_{C_4H_{10}}$
298.15	3.57	0.280
323.15	4.91	0.204

* Calculated by compiler assuming a linear function of $p_{C_4H_{10}}$ vs $x_{C_4H_{10}}$, ie. $x_{C_4H_{10}}$ (1 atm) = $1/H_{C_4H_{10}}$.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

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

SOURCE AND PURITY OF MATERIALS:

(1) L'Air Liquide sample; minimum purity 99.9 mole per cent.

(2) Touzart and Matignon or Serlabo sample, purity 99 mole per cent.

ESTIMATED ERROR:

δT/K = ±0.1; δH/atm = ±6% (estimated by compiler).

REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Butane; C_4H_{10}; [106-97-8] (2) 1,1'-Bicyclohexyl; $C_{12}H_{22}$; [92-51-3]	Chappelow, C.C.; Prausnitz, J.M. *A.I.Ch.E.J.* 1974, *20*, 1097-1104.

VARIABLES:	PREPARED BY:
T/K: 300-475 P/kPa: 101.325	C.L. Young

EXPERIMENTAL VALUES:

T/K	Henry's Constant[a] H/atm	Mole fraction[b] of butane at 1 atm. partial pressure, $x_{C_4H_{10}}$
300	4.59	0.2179
325	7.34	0.1362
350	11.4	0.0877
375	17.2	0.0581
400	24.3	0.0421
425	31.9	0.0313
450	39.5	0.0253
475	46.4	0.0216

[a] Authors stated measurements were made at several pressures and values of solubility used were all within the Henry's law region.

[b] Calculated by compiler assuming linear relationship between mole fraction and pressure.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

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

SOURCE AND PURITY OF MATERIALS:

Solvent degassed; no other details given.

ESTIMATED ERROR:

$\delta T/\mathrm{K} = \pm 0.1$; $\delta x_{C_4H_{10}} = \pm 1\%$

REFERENCES:

1. Dymond, J.; Hildebrand, J.H. *Ind. Eng. Chem. Fundam.* 1967, *6*, 130.
2. Cukor, P.M.; Prausnitz, J.M. *Ind. Eng. Chem. Fundam.* 1971, *10*, 638.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) 2-Methylpropane; C_4H_{10}; [75-28-5] (2) Benzene; C_6H_6; [71-43-2]	Jadot, R. *J. Chim. Phys.* 1972, *69*, 1036-40
VARIABLES: T/K: 298.15 P/kPa: 101.325	PREPARED BY: C.L. Young

EXPERIMENTAL VALUES:

T/K	Henry's Law Constant, H/atm	Mole fraction$^+$ at partial pressure of 101.3 kPa, $x_{C_4H_{10}}$	#ΔH^∞ /cal mol^{-1} (/J mol^{-1})
298.15	8.160	0.1225	1100 (4602)

\+ Calculated by compiler assuming $x_{C_4H_{10}} = 1/H$.

\# Excess partial molar enthalpy of solution at infinite dilution.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The conventional gas chromatographic technique was used. The carrier gas was helium. The value of Henry's law constant was calculated from the retention time. The value applies to very low partial pressures of gas and there may be a substantial difference from that measured at 1 atm. pressure. There is also considerable uncertainty in the value of Henry's constant since no allowance was made for surface adsorption.

SOURCE AND PURITY OF MATERIALS:

No details given.

ESTIMATED ERROR:

δT/K = ±0.05; δH = ±2%

REFERENCES.

COMPONENTS:

(1) 2-Methylpropane, (*iso*butane); C_4H_{10}; [75-28-5]

(2) 1,3,5-Trimethylbenzene, (mesitylene); C_9H_{12}; [108-67-8]

ORIGINAL MEASUREMENTS:

Gerrard, W.

Solubility of Gases and Liquids, Plenum, New York, 1976, Chapter 12.

VARIABLES:

T/K: 273.15

P/kPa: 13.3-101.3

PREPARED BY:

C.L. Young

EXPERIMENTAL VALUES:

T/K	P/mmHg	P/kPa	Mole fraction of 2-methyl propane in liquid, $x_{C_4H_{10}}$
273.15	100	13.3	0.058
	200	26.7	0.117
	300	40.0	0.180
	400	53.3	0.245
	500	66.7	0.322
	600	80.0	0.404
	700	93.3	0.496
	760	101.3	0.568

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Gas was passed into a known weight of pure liquid in a bubbler tube at a total pressure measured by a manometer assembly. The amount of absorbed gas was estimated by weighing. The temperature was manually controlled to within 0.2K. The apparatus and procedure are described by Gerrard (1, 2).

SOURCE AND PURITY OF MATERIALS:

No details given.

ESTIMATED ERROR:

δT/K = ±0.1; $\delta x/x$ = ±3%

(estimated by compiler)

REFERENCES:

1. Gerrard, W.
   J. Appl. Chem. Biotechnol. 1972, *22*, 623-650.
2. Gerrard, W.
   Solubility of Gases and Liquids, Plenum Press, New York, 1976, Chapter 1.

COMPONENTS:

(1) 2-Methylpropane; C_4H_{10}; [75-28-5]

(2) 1-Methylnaphthalene; $C_{11}H_{10}$; [1321-94-4]

ORIGINAL MEASUREMENTS:

Chappelow, C.C.; Prausnitz, J.M.;

A.I.Ch.E.J. 1974, *20*, 1097-1104.

VARIABLES:

T/K: 300-475

P/kPa: 101.325

PREPARED BY:

C.L. Young

EXPERIMENTAL VALUES:

T/K	Henry's Constant[a] H/atm	Mole fraction[b] of 2-methyl propane at 1 atm. partial pressure, $x_{C_4H_{10}}$
300	12.0	0.0833
325	19.9	0.0503
350	30.3	0.0330
375	42.8	0.0234
400	57.1	0.0175
425	72.1	0.0139
450	86.8	0.0115
475	92.9	0.0108

[a] Authors stated measurements were made at several pressures and values of solubility used were all within the Henry's law region.

[b] Calculated by compiler assuming linear relationship between mole fraction and pressure.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

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

SOURCE AND PURITY OF MATERIALS:

Solvent degassed; no other details given.

ESTIMATED ERROR:

δT/K = ±0.1; $\delta x_{C_4H_{10}}$ = ±1%

REFERENCES:

1. Dymond, J.; Hilderbrand, J.H. *Ind. Eng. Chem. Fundam.* 1967, *6*, 130.

2. Cukor, P.M.; Prausnitz, J.M. *Ind. Chem. Eng. Fundam.* 1971, *10*, 638.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) 2-Methylpropane; (isobutane); C_4H_{10}; [75-28-5] (2) 1,1'-Bicyclohexyl; $C_{12}H_{22}$; [92-51-3]	Chappelow, C.C, Prausnitz, J.M. *A.I.Ch.E.J.* 1974, *20*, 1097-1104.
VARIABLES:	**PREPARED BY:**
T/K: 300-475 P/kPa: 101.325	C.L. Young

EXPERIMENTAL VALUES:

T/K	Henry's Constant[a] H/atm	Mole fraction[b] of 2-methyl propane at 1 atm. partial pressure, $x_{C_4H_{10}}$
300	6.43	0.158
325	10.5	0.0952
350	16.3	0.0613
375	23.0	0.0435
400	31.3	0.0319
425	41.4	0.0242
450	50.6	0.0198
475	55.7	0.0180

[a] Authors stated measurements were made at several pressures and values of solubility used were all within the Henry's law region.

[b] Calculated by compiler assuming linear relationship between mole fraction and pressure.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

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

SOURCE AND PURITY OF MATERIALS:

Solvent degassed; no other details given.

ESTIMATED ERROR:

$\delta T/\mathrm{K} = \pm 0.1$; $\delta x_{C_4H_{10}} = \pm 1\%$.

REFERENCES:

1. Dymond, J.; Hildebrand, J.H. *Ind. Eng. Chem. Fundam.* 1967, *6* ,130.
2. Cukor, P.M.; Prausnitz, J.M. *Ind. Chem. Eng. Fundam.* 1971, *10*, 638.

COMPONENTS:

(1) 2-Methylpropane, (isobutane); C_4H_{10}; [75-28-5]

(2) Octamethylcyclotetrasiloxane; $C_8H_{24}O_4Si_4$; [556-67-2]

ORIGINAL MEASUREMENTS:

Chappelow, C.C.; Prausnitz, J.M.

A.I.Ch.E.J. 1974, *20*, 1097-1104.

VARIABLES:

T/K: 300-425

P/kPa: 101.325

PREPARED BY:

C.L. Young

EXPERIMENTAL VALUES:

T/K	Henry's Constant[a] /atm	Mole fraction[b] of 2-methylpropane at 1 atm. partial pressure, $x_{C_4H_{10}}$
300	2.98	0.336
325	5.05	0.198
350	7.96	0.126
375	11.4	0.0877
400	15.4	0.0649
425	20.3	0.0493

[a] Authors stated measurements were made at several pressures and values of solubility used were all with the Henry's Law region.

[b] Calculated by compiler assuming a linear relationship between mole fraction and pressure. (This introduces additional uncertainty into the mole fraction value for mole fractions above about 0.05).

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

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

SOURCE AND PURITY OF MATERIALS:

Solvent degassed, no other details given.

ESTIMATED ERROR:

δT/K = ±0.1; $\delta x_{C_4H_{10}}$ = ±1%

REFERENCES:

1. Dymond, J.; Hildebrand, J.H. *Ind. Eng. Chem. Fundam.* 1967, *6*, 130.
2. Cukor, P.M.; Prausnitz, J.M. *Ind. Eng. Chem. Fundam.* 1971, *10*, 638.

COMPONENTS:	EVALUATOR:
(1) Propane; C_3H_8; [74-98-6] Butane; C_4H_{10}; [106-97-8] 2-Methylpropane; C_4H_{10}; [75-28-5] (2) Non-polar solvents excluding alkanes and organohalides, at high pressure	Walter Hayduk Department of Chemical Engineering University of Ottawa Ottawa, Canada K1N 9B4 July, 1984

CRITICAL EVALUATION:

Data for the solubilities at high pressure are available for *propane* in benzene (1,2) and also in 1,2,3,4-tetrahydronaphthalene (tetralin) (3), as well as for the mixed gas, *propane* and *1-propene* in 1,2,3,4-tetrahydronaphthalene (3).

The data of Glanville et al. (1) for the solubilities of *propane* in benzene were tested for consistency by plotting the gas partial pressure versus mole fraction solubility on log scales. Normally extrapolation of such data yields the solubility at 101.325 kPa pressure which checks the solubility measured at the low pressure. Where these checks were possible, the Glanville (1) data appeared too low by more than 10%. They also suggest the unlikely possibility that Henry's law is not obeyed even for relatively low pressures. The early data of Ipatieff et al. (2) (1942) are not complete because the gas phase analysis was not provided. An estimate of the gas composition using Raoult's law for the solvent yields several solubility results which are higher by more than 10% than those of Glanville et al. Because the data of Glanville et al. appear inconsistent and inaccurate, they are classified as doubtful. Because they are incomplete, the data of Ipatieff et al. (2) are simple unclassified.

The solubilities are available for *propane* at two temperatures in 1,2,3,4-tetrahydronaphthalene (tetralin) (3). These data appear consistent and are classified as tentative. Data are also available by the same workers (3) for the solubilities of the gas mixtures, *propane* and *1-propene*, in 1,2,3,4-tetrahydronaphthalene. The gas phase compositions corresponding to the solubilities are not available, however; hence it is not possible to test the consistency of the data. These data are incomplete and are, therefore, not classified.

References

1. Glanville, J.W.; Sage, B.H.; Lacey, W.N. *Ind. Eng. Chem.* 1950, *42*, 508-513.

2. Ipatieff, V.N.; Monroe, G.S. *Ind. Eng. Chem. Anal. Edn.* 1942, *14*, 166-171.

3. Noda, K.; Sakal, M.; Ishida, K. *J. Chem. Eng. Data* 1982, *27*, 32-34.

COMPONENTS:

(1) Propane; C_3H_8; [74-98-6]

(2) Benzene; C_6H_6; [71-43-2]

ORIGINAL MEASUREMENTS:

Ipatieff, V. N.; Monroe, G. S.
Ind. Eng. Chem. Anal. Edn.
1942, *14*, 166-171.

VARIABLES:

T/K: 423-515
P/MPa: 1.1-4.96

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	T/°C	P/atm	P/MPa	Solubility[a]	Mole fraction of propane $x_{C_3H_8}$
423	150	11.0	1.11	7.41	0.116
		21.0	2.13	22.25	0.2827
433	160	13.0	1.32	7.54	0.118
		24.5	2.48	22.36	0.2837
443	170	15.5	1.57	7.66	0.119
		28.5	2.89	22.50	0.2849
453	180	18.0	1.82	7.77	0.121
		33.0	3.34	22.70	0.2867
463	190	21.0	2.13	7.87	0.122
		38.5	3.90	22.95	0.2890
473	200	24.0	2.43	7.97	0.124
		43.5	4.41	23.24	0.2916
483	210	28.0	2.84	8.07	0.125
		49.0	4.96	23.56	0.2944
423	150	11	1.1	7.41	0.116
383	110	11	1.1	22.12	0.2815
463	190	21	2.1	7.88	0.122
423	150	21	2.1	22.26	0.2828
490	217	31	3.1	8.13	0.126
448	175	31	3.1	22.60	0.2858
515	242	41	4.2	8.32	0.128
468	195	41	4.2	23.08	0.2902

[a] g of propane per 100 g benzene.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Rotating bomb of 3.5 dm^3 capacity. Pressure measured with a Bourdon gauge and temperature measured with thermocouple. Propane in both liquid and gaseous samples determined by stripping out benzene at low temperature and estimating propane volumetrically. Benzene estimated gravimetrically.

SOURCE AND PURITY OF MATERIALS:

1. Phillips Petroleum Co. sample; C.P. grade.
2. Baker C.P. thiophene-free sample n_D^{20} 1.5012.

ESTIMATED ERROR:

$\delta T/K = \pm 0.5$; $\delta x_{C_3H_8} = \pm 3\%$
(estimated by compiler).

REFERENCES:

COMPONENTS:

(1) Propane; C_3H_8; [74-98-6]

(2) Benzene; C_6H_6; [71-43-2]

ORIGINAL MEASUREMENTS:

Glanville, J. W.; Sage, B. H.;
Lacey, W. N.
Ind. Eng. Chem.
1950, *42*, 508-513.

EXPERIMENTAL VALUES: (concluded)

T/K (t/°F)	P/psi	$P/10^5$Pa	Wt. fraction in liquid	Wt. fraction in gas	Mole fraction in liquid, $x_{C_3H_8}$	Mole fraction in gas, $y_{C_3H_8}$
377.59 (220)	200	13.79	0.1572	0.7507	0.2484	0.8421
	250	17.23	0.2227	0.7997	0.3367	0.8761
	300	20.68	0.2945	0.8371	0.4251	0.9010
	350	24.47	0.3749	0.8642	0.5151	0.9185
	400	27.58	0.4640	0.8920	0.6052	0.9360
	450	31.04	0.5671	0.9144	0.6988	0.9498
	500	37.91	0.6675	0.9313	0.6675	0.9600
	550	41.37	0.7657	0.9467	0.7657	0.9692
	600	44.81	0.8797	0.9622	0.8797	0.9783
410.93 (280)	80	5.52	0.0081	0.1108	0.0143	0.1808
	100	6.89	0.0190	0.2206	0.0332	0.3339
	150	10.34	0.0479	0.3992	0.0818	0.5407
	200	13.79	0.0792	0.5077	0.1322	0.6462
	250	17.23	0.1133	0.5819	0.1846	0.7114
	300	20.68	0.1503	0.6352	0.2386	0.7552
	350	24.47	0.1906	0.6750	0.2944	0.7863
	400	27.58	0.2340	0.7047	0.3511	0.8087
	450	31.04	0.2768	0.7255	0.4040	0.8240
	500	34.47	0.3292	0.7474	0.4650	0.8397
	550	37.91	0.3917	0.7645	0.5328	0.8518
	600	41.37	0.4574	0.7814	0.5989	0.8636
	650	44.81	0.5261	0.7991	0.6629	0.8757
	700	48.94	0.6113	0.8052	0.7358	0.8798
	750	51.71	0.7104	0.8084	0.8129	0.8820
	769	53.02	0.798	0.798	0.875	0.875
444.26 (340)	150	10.34	0.0103	0.0923	0.0181	0.1526
	200	13.79	0.0323	0.2332	0.0558	0.3501
	250	17.23	0.0552	0.3304	0.0938	0.4664
	300	20.68	0.0793	0.4030	0.1324	0.5446
	350	24.47	0.1048	0.4588	0.1718	0.6003
	400	27.58	0.1312	0.5022	0.2111	0.6412
	450	31.04	0.1600	0.5362	0.2523	0.6719
	500	34.47	0.1905	0.5650	0.2942	0.6970
	550	37.91	0.2234	0.5848	0.3375	0.7138
	600	41.37	0.2576	0.6042	0.3806	0.7300
	650	44.81	0.2916	0.6185	0.4218	0.7417
	700	48.94	0.3358	0.6266	0.4724	0.7482
	750	51.71	0.3794	0.6278	0.5199	0.7492
	800	55.16	0.4290	0.6227	0.5709	0.7451
	850	58.61	0.4968	0.5773	0.6362	0.7075
	859	59.23	0.549	0.549	0.6831	0.6831
477.59 (400)	250	17.23	0.0097	0.0571	0.0171	0.0969
	300	20.68	0.0283	0.1456	0.0491	0.2319
	350	24.47	0.0450	0.2059	0.0770	0.3147
	400	27.58	0.0691	0.2588	0.1162	0.3822
	450	31.04	0.0866	0.3062	0.1438	0.4388
	500	34.47	0.1053	0.3384	0.1725	0.4754
	550	37.91	0.1265	0.3685	0.2042	0.5083
	600	41.37	0.1500	0.3944	0.2382	0.5357
	650	44.81	0.1754	0.4184	0.2737	0.5603
	700	48.94	0.2027	0.4366	0.3105	0.5785
	750	51.71	0.2308	0.4461	0.3470	0.5879
	800	55.16	0.2597	0.4419	0.3832	0.5837
	850	58.61	0.3038	0.4132	0.4359	0.5550
	867	59.78	0.349	0.349	0.487	0.487

COMPONENTS:

(1) Propane; C_3H_8; [74-98-6]

(2) Benzene; C_6H_6; [71-43-2]

ORIGINAL MEASUREMENTS:

Glanville, J. W.; Sage, B. H.;
Lacey, W. N.
Ind. Eng. Chem.
1950, *42*, 508-513.

VARIABLES:

T/K: 310.9-477.6
P/kPa: 138-5978

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K (t/°F)	P/psi	$P/10^5$Pa	Wt. fraction in liquid	Wt. fraction in gas	Mole fraction in liquid, $x_{C_3H_8}$	Mole fraction in gas, $y_{C_3H_8}$
310.93	20	1.38	0.0228	0.7378	0.0397	0.8329
(100)	40	2.76	0.0624	0.8490	0.1055	0.9088
	60	4.14	0.1194	0.9000	0.1937	0.9410
	80	5.52	0.1980	0.9310	0.3042	0.9598
	100	6.89	0.3038	0.9505	0.4359	0.9714
	150	10.34	0.6801	0.9831	0.7901	0.9904
344.26	20	1.38	0.0076	0.3046	0.0134	0.4369
(160)	40	2.76	0.0277	0.6114	0.0480	0.7359
	60	4.14	0.0495	0.7420	0.0845	0.8359
	80	5.52	0.0772	0.7980	0.1291	0.8750
	100	6.89	0.1083	0.8280	0.1771	0.8950
	150	10.34	0.2107	0.8780	0.3210	0.9272
	200	13.79	0.3453	0.9172	0.4830	0.9515
	250	17.23	0.5146	0.9481	0.6525	0.9700
	300	20.68	0.7023	0.9727	0.8069	0.9844
	350	24.47	0.8801	0.9903	0.9286	0.9945
377.59	40	2.76	0.0074	0.1670	0.0130	0.2621
(220)	60	4.14	0.0220	0.3596	0.0383	0.4987
	80	5.52	0.0376	0.4772	0.0647	0.6179
	100	6.89	0.0537	0.5573	0.0913	0.6904
	150	10.34	0.1015	0.6792	0.1667	0.7895

(cont.)

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

PVT cell charged with mixture of known composition. Pressure measured with pressure balance. Temperature measured using resistance thermometer. Bubble and dew points determined for various compositions. Co-existing liquid and gas phase properties determined by graphical means. Details in ref. (1).

SOURCE AND PURITY OF MATERIALS:

1. Phillips Petroleum Co., distilled, purity better than 99.9 mole per cent.
2. Commercial pure sample, fractionally crystallised and distilled.

ESTIMATED ERROR:

$\delta T/K = \pm 0.03$; $\delta P/10^5\text{Pa} = \pm 0.1$;
$\delta x_{C_3H_8}$, $\delta y_{C_3H_8} = \pm 0.005$.

REFERENCES:

1. Sage, B. H.; Lacey, W. N.
Trans. Inst. Mining Met. Engnrs.
1940, *136*, 136.

COMPONENTS:

(1) Propane; C_3H_8; [74-98-6]

(2) 1,2,3,4-Tetrahydronaphthalene
(tetralin); $C_{10}H_{12}$;
[119-64-2]

ORIGINAL MEASUREMENTS:

Noda, K.; Sakal, M.; Ishida, K.

J. Chem. Eng. Data

1982, *27*, 32-34.

VARIABLES:

T/K: 273.15, 293.15

P/kPa: 136-788

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	P/kPa	Mole fraction of propane in liquid, $x_{C_3H_8}$	T/K	P/kPa	Mole fraction of propane in liquid, $x_{C_3H_8}$
273.15	136	0.1483	293.15	197	0.1329
	153	0.1729		217	0.1479
	170	0.1900		241	0.1658
	211	0.2598		320	0.2236
	222	0.2687		345	0.2503
	234	0.2893		467	0.3703
	299	0.4131		481	0.3881
	304	0.4269		624	0.6115
	358	0.5515		648	0.6408
	382	0.6676		658	0.6689
	391	0.7024		725	0.8273
	400	0.7424		788	0.9411
	423	0.8520			
	450	0.9445			
	456	0.9617			

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Static method described in ref. (1). Pyrex glass cell fitted with gas sample port and Bourdon pressure gauge. Composition of liquid phase estimated from known volume of system and amounts added.

SOURCE AND PURITY OF MATERIALS:

1. Research grade from Takachiho Kagaku Kogyo; purity 99.9 volume per cent.
2. Reagent grade, fractionated b.pt. (at 0.8 kPa) 341.05 K.

ESTIMATED ERROR:

$\delta T/K = \pm 0.02$; $\delta P/\text{kPa} = \pm 1$;

$\delta x_{C_3H_8} = \pm 0.001$.

REFERENCES:

1. Noda, K.; Morisue, T.; Ishida, K.
   J. Chem. Eng. Japan
   1975, *8*, 104.

COMPONENTS:

(1) Propane; C_3H_8; [74-98-6]

(2) 1-Propene; C_3H_6; [115-07-1]

(3) 1,2,3,4-Tetrahydronaphthalene (tetralin); $C_{10}H_{12}$; [119-64-2]

ORIGINAL MEASUREMENTS:

Noda, K.; Sakal, M.; Ishida, K.

J. Chem. Eng. Data

1982, *27*, 32-34.

VARIABLES:

T/K: 273.15,293.15

P/kPa: 148-761

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	P/kPa	Mole fraction of 1-propene, $x_{C_3H_6}$	Mole fraction of propane, $x_{C_3H_8}$	T/K	P/kPa	Mole fraction of 1-propene, $x_{C_3H_6}$	Mole fraction of propane, $x_{C_3H_8}$
273.15	153	0.1379	0.0356	293.15	217	0.1209	0.0300
	148	0.1058	0.0600		210	0.0935	0.0507
	300	0.2972	0.0786		459	0.2686	0.0700
	349	0.3653	0.0985		502	0.3041	0.0786
	260	0.2030	0.1167		394	0.1824	0.1030
	192	0.0974	0.1250		279	0.0866	0.1081
	328	0.2733	0.1593		467	0.2267	0.1282
	179	0.0452	0.1610		259	0.0401	0.1403
	468	0.5899	0.1612		780	0.5548	0.1545
	313	0.1791	0.2348		494	0.1659	0.2180
	334	0.1958	0.2601		492	0.1609	0.2282
	455	0.4666	0.2777		431	0.0703	0.2535
	278	0.0777	0.2809		761	0.4372	0.2653
	339	0.1030	0.3818		513	0.0866	0.3221
	446	0.3279	0.4402		755	0.3119	0.4288
	428	0.1636	0.6071		730	0.1545	0.5894

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Static method described in ref. (1). Pyrex glass cell fitted with gas sample port and Bourdon pressure gauge. Composition of liquid phase estimated from known volume of system and amounts added. Gas sample analysed by GC.

SOURCE AND PURITY OF MATERIALS:

1 and 2. Research grade from Takachiho Kagaku Kogyo; purities 99.9 and 99.7 volume per cent, respectively.

3. Reagent grade, fractionated b.pt. (at 0.8 kPa) 341.05 K.

ESTIMATED ERROR:

$\delta T/K = \pm 0.02$; $\delta P/kPa = \pm 1$;

$\delta x_{C_3H_8}$, $\delta x_{C_3H_6} = \pm 0.001$.

REFERENCES.

1. Noda, K.; Morisue, T.; Ishida, K. *J. Chem. Eng. Japan* 1975, *8*, 104.

COMPONENTS:	EVALUATOR:
1. Propane; C_3H_8; [74-98-6] or Butane; C_4H_{10}; [106-97-8] or 2-Methylpropane; C_4H_{10}; [75-28-5] 2. Organohalides	Colin L. Young, Department of Physical Chemistry, University of Melbourne, Parkville, Victoria 3052, Australia. December 1984

CRITICAL EVALUATION:

In general data for these systems can only be evaluated by comparison of techniques and estimation of the reliability of a particular worker's data in general by comparisons on other systems rather than the system being evaluated. Very few systems in the title group have been studied by more than one worker.

Trichloromethane; $CHCl_3$; [67-66-3]

The solubility of the three gases in trichloromethane has been studied by Lebeau (1,2,3). The data of this worker for the solubility of propane, butane and 2-methylpropane in water are significantly different from the recommended values and hence data for the present systems are classified as doubtful.

Tetrachloromethane; CCl_4; [56-23-5]

The solubility of propane and butane in tetrachloromethane has been investigated by Hayduk and coworkers (4,5) and by Jadot (6). The system 2-methylpropane + tetrachloromethane has also been studied by Blais and Hayduk (5). The values of Jadot (6) were determined at very low partial pressures using gas chromatography. Extrapolation of the data to pressures of 101.3 kPa involves assuming Henry's law is obeyed between zero and 101.3 kPa and such an extrapolation would be expected to give values at 101.3 kPa which are slightly too large. In fact values at 101.3 kPa calculated from Jadot results are somewhat higher than the values of Hayduk and coworkers and therefore both sets of data are classified as tentative but the values of Jadot should be taken as applying to very low partial pressures.

Chlorobenzene; C_6H_5Cl; [108-90-7]

The solubility of the three gases in chlorobenzene have been studied by Hayduk and coworkers (5,7) using a well established volumetric method. The data appear to be of good precision and are classified as tentative.

Fluorocarbons

Fleury and Hayduk (4) and Thomsen and Gjaldbaek (8) studied the solubility of propane in tetradecafluorohexane and hexadecafluoroheptane, respectively. The mole fraction solubilities at 298.15 K differ by only about 5% being greater in hexadecafluoroheptane. This is consistent with trends of the solubility of simple hydrocarbon gases in alkanes. Both sets of values are classified as tentative.

Data of Gerrard

Gerrard (9,10) studied the solubilities of the three gases in several organohalides. These systems have not been studied by other workers. In view of the fact that the temperature dependence of the solubilities do not appear anomalous and that Gerrard's data on other systems are of, at least, moderate accuracy, his data for the current system are classified as tentative.

Data of Berlin *et al.*

The data of Berlin *et al.* are rejected since they do not appear to correspond to gas solubility, the maximum pressure studied being considerably greater than the vapor pressure of propane, butane or 2-methylpropane at the experimental temperature. It is possible that the data refer to liquid-liquid equilibrium although not indicated as such in the original.

(cont.)

COMPONENTS:

1. Propane; C_3H_8; [74-98-6]

or Butane; C_4H_{10}; [106-97-8]

or 2-Methylpropane; C_4H_{10}; [75-28-5]

2. Organohalides

EVALUATOR:

Colin L. Young,
Department of Physical Chemistry,
University of Melbourne,
Parkville, Victoria 3052,
Australia.

December 1984

CRITICAL EVALUATION:

References

1. Lebeau, P. *Bull. Acad. Roy. Belg.* 1908, 300.
2. Lebeau, P. *Comp. Rend.* 1905, *140*, 1454 and 1572.
3. Lebeau, P. *Bull. Soc. Chim.* [3] 1905, *33*, 1137.
4. Fleury, D.; Hayduk, W. *Can. J. Chem. Eng.* 1975, *53*, 195.
5. Blais, C.; Hayduk, W. *J. Chem. Eng. Data* 1983, *28*, 181.
6. Jadot, R. *J. Chim. Phys.* 1972, *69*, 1036.
7. Hayduk, W.; Castaneda, R. *Can. J. Chem. Eng.* 1973, *51*, 353.
8. Thomsen, E. S.; Gjaldbaek, J. C. *Acta Chem. Scand.* 1963, *17*, 134.
9. Gerrard, W. *Solubility of Gases and Liquids, Plenum, New York,* 1976, Chapter 12.
10. Gerrard, W. *J. Appl. Chem. Biotechnol.* 1973, *23*, 1.
11. Berlin, M. A.; Pluzhnikova, M. F.; Stepanova, I. N.; Tsybnlevskii, A. M. *Zh. Fiz. Khim.* 1977, *51*, 767.

COMPONENTS:

(1) Propane; C_3H_8; [74-98-6]

(2) Water, Benzene, Ethanol, Diethylether, Chloroform, Turpentine

ORIGINAL MEASUREMENTS:

Lebeau, P.

Compt. Rend. 1905, *140*, 1454-6 and 1572.

Bull. Soc. Chim. [3] 1905, *33*, 1137-9.

VARIABLES:

T/K = 290.8 - 294.8
p/kPa = 100.4 - 100.9

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

Temperature t/°C	Temperature T/K	Pressure[a] p/mmHg	Solubility Volume propane/100 Volumes Solvent
Water; H_2O; [7732-18-5]			
17.8	291.0	753	6.5
Benzene; C_6H_6O; [71-43-2]			
21.5	294.7	757	1452
Ethanol; C_2H_6O; [64-17-5]			
16.6	290.8	754	790
1,1'-Oxybisethane or diethylether; $C_4H_{10}O$; [60-29-7]			
16.6	290.8	757	926
Chloroform or trichloromethane; $CHCl_3$; [67-66-3]			
21.6	294.8	757	1299
Oil of turpentine			
17.7	290.9	757	1587

[a] Not clear whether this is total pressure or propane partial pressure. It is probably total pressure.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Details not given.

The data are reported in both papers.

SOURCE AND PURITY OF MATERIALS:

(1) Propane. Prepared by author from carefully purified propyl iodide by reaction with sodium in liquid ammonia.
Melting point/°C = -195
Boiling point/°C = -44.5
Critical temperature/°C = 102.

(2) Solvents. No information.

ESTIMATED ERROR:

REFERENCES:

COMPONENTS:

(1) Propane; C_3H_8; [74-98-6]

(2) Tetrachloromethane; CCl_4; [56-23-5]

ORIGINAL MEASUREMENTS:

Jadot, R.

J. Chim. Phys. 1972, *69*, 1036-40

VARIABLES:

T/K: 298.15

P/kPa: 101.3

PREPARED BY:

C.L. Young

EXPERIMENTAL VALUES:

T/K	Henry's Law Constant, H/atm	Mole fraction$^+$ at partial pressure of 101.3 kPa, $x_{C_3H_8}$	#ΔH^∞ /cal mol^{-1} (/J mol^{-1})
298.15	11.648	0.08585	501 (2096)

\+ Calculated by compiler assuming $x_{C_3H_8} = 1/H$.

\# Excess partial molar enthalpy of solution at infinite dilution.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The conventional gas chromatographic technique was used. The carrier gas was helium. The value of Henry's law constant was calculated from the retention time. The value applies to very low partial pressures of gas and there may be a substantial difference from that measured at 1 atm. pressure. There is also considerable uncertainty in the value of Henry's constant since no allowance was made for surface adsorption.

SOURCE AND PURITY OF MATERIALS:

No details given

ESTIMATED ERROR:

$\delta T/K = \pm 0.05$; $\delta H = \pm 2\%$

REFERENCES:

COMPONENTS:

(1) Propane; C_3H_8; [74-98-6]

(2) Tetrachloromethane (carbon tetrachloride); CCl_4; [56-23-5]

ORIGINAL MEASUREMENTS:

Fleury, D.; Hayduk, W.

Can. J. Chem. Eng. 1975, *53*, 195-199.

VARIABLES:

T/K: 258.15-323.15

P/kPa: 101.325

PREPARED BY:

W. Hayduk

EXPERIMENTAL VALUES:

T/K	Ostwald Coefficient[1] L/cm^3 cm^{-3}	Bunsen Coefficient[2] α/cm^3 (STP) cm^{-3}atm^{-1}	Mole Fraction[1] x_1
258.15	76.0	80.4	0.254 (0.2536)[3]
273.15	42.5	42.5	0.155 (0.1554)
298.15	21.9	20.1	0.0813 (0.0811)
323.15	13.6	11.5	0.0497 (0.0497)

[1] Original data.

[2] Calculated by compiler.

[3] The mole fraction solubility of the original data was used to determine the following equations for $\Delta G°$ and $\ln x_1$ and table of smoothed values:

$$\Delta G°/\text{J mol}^{-1} = -RT \ln x_1 = 597.65\, T - 77.797\, T \ln T - 39807$$

$$\ln x_1 = 4787.9/T + 9.3573 \ln T - 71.885$$

Std. deviation for $\Delta G°$ = 4.6 J mol^{-1}

T/K	$\Delta G°$/J mol^{-1}	x_1	T/K	$\Delta G°$/J mol^{-1}	x_1
258.15	2944	0.2536	298.15	6227	0.0811
273.15	4228	0.1554	303.15	6607	0.0727
283.15	5048	0.1171	313.15	7347	0.0595
293.15	5841	0.0910	323.15	8063	0.0497

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

A volumetric method using a glass apparatus was employed. Degassed solvent contacted the gas while flowing as a thin film, at a constant rate, through an absorption spiral into a solution buret. A constant solvent flow was obtained by means of a calibrated syringe pump. The solution at the end of the spiral was considered saturated. Dry gas was maintained at atmospheric pressure in a gas buret by mechanically raising the mercury level in the buret at an adjustable rate. The solubility was calculated from the constant slope of volume of gas dissolved and volume of solvent injected.

Degassing was accomplished using a two stage vacuum process described by Clever et al. (1).

SOURCE AND PURITY OF MATERIALS:

1. Matheson Co. Specified as instrument grade of minimum purity 99.5 per cent.
2. Fisher Scientific. Specified minimum purity 99.0 per cent.

ESTIMATED ERROR:

δT/K = 0.1

$\delta x_1/x_1$ = 0.01

REFERENCES:

1. Clever, H.L.; Battino, R.; Saylor, J.H.; Gross, P.M. *J. Phys. Chem.* 1971, *61*, 1078.

COMPONENTS:

(1) Propane; C_3H_8; [74-98-6]

(2) 1,1'-Oxybis, 2-Chloroethane (Chlorex); $C_4H_8Cl_2O$; [111-44-4]

ORIGINAL MEASUREMENTS:

Ezheleva, A.E.; Zorin, A.D.

Tr. Khim. Khim. Tech. (Gorkii) 1961, *1*, 37-40.

VARIABLES:

T/K: 303.15-343.15

P/kPa: 101.325 and above

PREPARED BY:

W. Hayduk

EXPERIMENTAL VALUES:

T/K	Ostwald Coefficient[2] L/cm^{3}cm^{-3}	Bunsen Coefficient[2] α/cm^3(STP)cm^{-3}atm^{-1}	Mole Fraction[1] x_1
303.15	8.42	7.54	0.039 (0.0398)[3]
313.15	7.03	6.09	0.032 (0.0316)
323.15	5.82	4.88	0.026 (0.0254)
333.15	4.78	3.88	0.021 (0.0208)
343.15	3.89	3.07	0.0168(0.0172)

[1] Original data given as the inverse of Henry's constant which is equivalent to mole fraction at a gas partial pressure of 101.325 kPa.

[2] Ostwald and Bunsen coefficients calculated by compiler using authors' assumption that solvent is non-volatile.

[3] From equation of smoothed data:

$$\ln x_1 = 2186.8/T - 10.437$$

Correlation coefficient = 0.9982

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The apparatus consisted of a two-chamber, rocking device with separate gas and liquid chambers joined by two tubes and microvalves. The gas chamber was equipped with a pressure gauge. After evacuation, gas and deaerated solvent were separately charged, and then contacted by opening the microvalves and by rocking. The solubility was calculated from a knowledge of the volume of the solvent charged, and the initial and final gas pressures.

The solvent was considered non-volatile and the gas pressure was considered to be the total pressure.

SOURCE AND PURITY OF MATERIALS:

1. Source and purity not given. Gas purified by low temperature fractionation and analyzed by gas chromatography.
2. Source and purity not given. Refractive index measured:

n_D^{20} = 1.4535

ESTIMATED ERROR:

δT/K = 0.05

$\delta x_1/x_1$ = 0.05

(estimated by compiler)

REFERENCES:

COMPONENTS:

(1) Propane; C_3H_8; [74-98-6]

(2) Chlorobenzene; C_6H_5Cl; [108-90-7]

ORIGINAL MEASUREMENTS:

Hayduk, W.; Castañeda, R.
Can. J. Chem. Eng. 1973, *51*,
353-358.

VARIABLES:

T/K: 273.15-323.15
P/kPa: 101.325

PREPARED BY:

W. Hayduk

EXPERIMENTAL VALUES:

T/K	Ostwald Coefficient[1] $L/cm^3\ cm^{-3}$	Bunsen Coefficient[2] $\alpha/cm^3\ (STP)cm^{-3}atm^{-1}$	Mole Fraction[1] x_1
273.15	25.4	25.4	0.1034 (0.1029)[3]
298.15	14.16	12.97	0.0570 (0.0575)
323.15	9.12	7.71	0.3053 (0.0352)

[1] Original data.

[2] Calculated by compiler.

[3] The mole fraction solubility of the original data was used to determine the following equations for $\Delta G°$ and $\ln x_1$ and table of smoothed values:

$$\Delta G°/J\ mol^{-1} = -RT \ln x_1 = 76.625\, T - 15766$$

$$\ln x_1 = 1896.3/T - 9.2167$$

Std. deviation for $\Delta G°$ = 18.8 J mol^{-1}; Correlation coefficient = 0.9999

T/K	$\Delta G°/J\ mol^{-1}$	x_1	T/K	$\Delta G°/J\ mol^{-1}$	x_1
273.15	5164	0.1029	303.15	7463	0.0518
283.15	5930	0.0805	313.15	8229	0.0424
293.15	6697	0.0641	323.15	8995	0.0352
298.15	7080	0.0575			

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

A volumetric method using a glass apparatus was employed. Degassed solvent contacted the gas while flowing as a thin film, at a constant rate, through an absorption spiral into a solution buret. A constant solvent flow was obtained by means of a calibrated syringe pump. The solution at the end of the spiral was considered saturated. Dry gas was maintained at atmospheric pressure in a gas buret by mechanically raising the mercury level in the buret at an adjustable rate. The solubility was calculated from the constant slope of volume of gas dissolved and volume of solvent injected.

Degassing was accomplished using a two stage vacuum process described by Clever et al. (1).

SOURCE AND PURITY OF MATERIALS:

1. Matheson Co. Specified as instrument grade of minimum purity 99.5 per cent.
2. Fisher. Fisher Certified Reagent grade of specified purity 99.7 per cent.

ESTIMATED ERROR:

$\delta T/K = 0.1$

$\delta x_1/x_1 = 0.01$

REFERENCES:

1. Clever, H.L.; Battino, R.; Saylor, J.H.; Gross, P.M. *J. Phys. Chem.* 1971, *61*, 1078.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Propane; C_3H_8; [74-98-6] (2) Iodobenzene; C_6H_5I; [591-50-4]	Gerrard, W. *J. Appl. Chem. Biotechnol.* 1973, *23*, 1-17.
VARIABLES: T/K: 268.2-298.2 P/kPa: 101.3	PREPARED BY: C. L. Young

EXPERIMENTAL VALUES:

Total pressure = 101.3 kPa.

T/K	Mole ratio	Mole fraction of propane[#]
268.2	0.214	0.176
273.2	0.186	0.157
278.2	0.162	0.139
283.2	0.141	0.124
293.2	0.116	0.104
298.2	0.106	0.0958

[#] Calculated by compiler.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Gas was passed into a known weight of pure liquid in a bubbler tube at a total pressure measured using a manometer assembly. The amount of absorbed gas was estimated by weighing. The temperature was controlled to within 0.2 K. The apparatus and procedure are described by Gerrard, ref. (1).

SOURCE AND PURITY OF MATERIALS:

No details given except that "all compounds were purified by conventional procedures".

ESTIMATED ERROR:

$\delta T/K = \pm 0.1$; $\delta x/x = \pm 3\%$ (estimated by compiler).

REFERENCES:

1. Gerrard, W.
J. Appl. Chem. Biotechnol.
1972, *22*, 623.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Propane; C_3H_8; [74-98-6] (2) Tetradecafluorohexane (perfluorohexane); C_6F_{14}; [355-42-0]	Fleury, D.; Hayduk, W. *Can. J. Chem. Eng.* 1975, *53*, 195-199.

VARIABLES:	PREPARED BY:
T/K: 258.15-323.15 P/kPa: 101.325	W. Hayduk

EXPERIMENTAL VALUES:

T/K	Ostwald Coefficient[1] L/cm³ cm⁻³	Bunsen Coefficient[2] α/cm³ (STP)cm⁻³atm⁻¹	Mole Fraction[1] x_1
258.15	15.5	16.4	0.124 (0.124)[3]
278.15	9.03	8.87	0.0731 (0.0734)
298.15	5.90	5.41	0.0480 (0.0478)
323.15	3.99	3.37	0.0308 (0.0308)

[1] Original data.

[2] Calculated compiler.

[3] The mole fraction solubility of the original data was used to determine the following equations for $\Delta G°$ and $\ln x_1$ and table of smoothed values:

$$\Delta G°/\text{J mol}^{-1} = -RT \ln x_1 = 321.95\, T - 37.053\, T \ln T - 25507$$

$$\ln x_1 = 3067.9/T - 38.724 + 4.4567 \ln T$$

Std. deviation for $\Delta G°$ = 10.1 J mol⁻¹

T/K	$\Delta G°$/J mol⁻¹	x_1	T/K	$\Delta G°$/J mol⁻¹	x_1
258.15	4484	0.1238	298.15	7539	0.04775
273.15	5655	0.0829	303.15	7907	0.0434
278.15	6039	0.0734	313.15	8633	0.0363
293.15	7169	0.0528	323.15	9347	0.03084

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

A volumetric method using a glass apparatus was employed. Degassed solvent contacted the gas while flowing as a thin film, at a constant rate, through an absorption spiral into a solution buret. A constant solvent flow was obtained by means of a calibrated syringe pump. The solution at the end of the spiral was considered saturated. Dry gas was maintained at atmospheric pressure in a gas buret by mechanically raising the mercury level in the buret at an adjustable rate. The solubility was calculated from the constant slope of volume of gas dissolved and volume of solvent injected.

Degassing was accomplished using a two stage vacuum process described by Clever et al. (1).

SOURCE AND PURITY OF MATERIALS:

1. Matheson Co. Specified as instrument grade of minimum purity 99.5 per cent.
2. PCR Inc. Specified minimum purity 99.0 per cent.

ESTIMATED ERROR:

δT/K = 0.1

$\delta x_1/x_1$ = 0.01

REFERENCES:

1. Clever, H.L.; Battino, R.; Saylor, J.H.; Gross, P.M. *J. Phys. Chem.* 1971, *61*, 1078.

COMPONENTS:

(1) Propane; C_3H_8; [74-98-6]

(2) 1-Bromo-3-methylbenzene
(*m*-bromotoluene); C_7H_7Br;
[591-17-3]

ORIGINAL MEASUREMENTS:

Gerrard, W.
J. Appl. Chem. Biotechnol.
1973, *23*, 1-17.

VARIABLES:

T/K: 268.2-293.2

P/kPa: 101.3

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

Total pressure = 101.3 kPa

T/K	Mole ratio	Mole fraction of propane#
268.2	0.150	0.130
273.2	0.132	0.117
278.2	0.116	0.104
283.2	0.103	0.0937
293.2	0.083	0.0766

Calculated by compiler.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Gas was passed into a known weight of pure liquid in a bubbler tube at a total pressure measured using a manometer assembly. The amount of absorbed gas was estimated by weighing. The temperature was controlled to within 0.2 K. The apparatus and procedure are described by Gerrard, ref. (1).

SOURCE AND PURITY OF MATERIALS:

No details given except that "all compounds were purified by conventional procedures".

ESTIMATED ERROR:

$\delta T/K = \pm 0.1$; $\delta x/x = \pm 3\%$
(estimated by compiler).

REFERENCES:

1. Gerrard, W.
J. Appl. Chem. Biotechnol.
1972, *22*, 623.

COMPONENTS:

(1) Propane; C_3H_8; [74-98-6]

(2) Hexadecafluoroheptane (Perfluoroheptane); C_7F_{16}; [335-57-9]

ORIGINAL MEASUREMENTS:

Thomsen, E.S.; Gjaldbaek, J.C.

Acta Chem. Scand. 1963, *17*, 134-138.

VARIABLES:

T/K: 298.15

P/kPa: 101.325

PREPARED BY:

E.S. Thomsen, W. Hayduk

EXPERIMENTAL VALUES:

T/K	Ostwald Coefficient[2] $L/\text{cm}^3\ \text{cm}^{-3}$	Bunsen Coefficient[1] $\alpha/\text{cm}^3\ (\text{STP})\text{cm}^{-3}\text{atm}^{-1}$	Mole Fraction[2] x_1
298.15	5.67	5.17	0.0505

[1] Original data.

[2] Calculated by compilers using a real gas molar volume.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The method utilizes a combined glass manometer and bulb enclosed in an air thermostat which is shaken until equilibrium is established. Mercury is used for calibrating the volumes and as the confining liquid. Details in reference 1.

The absorbed gas volume is calculated from the initial dry gas, and final solvent vapor-saturated gas volume. The amount of solvent is determined by measuring the mass of mercury displaced.

SOURCE AND PURITY OF MATERIALS:

1. Phillips Petroleum Co. Specified as research grade and GC analysis indicated 0.1 per cent air and 0.03 per cent ethane impurities.
2. Source not given. Fractionated to yield boiling point t/°C 82.55-82.56.

ESTIMATED ERROR:

δT/K = 0.05

$\delta x_1/x_1$ = 0.015

REFERENCES:

1. Gjaldbaek, J.C. *Acta Chem. Scand.* 1952, *6*, 623.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Propane; C_3H_8; [74-98-6] (2) 1-Iodooctane; $C_8H_{17}I$; [629-27-6]	Gerrard, W. *J. Appl. Chem. Biotechnol.* 1973, *23*, 1-17.
VARIABLES: *T*/K: 268.2-293.2 *P*/kPa: 101.3	PREPARED BY: C. L. Young

EXPERIMENTAL VALUES:

Total pressure = 101.3 kPa

T/K	Mole ratio	Mole fraction of propane[#]
268.2	0.261	0.207
273.2	0.229	0.186
278.2	0.198	0.165
283.2	0.172	0.147
293.2	0.129	0.114

[#] Calculated by compiler.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Gas was passed into a known weight of pure liquid in a bubbler tube at a total pressure measured using a manometer assembly. The amount of absorbed gas was estimated by weighing. The temperature was controlled to within 0.2 K. The apparatus and procedure are described by Gerrard, ref. (1).

SOURCE AND PURITY OF MATERIALS:

No details given except that "all compounds were purified by conventional procedures".

ESTIMATED ERROR:

$\delta T/K = \pm 0.1$; $\delta x/x = \pm 3\%$ (estimated by compiler).

REFERENCES:

1. Gerrard, W. *J. Appl. Chem. Biotechnol.* 1972, *22*, 623.

COMPONENTS:

(1) Butane; C_4H_{10}; [106-97-8]

(2) Water; H_2O; [7732-18-5]
Ethanol; C_2H_6O; [64-17-5]
Diethylether; $C_4H_{10}O$; [60-29-7]
Chloroform; $CHCl_3$; [67-66-3]

ORIGINAL MEASUREMENTS:

Lebeau, P.

Bull. Acad. Roy. Belg. 1908, 300-4.

VARIABLES:

T/K = 290, 291
p/kPa = 102.9 - 104.8

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

Temperature t/°C	T/K	Pressure[a] p/mmHg	Solubility Volume Butane/Volume Solvent
Water			
17	290	772	0.15
Ethanol			
17	290	775	18.83
Diethylether or 1'1'-oxybisethane			
18	291	773	29.8
Chloroform or trichloromethane			
17	290	786	32.5

[a] Not clear whether this is total pressure or butane partial pressure. It is probably the total pressure.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Details not given.

SOURCE AND PURITY OF MATERIALS:

(1) Butane. Prepared by author by the reaction of sodium in liquid ammonia on butyl iodide. The normal boiling point is 0.5 °C, and the critical temperature is 151-2 °C.

(2) Solvents. No information.

ESTIMATED ERROR:

REFERENCES:

COMPONENTS:

(1) Butane; C_4H_{10}; [106-97-8]

(2) Tetrachloromethane (carbon tetrachloride); CCl_4; [56-23-5]

ORIGINAL MEASUREMENTS:

Blais, C.; Hayduk, W.

J. Chem. Eng. Data 1983, *28*, 181-184.

VARIABLES:

T/K: 298.15,323.15

P/kPa: 101.325

PREPARED BY:

W. Hayduk

EXPERIMENTAL VALUES:

T/K	Ostwald Coefficient[1] L/cm^3 cm^{-3}	Bunsen Coefficient[2] α/cm^3 (STP)cm^{-3}atm^{-1}	Mole Fraction[1] x_1
298.15	122.7	112.4	0.339 (0.3390)[3]
323.15	52.0	43.95	0.167 (0.1670)

[1] Original data.

[2] Calculated by compiler.

[3] The mole fraction solubility of the original data was used to determine the following equations for ΔG° and ln x_1 and table of smoothed values:

$$\Delta G°/\text{J mol}^{-1} = -RT \ln x_1 = 721.51\, T \ln T - 4022.1\, T$$

$$\ln x_1 = 49.0169 - 8.79294 \ln T$$

T/K	$10^{-4}\Delta G°$/J mol^{-1}	x_1
298.15	2.646	0.3390
303.15	3.055	0.2929
313.15	3.889	0.2202
323.15	4.746	0.1670

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

A volumetric method using a glass apparatus was employed. Degassed solvent contacted the gas while flowing as a thin film, at a constant rate, through an absorption spiral into a solution buret. A constant solvent flow was obtained by means of a calibrated syringe pump. The solution at the end of the spiral was considered saturated. Dry gas was maintained at atmospheric pressure in a gas buret by mechanically raising the mercury level in the buret at an adjustable rate. The solubility was calculated from the constant slope of volume of gas dissolved and volume of solvent injected.

Degassing was accomplished using a two stage vacuum process described by Clever et al. (1).

SOURCE AND PURITY OF MATERIALS:

1. Liquid Carbonic. Pure grade of minimum purity 99.0 per cent.
2. Canlab (J.T. Baker Company). Spectrophotometric grade of minimum specified purity 99.9 per cent.

ESTIMATED ERROR:

δT/K = 0.1

$\delta x_1/x_1$ = 0.01

REFERENCES:

1. Clever, H.L.; Battino, R.; Saylor, J.H.; Gross, P.M. *J. Phys. Chem.* 1957, *61*, 1078.

COMPONENTS:

(1) Butane; C_4H_{10}; [106-97-8]

(2) Tetrachloromethane; CCl_4; [54-23-5]

ORIGINAL MEASUREMENTS:

Jadot, R.

J. Chim. Phys. 1972, *69*, 1036-40

VARIABLES:

T/K: 298.15

P/kPa: 101.3

PREPARED BY:

C.L. Young

EXPERIMENTAL VALUES:

T/K	Henry's Law Constant, H/atm	Mole fraction$^+$ at partial pressure of 101.3 kPa, $x_{C_4H_{10}}$	#ΔH^∞ /cal mol^{-1} (/J mol^{-1})
298.15	2.785	0.3591	602 (2519)

\+ Calculated by compiler assuming $x_{C_4H_{10}} = 1/H$.

\# Excess partial molar enthalpy of solution at infinite dilution.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The conventional gas chromatographic technique was used. The carrier gas was helium. The value of Henry's law constant was calculated from the retention time. The value applies to very low partial pressures of gas and there may be a substantial difference from that measured at 1 atm. pressure. There is also considerable uncertainty in the value of Henry's constant since no allowance was made for surface adsorption.

SOURCE AND PURITY OF MATERIALS:

No details given.

ESTIMATED ERROR:

δT/K = ±0.05; δH = ±2%

REFERENCES:

COMPONENTS:

(1) Butane; C_4H_{10}; [106-97-8]

(2) 2,2,2-Trichloroethanol; $C_2H_3Cl_3O$; [115-20-8]
Dichloroacetic acid; $C_2H_2Cl_2O_2$; [79-43-6]
1,2-Dibromoethane; $C_2H_4Br_2$; [106-93-4]

ORIGINAL MEASUREMENTS:

Gerrard, W.

J. Appl. Chem. Biotechnol.

<u>1973</u>, *23*, 1-17.

VARIABLES:

T/K: 278.2-298.2
P/kPa: 101.3

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

Total pressure = 101.3 kPa

T/K	Mole ratio	Mole fraction of butane[#]
	2,2,2-Trichloroethanol; $C_2H_3Cl_3O$; [115-20-8]	
278.2	0.370	0.270
283.2	0.250	0.200
293.2	0.115	0.103
298.2	0.100	0.0909
	Dichloroacetic acid; $C_2H_2Cl_2O_2$; [79-43-6]	
298.2	0.0667	0.0625
	1,2-Dibromoethane; $C_2H_4Br_2$; [106-93-4]	
278.2	1.81	0.644

[#] Calculated by compiler.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Gas was passed into a known weight of pure liquid in a bubbler tube at a total pressure measured using a manometer assembly. The amount of absorbed gas was estimated by weighing. The temperature was controlled to within 0.2 K. The apparatus and procedure are described by Gerrard, ref. (1).

SOURCE AND PURITY OF MATERIALS:

No details given except that "all compounds were purified by conventional procedures".

ESTIMATED ERROR:

$\delta T/K = \pm 0.1$; $\delta x/x = \pm 3\%$
(estimated by compiler).

REFERENCES:

1. Gerrard, W.
J. Appl. Chem. Biotechnol.
<u>1972</u>, *22*, 623.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Butane; C_4H_{10}; [106-97-8] (2) Chlorobenzene; C_6H_5Cl; [108-90-7]	Blais, C.; Hayduk, W. *J. Chem. Eng. Data* 1983, *28*, 181-184.
VARIABLES:	**PREPARED BY:**
T/K: 298.15,323.15 P/kPa: 101.325	W. Hayduk

EXPERIMENTAL VALUES:

T/K	Ostwald Coefficient[1] L/cm^3 cm^{-3}	Bunsen Coefficient[2] α/cm^3 (STP)cm^{-3}atm^{-1}	Mole Fraction[1] x_1
298.15	85.4	78.24	0.269 (0.2690)[3]
323.15	37.3	31.53	0.131 (0.1310)

[1] Original data.

[2] Calculated by compiler.

[3] The mole fraction solubility of the original data was used to determine the following equations for ΔG° and ln x_1 and table of smoothed values:

$$\Delta G°/\text{J mol}^{-1} = -RT \ln x_1 = 733.24\ T \ln T - 4070.0\ T$$

$$\ln x_1 = 49.5998 - 8.93585 \ln T$$

T/K	$10^{-4}\Delta G°$/J mol^{-1}	x_1
298.15	3.212	0.2690
303.15	3.636	0.2319
313.15	4.501	0.1735
323.15	5.390	0.1310

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

A volumetric method using a glass apparatus was employed. Degassed solvent contacted the gas while flowing as a thin film, at a constant rate, through an absorption spiral into a solution buret. A constant solvent flow was obtained by means of a calibrated syringe pump. The solution at the end of the spiral was considered saturated. Dry gas was maintained at atmospheric pressure in a gas buret by mechanically raising the mercury level in the buret at an adjustable rate. The solubility was calculated from the constant slope of volume of gas dissolved and volume of solvent injected.

Degassing was accomplished using a two stage vacuum process described by Clever et al. (1).

SOURCE AND PURITY OF MATERIALS:

1. Liquid Carbonic. Pure grade of minimum purity 99.0 per cent.
2. Canlab (Matheson, Coleman and Bell). Specified minimum purity 98.0 per cent.

ESTIMATED ERROR:

δT/K = 0.1

$\delta x_1/x_1$ = 0.01

REFERENCES:

1. Clever, H.L.; Battino, R.; Saylor, J.H.: Gross, P.M. *J. Phys. Chem.* 1957, *61*, 1078.

COMPONENTS:

(1) Butane; C_4H_{10}; [106-97-8]

(2) Iodobenzene; C_6H_5I; [591-50-4]

ORIGINAL MEASUREMENTS:

Gerrard, W.

J. Appl. Chem. Biotechnol.

1973, *23*, 1-17.

VARIABLES:

T/K: 278.2-293.2

P/kPa: 101.3

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

Total pressure = 101.3 kPa

T/K	Mole ratio	Mole fraction of propane#
278.2	3.55	0.780
283.2	0.612	0.380
293.2	0.280	0.219

\# Calculated by compiler.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Gas was passed into a known weight of pure liquid in a bubbler tube at a total pressure measured using a manometer assembly. The amount of absorbed gas was estimated by weighing. The temperature was controlled to within 0.2 K. The apparatus and procedure are described by Gerrard, ref. (1).

SOURCE AND PURITY OF MATERIALS:

No details given except that "all compounds were purified by conventional procedures".

ESTIMATED ERROR:

$\delta T/K = \pm 0.1$; $\delta x/x = \pm 3\%$

(estimated by compiler).

REFERENCES:

1. Gerrard, W.
J. Appl. Chem. Biotechnol.
1972, *22*, 623.

COMPONENTS:

(1) Butane; C_4H_{10}; [106-97-8]
(2) 1-Bromo-3-methylbenzene
(*m*-bromotoluene); C_7H_7Br;
[591-17-3]

ORIGINAL MEASUREMENTS:

Gerrard, W.
J. Appl. Chem. Biotechnol.
1973, *23*, 1-17.

VARIABLES:
T/K: 283.2,293.2
P/kPa: 101.3

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

Total pressure = 101.3 kPa

T/K	Mole ratio	Mole fraction of butane#
283.2	0.952	0.488
293.2	0.431	0.301

Calculated by compiler.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Gas was passed into a known weight of pure liquid in a bubbler tube at a total pressure measured using a manometer assembly. The amount of absorbed gas was estimated by weighing. The temperature was controlled to within 0.2 K. The apparatus and procedure are described by Gerrard, ref. (1).

SOURCE AND PURITY OF MATERIALS:

No details given except that "all compounds were purified by conventional procedures".

ESTIMATED ERROR:

$\delta T/K = \pm 0.1$; $\delta x/x = \pm 3\%$
(estimated by compiler).

REFERENCES:

1. Gerrard, W.
J. Appl. Chem. Biotechnol.
1972, *22*, 623.

COMPONENTS:

(1) Butane; C_4H_{10}; [106-97-8]

(2) 1-Iodooctane; $C_8H_{17}I$; [629-27-6]

ORIGINAL MEASUREMENTS:

Gerrard, W.

J. Appl. Chem. Biotechnol. 1973, *23*, 1-17.

VARIABLES:

T/K: 278.2-293.2

P/kPa: 101.3

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

Total pressure = 101.3 kPa

T/K	Mole ratio	Mole fraction of butane#
278.2	3.88	0.795
283.2	1.64	0.621
293.2	0.74	0.425

Calculated by compiler.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Gas was passed into a known weight of pure liquid in a bubbler tube at a total pressure measured using a manometer assembly. The amount of absorbed gas was estimated by weighing. The temperature was controlled to within 0.2 K. The apparatus and procedure are described by Gerrard, ref. (1).

SOURCE AND PURITY OF MATERIALS:

No details given except that "all compounds were purified by conventional procedures".

ESTIMATED ERROR:

$\delta T/K = \pm 0.1$; $\delta x/x = \pm 3\%$ (estimated by compiler).

REFERENCES:

1. Gerrard, W. *J. Appl. Chem. Biotechnol.* 1972, *22*, 623.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) 2-Methylpropane or isobutane; C_4H_{10}; [75-28-5] (2) Water; H_2O; [7732-18-5] Ethanol; C_2H_6O; [64-17-5] Diethylether; $C_4H_{10}O$; [60-29-7] Chloroform; $CHCl_3$; [67-66-3]	Lebeau, P. *Bull. Acad. Roy. Belg.* 1908, 300-4.
VARIABLES:	**PREPARED BY:**
T/K = 290, 291 p/kPa = 102.9 - 104.8	H. L. Clever

EXPERIMENTAL VALUES:

Temperature t/°C	T/K	Pressure[a] p/mmHg	Solubility Volume Isobutane/Volume Solvent
Water			
17	290	772	0.13
Ethanol			
17	290	775	13.2
Diethylether or 1'1'-oxybisethane			
18	291	773	27.9
Chloroform or trichloromethane			
17	290	786	39.5

[a] Not clear whether this is total pressure or isobutane partial pressure. It is probably the total pressure.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Details not given.

SOURCE AND PURITY OF MATERIALS:

(1) Isobutane. Prepared by the author by the reaction of sodium or calcium in liquid ammonia on isobutyl chloride. The normal boiling point is -10.5 °C and the critical temperature is 134-5 °C.

(2) Solvents. No information.

ESTIMATED ERROR:

REFERENCES:

COMPONENTS:

(1) 2-Methylpropane (isobutane); C_4H_{10}; [75-28-5]

(2) Tetrachloromethane (carbon tetrachloride); CCl_4; [56-23-5]

ORIGINAL MEASUREMENTS:

Blais, C.; Hayduk, W.

J. Chem. Eng. Data 1983, *28*, 181-184.

VARIABLES:

T/K: 298.15,323.15

P/kPa: 101.325

PREPARED BY:

W. Hayduk

EXPERIMENTAL VALUES:

T/K	Ostwald Coefficient[1] L/cm³ cm⁻³	Bunsen Coefficient[2] α/cm³ (STP)cm⁻³atm⁻¹	Mole Fraction[1] x_1
298.15	76.5	70.09	0.231 (0.2310)[3]
323.15	39.9	33.73	0.132 (0.1320)

[1] Original data.

[2] Calculated by compiler.

[3] The mole fraction solubility of the original data was used to determine the following equations for ΔG° and ln x_1 and table of smoothed values:

$$\Delta G°/\text{J mol}^{-1} = -RT\ln x_1 = 600.71\ T\ln T - 3304.8\ T$$

$$\ln x_1 = 40.2754 - 7.32078\ln T$$

T/K	$10^{-4}\Delta G°$/J mol⁻¹	x_1
298.15	3.512	0.2380
303.15	3.874	0.2107
313.15	4.612	0.1662
323.15	5.369	0.1320

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

A volumetric method using a glass apparatus was employed. Degassed solvent contacted the gas while flowing as a thin film, at a constant rate, through an absorption spiral into a solution buret. A constant solvent flow was obtained by means of a calibrated syringe pump. The solution at the end of the spiral was considered saturated. Dry gas was maintained at atmospheric pressure in a gas buret by mechanically raising the mercury level in the buret at an adjustable rate. The solubility was calculated from the constant slope of volume of gas dissolved and volume of solvent injected.

Degassing was accomplished using a two stage vacuum process described by Clever et al. (1).

SOURCE AND PURITY OF MATERIALS:

1. Liquid Carbonic. Pure grade of minimum purity 99.0 per cent.
2. Canlab (J.T. Baker Company). Spectrophotometric grade of minimum specified purity 99.9 per cent.

ESTIMATED ERROR:

δT/K = 0.1

$\delta x_1/x_1$ = 0.01

REFERENCES:

1. Clever, H.L.; Battino, R.; Saylor, J.H.; Gross, P.M. *J. Phys. Chem.* 1957, *61*, 1078.

COMPONENTS:

(1) 2-Methylpropane (isobutane); C_4H_{10}; [75-28-5]

(2) 1,1′-Oxybis, 2-Chloroethane (Chlorex); $C_4H_8Cl_2O$; [111-44-4]

ORIGINAL MEASUREMENTS:

Ezheleva, A.E.; Zorin, A.D.

Tr. Khim. Khim. Tech. (Gorkii) 1961, *1*, 37-40.

VARIABLES:

T/K: 303.15-343.15

P/kPa: 101.325 and above

PREPARED BY:

W. Hayduk

EXPERIMENTAL VALUES:

T/K	Ostwald Coefficient[2] L/cm^{3}cm^{-3}	Bunsen Coefficient[2] α/cm^3(STP)cm^{-3}atm^{-1}	Mole Fraction[1] x_1
303.15	13.3	11.8	0.0610(0.0607)[3]
313.15	11.6	9.95	0.0522[4](0.0520)
323.15	10.1	8.38	0.0447(0.0448)
333.15	8.61	6.92	0.0375(0.0387)
343.15	8.08	6.29	0.0345(0.0337)

[1] Original data given as the inverse of Henry's constant which is equivalent to mole fraction at a gas partial pressure of 101.325 kPa.

[2] Ostwald and Bunsen coefficients calculated by compiler using author's assumption that solvent is non-volatile.

[3] From equation of smoothed data:

$$\ln x_1 = 24.349 - 4.7515 \ln T$$

Correlation coefficient = 0.9961

[4] Value corrected to read as shown; original value of x_1 = 0.0022 appears to be a misprint.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The apparatus consisted of a two-chamber, rocking device with separate gas and liquid chambers joined by two tubes and microvalves. The gas chamber was equipped with a pressure gauge. After evacuation, gas and deaerated solvent were separately charged, and then contacted by opening the microvalves and by rocking. The solubility was calculated from a knowledge of the volume of the solvent charged, and the initial and final gas pressures.

The solvent was considered non-volatile and the gas pressure was considered to be the total pressure.

SOURCE AND PURITY OF MATERIALS:

1. Source and purity not given. Gas purified by low temperature fractionation and analyzed by gas chromatography.
2. Source and purity not given. Refractive index measured:

n_D^{20} = 1.4535

ESTIMATED ERROR:

δT/K = 0.05

$\delta x_1/x_1$ = 0.05

(estimated by compiler)

REFERENCES:

COMPONENTS:

(1) 2-Methylpropane (isobutane); C_4H_{10}; [75-28-5]

(2) Chlorobenzene; C_6H_5Cl; [108-90-7]

ORIGINAL MEASUREMENTS:

Blais, C.; Hayduk, W.

J. Chem. Eng. Data 1983, *28*, 181-184.

VARIABLES:

T/K: 298.15,323.15

P/kPa: 101.325

PR PAR D BY:

W. Hayduk

EXPERIMENTAL VALUES:

T/K	Ostwald Coefficient[1] L/cm^3 cm^{-3}	Bunsen Coefficient[2] α/cm^3 (STP)cm^{-3}atm^{-1}	Mole Fraction[1] x_1
298.15	45.1	41.32	0.162 (0.1620)[3]
323.15	23.1	19.53	0.0853 (0.0853)

[1] Original data.

[2] Calculated by compiler.

[3] The mole fraction solubility of the original data was used to determine the following equations for ΔG° and ln x_1 and table of smoothed values:

$$\Delta G°/\text{J mol}^{-1} = -RT \ln x_1 = 653.658\, T \ln T - 3574.93\, T$$

$$\ln x_1 = 43.5669 - 7.9660 \ln T$$

T/K	$10^{-4}\Delta G°$/J mol^{-1}	x_1
298.15	4.453	0.1620
303.15	4.857	0.1419
313.15	5.682	0.1096
323.15	6.527	0.08530

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

A volumetric method using a glass apparatus was employed. Degassed solvent contacted the gas while flowing as a thin film, at a constant rate, through an absorption spiral into a solution buret. A constant solvent flow was obtained by means of a calibrated syringe pump. The solution at the end of the spiral was considered saturated. Dry gas was maintained at atmospheric pressure in a gas buret by mechanically raising the mercury level in the buret at an adjustable rate. The solubility was calculated from the constant slope of volume of gas dissolved and volume of solvent injected.

Degassing was accomplished using a two stage vacuum process described by Clever et al. (1).

SOURCE AND PURITY OF MATERIALS:

1. Liquid Carbonic. Pure grade of minimum purity 99.0 per cent.
2. Canlab (Matheson, Coleman and Bell). Specified minimum purity 98.0 per cent.

ESTIMATED ERROR:

δT/K = 0.1

$\delta x_1/x_1$ = 0.01

REFERENCES:

1. Clever, H.L.; Battino, R.; Saylor, J.H.; Gross, P.M. *J. Phys. Chem.* 1957 *61*, 1078.

COMPONENTS:

(1) 2-Methylpropane, (*iso*butane); C_4H_{10}; [75-28-5]

(2) Bromobenzene; C_6H_5Br; [108-86-1]

ORIGINAL MEASUREMENTS:

Gerrard, W.

Solubility of Gases and Liquids, Plenum, New York, 1976, Chapter 12.

VARIABLES:

T/K: 273.15

P/kPa: 13.3-101.3

PREPARED BY:

C.L. Young

EXPERIMENTAL VALUES:

T/K	P/mmHg	P/kPa	Mole fraction of 2-methyl propane in liquid, $x_{C_4H_{10}}$
275.13	100	13.3	0.033
	200	26.7	0.068
	300	40.0	0.108
	400	53.3	0.154
	500	66.7	0.208
	600	80.0	0.270
	700	93.3	0.360
	760	101.3	0.435

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Gas was passed into a known weight of pure liquid in a bubbler tube at a total pressure measured by a manometer assembly. The amount of absorbed gas was estimated by weighing. The temperature was manually controlled to within 0.2K The apparatus and procedure are described by Gerrard (1, 2).

SOURCE AND PURITY OF MATERIALS:

No details given.

ESTIMATED ERROR:

δT/K = ±0.1; $\delta x/x$ = ±3%

(estimated by compiler)

REFERENCES:

1. Gerrard, W. *J. Appl. Chem. Biotechnol.* 1972, *22*, 623-650.
2. Gerrard, W. *Solubility of Gases and Liquids, Plenum Press, New York,* 1976, Chapter 1.

COMPONENTS:

(1) 2-Methylpropane, (isobutane); C_4H_{10}; [75-28-5]

(2) 1-Bromooctane; $C_8H_{17}Br$; [111-83-1]

ORIGINAL MEASUREMENTS:

Gerrard, W.

Solubility of Gases and Liquids *Plenum, New York,* 1976, Chapter 12.

VARIABLES:

T/K: 273.15

P/kPa: 13.3-101.3

PREPARED BY:

C.L. Young

EXPERIMENTAL VALUES:

T/K	P/mmHg	P/kPa	Mole fraction of 2-methylpropane in liquids, $x_{C_4H_{10}}$
273.15	100	13.3	0.070
	200	26.7	0.138
	300	40.0	0.208
	400	53.3	0.282
	500	66.7	0.355
	600	80.0	0.430
	700	93.3	0.516
	760	101.3	0.580

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Gas was passed into a known weight of pure liquid in a bubbler tube at a total pressure measured by a manometer assembly. The amount of absorbed gas was estimated by weighing. The temperature was manually controlled to within 0.2K. The apparatus and procedure are described by Gerrard (1,2).

SOURCE AND PURITY OF MATERIALS:

No details given.

ESTIMATED ERROR:

$\delta T/K = \pm 0.1$; $\delta x/x = \pm 3\%$
(estimated by compiler)

REFERENCES:

1. Gerrard, W.
   J. Appl. Chem. Biotechnol. 1972 *22*, 623-650.
2. Gerrard, W.
   Solubility of Gases and Liquids, Plenum Press, New York, 1976, Chapter 1.

COMPONENTS:

(1) Propane; C_3H_8; [74-98-6]

(2) Chlorobenzene; C_6H_5Cl; [108-90-7]

ORIGINAL MEASUREMENTS:

Berlin, M. A.; Pluzhnikova, M. F.; Stepanova, I. N.; Potapov, V. E.; Vasil'eva, N. A.; Tsybnlevskii, A. M.

Zh. Prikl. Khim.

<u>1980</u>, *53*, 1661-3.

VARIABLES:

T/K: 293.2

P/MPa: 1.0-6.0

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	P/MPa	V[a]	Mole fraction of propane[b] $x_{C_3H_8}$
293.2	1.0	51.64	0.1821
	6.0	567.55	0.7099

[a] Volume of propane measured at 293.2 K and 1 atmosphere pressure dissolved by unit volume of liquid.

[b] Calculated by compiler assuming molar volume of propane at 293.2 K and 1 atmosphere is 23.4 L.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

A gas chromatographic method. No details given except ref. (1) which contains little additional information.

SOURCE AND PURITY OF MATERIALS:

1. Purity about 99.6-99.8 mole per cent.
2. Purified; final purity checked by refractive index measurements.

ESTIMATED ERROR:

REFERENCES:

1. Berlin, M. A.; Pluzhnikova, M. F.; Stepanova, I. N.; Tsybnlevskii, A. M. *Zh. Fiz. Khim.* <u>1977</u>, *51*, 767.

COMPONENTS:

(1) Propane; C_3H_8; [74-98-6]

(2) 1-Chloro-4-methylbenzene; C_7H_7Cl; [106-43-4]

ORIGINAL MEASUREMENTS:

Berlin, M. A.; Pluzhnikova, M. F.; Stepanova, I. N.; Potapov, V. E.; Vasil'eva, N. A.; Tsybnlevskii, A. M.

Zh. Prikl. Khim.

1980, *53*, 1661-3.

VARIABLES:

T/K: 293.2

P/MPa: 1.0-6.0

PREPARED BY:

C.L. Young

EXPERIMENTAL VALUES:

T/K	P/MPa	α^a	Mole fraction of propane^b $x_{C_3H_8}$
293.2	1.0	324.50	0.6194
	6.0	1115.10	0.8483

[a] Volume of propane measured at 293.2 K and 1 atmosphere pressure dissolved by unit volume of liquid.

[b] Calculated by compiler assuming molar volume of propane at 293.2 K and 1 atmosphere is 23.4 L.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

A gas chromatographic method. No details given except ref. (1) which contains little additional information.

SOURCE AND PURITY OF MATERIALS:

1. Purity about 99.6-99.8 mole per cent.
2. Purified; final purity checked by refractive index measurements.

ESTIMATED ERROR:

REFERENCES:

1. Berlin, M. A.; Pluzhnikova, M. F.; Stepanova, I. N.; Tsybnlevskii, A. M. *Zh. Fiz. Khim.* 1977, *51*, 767.

COMPONENTS:

(1) Propane; C_3H_8; [74-98-6]

(2) 1-Chlorooctane; $C_8H_{17}Cl$; [111-85-3]

ORIGINAL MEASUREMENTS:

Berlin, M. A.; Pluzhnikova, M. F.; Stepanova, I. N.; Potapov, V. F.; Vasil'eva, N. A.; Tsybnlevskii, A. M.

Zh. Prikl. Khim.

1980, *53*, 1661-3.

VARIABLES:

T/K: 293.2

P/MPa: 1.0-6.0

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	P/MPa	α[a]	Mole fraction of propane[b] $x_{C_3H_8}$
293.2	1.0	293.7	0.6772
	2.0	495.0	0.7811
	3.5	867.1	0.8621
	6.0	1462.1	0.9134

[a] Volume of propane measured at 293.2 K and 1 atmosphere pressure dissolved by unit volume of liquid.

[b] Calculated by compiler assuming molar volume of propane at 293.2 K and 1 atmosphere is 23.4 L.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

A gas chromatographic method. No details given except ref. (1) which contains little additional information.

SOURCE AND PURITY OF MATERIALS:

1. Purity about 99.6-99.8 mole per cent.
2. Purified; final purity checked by refractive index measurements.

ESTIMATED ERROR:

REFERENCES:

1. Berlin, M. A.; Pluzhnikova, M. F.; Stepanova, I. N.; Tsybnlevskii, A. M. *Zh. Fiz. Khim.* 1977, *51*, 767.

COMPONENTS:

(1) Propane; C_3H_8; [74-98-6]

(2) 1-Iodooctane; $C_8H_{17}I$; [629-27-6]

ORIGINAL MEASUREMENTS:

Berlin, M. A.; Pluzhnikova, M. F.; Stepanova, I. N.; Potapov, V. F.; Vasil'eva, N. A.; Tsybnlevskii, A. M.

Zh. Prikl. Khim.

1980, *53*, 1661-3.

VARIABLES:

T/K: 293.2

P/MPa: 1.0-6.0

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	P/MPa	α[a]	Mole fraction of propane[b] $x_{C_3H_8}$
293.2	1.0	138.2	0.5140
	2.0	269.8	0.6737
	3.5	458.3	0.7781
	6.0	664.2	0.8356

[a] Volume of propane measured at 293.2 K and 1 atmosphere pressure dissolved by unit volume of liquid.

[b] Calculated by compiler assuming molar volume of propane at 293.2 K and 1 atmosphere is 23.4 L.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

A gas chromatographic method. No details given except ref. (1) which contains little additional information.

SOURCE AND PURITY OF MATERIALS:

1. Purity about 99.6-99.8 mole per cent.

2. Purified; final purity checked by refractive index measurements.

ESTIMATED ERROR:

REFERENCES:

1. Berlin, M. A.; Pluzhnikova, M. F.; Stepanova, I. N.; Tsybnlevskii, A. M. *Zh. Fiz. Khim.* 1977, *51*, 767.

COMPONENTS: (1) Propane; C_3H_8; [74-98-6] (2) 2-Iodooctane; $C_8H_{17}I$; [557-36-8]	ORIGINAL MEASUREMENTS: Berlin, M. A.; Pluzhnikova, M. F.; Stepanova, I. N.; Potapov, V. F.; Vasil'eva, N. A.; Tsybnlevskii, A. M. *Zh. Prikl. Khim.* 1980, *53*, 1661-3.
VARIABLES: *T*/K: 293.2 *P*/MPa: 1.0-6.0	PREPARED BY: C. L. Young

EXPERIMENTAL VALUES:

T/K	*P*/MPa	α^a	Mole fraction of propane[b] $x_{C_3H_8}$
293.2	1.0	149.9	0.5351
	2.0	292.9	0.6922
	3.5	497.2	0.7924
	6.0	720.5	0.8469

[a] Volume of propane measured at 293.2 K and 1 atmosphere pressure dissolved by unit volume of liquid.

[b] Calculated by compiler assuming molar volume of propane at 293.2 K and 1 atmosphere is 23.4 L.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

A gas chromatographic method. No details given except ref. (1) which contains little additional information.

SOURCE AND PURITY OF MATERIALS:

1. Purity about 99.6-99.8 mole per cent.
2. Purified; final purity checked by refractive index measurements.

ESTIMATED ERROR:

REFERENCES:

1. Berlin, M. A.; Pluzhnikova, M. F.; Stepanova, I. N.; Tsybnlevskii, A. M. *Zh. Fiz. Khim.* 1977, *51*, 767.

COMPONENTS:

(1) Propane; C_3H_8; [74-98-6]

(2) (1-Chloroethyl)-benzene;
C_8H_9Cl; [672-65-1]

ORIGINAL MEASUREMENTS:

Berlin, M. A.; Pluzhnikova, M. F.; Stepanova, I. N.; Potapov, V. F.; Vasil'eva, N. A.; Tsybnlevskii, A. M.

Zh. Prikl. Khim.

<u>1980</u>, *53*, 1661-3.

VARIABLES:

T/K: 293.2

P/MPa: 1.0-6.0

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	P/MPa	α[a]	Mole fraction of propane[b] $x_{C_3H_8}$
293.2	1.0	104.07	0.3684
	6.0	488.50	0.7324

[a] Volume of propane measured at 293.2 K and 1 atmosphere pressure dissolved by unit volume of liquid.

[b] Calculated by compiler assuming molar volume of propane at 293.2 K and 1 atmosphere is 23.4 L.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

A gas chromatographic method. No details given except ref. (1) which contains little additional information.

SOURCE AND PURITY OF MATERIALS:

1. Purity about 99.6-99.8 mole per cent.
2. Purified; final purity checked by refractive index measurements.

ESTIMATED ERROR:

REFERENCES:

1. Berlin, M. A.; Pluzhnikova, M. F.; Stepanova, I. N.; Tsybnlevskii, A. M. *Zh. Fiz. Khim.* <u>1977</u>, *51*, 767.

COMPONENTS:

(1) Propane; C_3H_8; [74-98-6]

(2) 1-Chloronaphthalene; $C_{10}H_7Cl$; [90-13-1]

ORIGINAL MEASUREMENTS:

Berlin, M. A.; Pluzhnikova, M. F.; Stepanova, I. N.; Potapov, V. F.; Vasil'eva, N. A.; Tsybnlevskii, A. M.

Zh. Prikl. Khim.

1980, *53*, 1661-3.

VARIABLES:

T/K: 293.2

P/MPa: 1.0-6.0

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	P/MPa	α^a	Mole fraction of propane[b] $x_{C_3H_8}$
293.2	1.0	91.03	0.3454
	6.0	529.17	0.7549

[a] Volume of propane measured at 293.2 K and 1 atmosphere pressure dissolved by unit volume of liquid.

[b] Calculated by compiler assuming molar volume of propane at 293.2 K and 1 atmosphere is 23.4 L.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

A gas chromatographic method. No details given except ref. (1) which contains little additional information.

SOURCE AND PURITY OF MATERIALS:

1. Purity about 99.6-99.8 mole per cent.
2. Purified; final purity checked by refractive index measurements.

ESTIMATED ERROR:

REFERENCES:

1. Berlin, M. A.; Pluzhnikova, M. F.; Stepanova, I. N.; Tsybnlevskii, A. M. *Zh. Fiz. Khim.* 1977, *51*, 767.

COMPONENTS:

(1) Propane; C_3H_8; [74-98-6]

(2) 1-Bromooctane; $C_8H_{17}Br$; [111-83-1]

ORIGINAL MEASUREMENTS:

Berlin, M. A.; Pluzhnikova, M. F.; Stepanova, I. N.; Potapov, V. F.; Vasil'eva, N. A.; Tsybnlevskii, A. M.

Zh. Prikl. Khim.

1980, *53*, 1661-3.

VARIABLES:

T/K: 293.2

P/MPa: 1.0-6.0

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	P/MPa	α^a	Mole fraction of propane[b] $x_{C_3H_8}$
293.2	1.0	220.0	0.6181
	2.0	454.5	0.7698
	3.5	724.1	0.8420
	6.0	1092.1	0.8893

[a] Volume of propane measured at 293.2 K and 1 atmosphere pressure dissolved by unit volume of liquid.

[b] Calculated by compiler assuming molar volume of propane at 293.2 K and 1 atmosphere is 23.4 L.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

A gas chromatographic method. No details given except ref. (1) which contains little additional information.

SOURCE AND PURITY OF MATERIALS:

1. Purity about 99.6-99.8 mole per cent.
2. Purified; final purity checked by refractive index measurements.

ESTIMATED ERROR:

REFERENCES:

1. Berlin, M. A.; Pluzhnikova, M. F.; Stepanova, I. N.; Tsybnlevskii, A. M. *Zh. Fiz. Khim.* 1977, *51*, 767.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) 2-Methylpropane; C_4H_{10}; [75-28-5] (2) Chlorobenzene; C_6H_5Cl; [108-90-7]	Berlin, M. A.; Pluzhnikova, M. F.; Stepanova, I. N.; Potapov, V. F.; Vasil'eva, N. A.; Tsybnlevskii, A. M. *Zh. Prikl. Khim.* <u>1980</u>, *53*, 1661-3.
VARIABLES: T/K: 293.2 P/MPa: 1.0-6.0	PREPARED BY: C. L. Young

EXPERIMENTAL VALUES:

T/K	P/MPa	α^a	Mole fraction of 2-methylpropane[b] $x_{C_4H_{10}}$
293.2	1.0	121.14	0.3460
	6.0	1180.60	0.8375

[a] Volume of 2-methylpropane measured at 293.2 K and 1 atmosphere pressure dissolved by unit volume of liquid.

[b] Calculated by compiler assuming molar volume of 2-methylpropane at 293.2 K and 1 atmosphere is 23.3 L.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

A gas chromatographic method. No details given except ref. (1) which contains little additional information.

SOURCE AND PURITY OF MATERIALS:

1. Purity about 99.6-99.8 mole per cent.
2. Purified; final purity checked by refractive index measurements.

ESTIMATED ERROR:

REFERENCES:

1. Berlin, M. A.; Pluzhnikova, M. F.; Stepanova, I. N.; Tsybnlevskii, A. M.
Zh. Fiz. Khim.
<u>1977</u>, *51*, 767.

COMPONENTS:

(1) 2-Methylpropane; C_4H_{10}; [75-28-5]

(2) 1-Chloro-4-methylbenzene; C_7H_7Cl; [106-43-4]

ORIGINAL MEASUREMENTS:

Berlin, M. A.; Pluzhnikova, M. F.; Stepanova, I. N.; Potapov, V. F.; Vasil'eva, N. A.; Tsybnlevskii, A. M.

Zh. Prikl. Khim.

1980, *53*, 1661-3.

VARIABLES:

T/K: 293.2

P/MPa: 1.0-6.0

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	P/MPa	α^a	Mole fraction of 2-methylpropane[b] $x_{C_4H_{10}}$
293.2	1.0	467.70	0.6565
	6.0	2894.30	0.9220

[a] Volume of 2-methylpropane measured at 293.2 K and 1 atmosphere pressure dissolved by unit volume of liquid.

[b] Calculated by compiler assuming molar volume of 2-methylpropane at 293.2 K and 1 atmosphere is 23.3 L.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

A gas chromatographic method. No details given except ref. (1) which contains little additional information.

SOURCE AND PURITY OF MATERIALS:

1. Purity about 99.6-99.8 mole per cent.
2. Purified; final purity checked by refractive index measurements.

ESTIMATED ERROR:

REFERENCES:

1. Berlin, M. A.; Pluzhnikova, M. F.; Stepanova, I. N.; Tsybnlevskii, A. M. *Zh. Fiz. Khim.* 1977, *51*, 767.

COMPONENTS:

(1) 2-Methylpropane; C_4H_{10}; [75-28-5]

(2) 1-Chlorooctane; $C_8H_{17}Cl$; [111-85-3]

ORIGINAL MEASUREMENTS:

Berlin, M. A.; Pluzhnikova, M. F.; Stepanova, I. N.; Potapov, V. F.; Vasil'eva, N. A.; Tsybnlevskii, A. M.

Zh. Prikl. Khim.

1980, *53*, 1661-3.

VARIABLES:

T/K: 293.2

P/MPa: 1.0-6.0

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	P/MPa	α^a	Mole fraction of 2-methylpropane[b] $x_{C_4H_{10}}$
293.2	1.0	665.5	0.8294
	2.0	1207.9	0.8982
	3.5	2101.6	0.9388
	6.0	3623.2	0.9636

[a] Volume of 2-methylpropane measured at 293.2 K and 1 atmosphere pressure dissolved by unit volume of liquid.

[b] Calculated by compiler assuming molar volume of 2-methylpropane at 293.2 K and 1 atmosphere is 23.3 L.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

A gas chromatographic method. No details given except ref. (1) which contains little additional information.

SOURCE AND PURITY OF MATERIALS:

1. Purity about 99.6-99.8 mole per cent.

2. Purified; final purity checked by refractive index measurements.

ESTIMATED ERROR:

REFERENCES:

1. Berlin, M. A.; Pluzhnikova, M. F.; Stepanova, I. N.; Tsybnlevskii, A. M. *Zh. Fiz. Khim.* 1977, *51*, 767.

COMPONENTS:

(1) 2-Methylpropane; C_4H_{10}; [75-28-5]

(2) 1-Bromooctane; $C_8H_{17}Br$; [111-83-1]

ORIGINAL MEASUREMENTS:

Berlin, M. A.; Pluzhnikova, M. F.; Stepanova, I. N.; Potapov, V. F.; Vasil'eva, N. A.; Tsybnlevskii, A.M.

Zh. Prikl. Khim.

1980, *53*, 1661-3.

VARIABLES:

T/K: 293.2

P/MPa: 1.0-6.0

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	P/MPa	α^a	Mole fraction of 2 methylpropane[b] $x_{C_4H_{10}}$
293.2	1.0	559.5	0.8066
	2.0	1131.4	0.8940
	3.5	1791.7	0.9303
	6.0	2592.1	0.9508

[a] Volume of 2-methylpropane measured at 293.2 K and 1 atmosphere pressure dissolved by unit volume of liquid.

[b] Calculated by compiler assuming molar volume of 2-methylpropane at 293.2 K and 1 atmosphere is 23.3 L.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

A gas chromatographic method. No details given except ref. (1) which contains little additional information.

SOURCE AND PURITY OF MATERIALS:

1. Purity about 99.6-99.8 mole per cent.
2. Purified; final purity checked by refractive index measurements.

ESTIMATED ERROR:

REFERENCES:

1. Berlin, M. A.; Pluzhnikova, M. F.; Stepanova, I. N.; Tsybnlevskii, A. M. *Zh. Fiz. Khim.* 1977, *51*, 767.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) 2-Methylpropane; C_4H_{10}; [75-28-5] (2) 1-Iodooctane; $C_8H_{17}I$; [629-27-6]	Berlin, M. A.; Pluzhnikova, M. F.; Stepanova, I. N.; Potapov, V. F.; Vasil'eva, N. A.; Tsybnlevskii, A. M. *Zh. Prikl. Khim.* 1980, *53*, 1661-3.
VARIABLES:	**PREPARED BY:**
T/K: 293.2 P/MPa: 1.0-6.0	C. L. Young

EXPERIMENTAL VALUES:

T/K	P/MPa	α^a	Mole fraction of 2-methylpropane[b] $x_{C_4H_{10}}$
293.2	1.0	323.1	0.7146
	2.0	638.6	0.8319
	3.5	1104.0	0.8954
	6.0	1668.7	0.9282

[a] Volume of 2-methylpropane measured at 293.2 K and 1 atmosphere pressure dissolved by unit volume of liquid.

[b] Calculated by compiler assuming molar volume of 2-methylpropane at 293.2 K and 1 atmosphere is 23.3 L.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

A gas chromatographic method. No details given except ref. (1) which contains little additional information.

SOURCE AND PURITY OF MATERIALS:

1. Purity about 99.6-99.8 mole per cent.
2. Purified; final purity checked by refractive index measurements.

ESTIMATED ERROR:

REFERENCES:

1. Berlin, M. A.; Pluzhnikova. M. F.; Stepanova, I. N.; Tsybnlevskii, A. M. *Zh. Fiz. Khim.* 1977, *51*, 767.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) 2-Methylpropane; C_4H_{10}; [75-28-5] (2) 2-Iodooctane; $C_8H_{17}I$; [557-36-8]	Berlin, M. A.; Pluzhnikova, M. F.; Stepanova, I. N.; Potapov, V. F.; Vasil'eva, N. A.; Tsybnlevskii, A. M. *Zh. Prikl. Khim.* 1980, *53*, 1661-3.

VARIABLES:	PREPARED BY:
T/K: 293.2 P/MPa: 1.0-6.0	C. L. Young

EXPERIMENTAL VALUES:

T/K	P/MPa	α[a]	Mole fraction of 2-methylpropane[b] $x_{C_4H_{10}}$
293.2	1.0	348.7	0.7306
	2.0	689.3	0.8428
	3.5	1191.6	0.9026
	6.0	1801.0	0.9334

[a] Volume of 2-methylpropane measured at 293.2 K and 1 atmosphere pressure dissolved by unit volume of liquid.

[b] Calculated by compiler assuming molar volume of 2-methylpropane at 293.2 K and 1 atmosphere is 23.3 L.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

A gas chromatographic method. No details given except ref. (1) which contains little additional information.

SOURCE AND PURITY OF MATERIALS:

1. Purity about 99.6-99.8 mole per cent.
2. Purified; final purity checked by refractive index measurements.

ESTIMATED ERROR:

REFERENCES:

1. Berlin, M. A.; Pluzhnikova, M. F.; Stepanova, I. N.; Tsybnlevskii, A. M. *Zh. Fiz. Khim.* 1977, *51*, 767.

COMPONENTS:

(1) 2-Methylpropane; C_4H_{10}; [75-28-5]

(2) (1-Chloroethyl)-benzene; C_8H_9Cl; [672-65-1]

ORIGINAL MEASUREMENTS:

Berlin, M. A.; Pluzhnikova, M. F.; Stepanova, I. N.; Potapov, V. F.; Vasil'eva, N. A.; Tsybnlevskii, A. M.

Zh. Prikl. Khim.

1980, *53*, 1661-3.

VARIABLES:

T/K: 293.2

P/MPa: 1.0-6.0

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	P/MPa	α^a	Mole fraction of 2-methylpropane[b] $x_{C_4H_{10}}$
293.2	1.0	243.60	0.5803
	6.0	1207.40	0.8727

[a] Volume of 2-methylpropane measured at 293.2 K and 1 atmosphere pressure dissolved by unit volume of liquid.

[b] Calculated by compiler assuming molar volume of 2-methylpropane at 293.2 K and 1 atmosphere is 23.3 L.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

A gas chromatographic method. No details given except ref. (1) which contains little additional information.

SOURCE AND PURITY OF MATERIALS:

1. Purity about 99.6-99.8 mole per cent.
2. Purified; final purity checked by refractive index measurements.

ESTIMATED ERROR:

REFERENCES:

1. Berlin, M. A.; Pluzhnikova, M. F.; Stepanova, I. N.; Tsybnlevskii, A. M.
Zh. Fiz. Khim.
1977, *51*, 767.

COMPONENTS:

(1) 2-Methylpropane; C_4H_{10}; [75-28-5]

(2) 1-Chloronaphthalene; $C_{10}H_7Cl$; [90-13-1]

ORIGINAL MEASUREMENTS:

Berlin, M. A.; Pluzhnikova, M. F.; Stepanova, I. N.; Potapov, V. F.; Vasil'eva, N. A.; Tsybnlevskii, A. M.

Zh. Prikl. Khim.

1980, *53*, 1661-3.

VARIABLES:

T/K: 293.2

P/MPa: 1.0-6.0

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	P/MPa	α[a]	Mole fraction of 2-methylpropane[b] $x_{C_4H_{10}}$
293.2	1.0	198.56	0.5372
	6.0	1214.82	0.8766

[a] Volume of 2-methylpropane measured at 293.2 K and 1 atmosphere pressure dissolved by unit volume of liquid.

[b] Calculated by compiler assuming molar volume of 2-methylpropane at 293.2 K and 1 atmosphere is 23.3 L.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

A gas chromatographic method. No details given except ref. (1) which contains little additional information.

SOURCE AND PURITY OF MATERIALS:

1. Purity about 99.6-99.8 mole per cent.
2. Purified; final purity checked by refractive index measurements.

ESTIMATED ERROR:

REFERENCES:

1. Berlin, M. A.; Pluzhnikova, M. F.; Stepanova, I. N.; Tsybnlevskii, A. M. *Zh. Fiz. Khim.* 1977, *51*, 767.

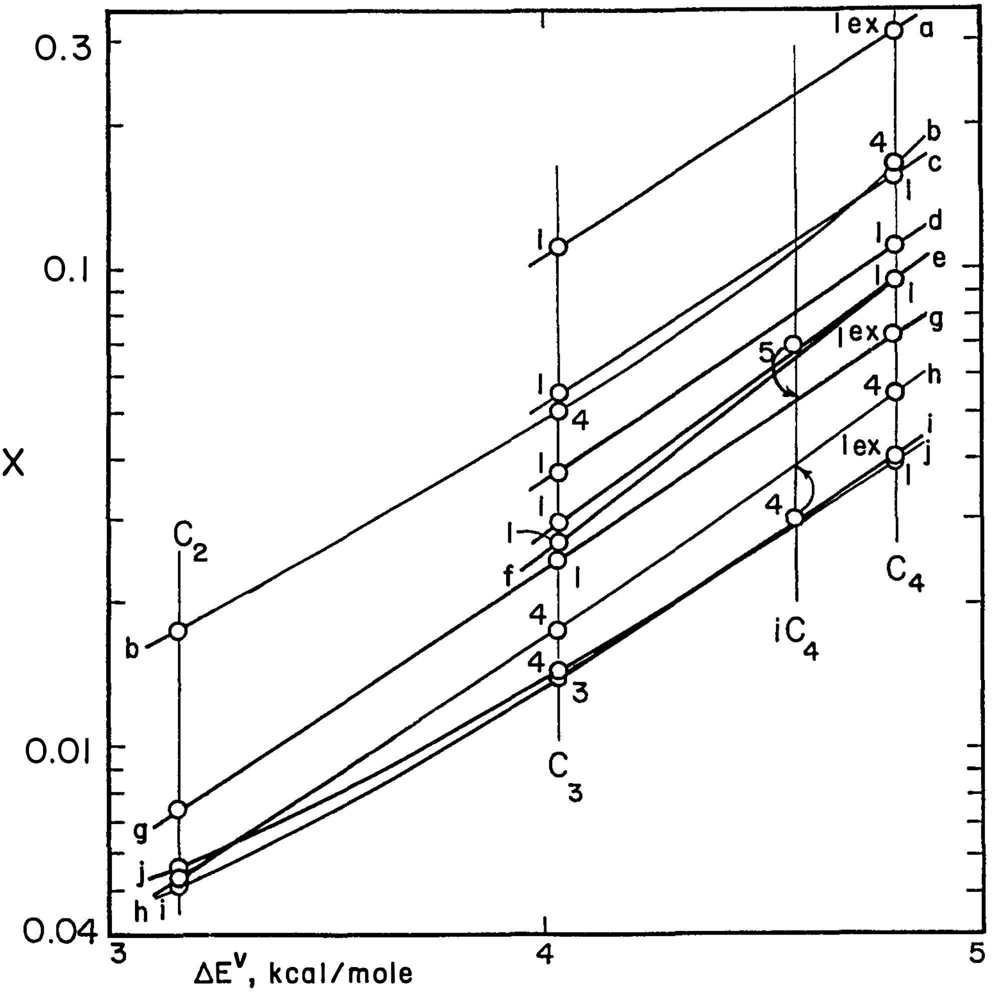
COMPONENTS:	EVALUATOR:
(1) Propane; C_3H_8; [74-98-6] Butane; C_4H_{10}; [106-97-8] 2-Methylpropane; C_4H_{10}; [75-28-5] (2) Nitrogen-containing solvents	Walter Hayduk Department of Chemical Engineering University of Ottawa Ottawa, Canada K1N 9B4 March, 1984

CRITICAL EVALUATION:

Most of the solubility data for *propane*, *2-methylpropane* and *butane* in nitrogen-containing solvents are those of Gerrard (1,7) and Lenoir (4). Certain data from these sources have been previously considered unreliable, generally yielding results that were toohigh when compared with those of other workers (see Critical Evaluations Alkanes, Alcohols, Non-polar solvents excluding alkanes and organohalides, in this volume, and also ref. 8). Consistency checks were applied to the data whenever possible in an attempt to discover grossly anomalous behavior. However, because it was impossible to independently ascertain their accuracy, most of the data are classified as tentative, or simply meaning, the best available.

A consistency check was developed by Linford and Hildebrand (9) for the solubilities of chemically similar gases, such as the alkane gases, in solvents which formed regular solutions. A linear relation was expected when the log of the solubility for a constant temperature was plotted as a function of the energy of vaporization at the normal boiling points. Because a consistent, although non-linear, relation was observed for polar or associating solvents (10), the test was considered to be

Figure 1. Solubilities at 298.15 K versus heat of vaporization of gas at the normal boiling point.



COMPONENTS:	EVALUATOR:
(1) Propane; C_3H_8; [74-98-6] Butane; C_4H_{10}; [106-97-8] 2-Methylpropane; C_4H_{10}; [75-28-5] (2) Nitrogen-containing solvents	Walter Hayduk Department of Chemical Engineering University of Ottawa Ottawa, Canada K1N 9B4 March, 1984

CRITICAL EVALUATION:

useful for the nitrogen-containing solvents. Some solubility data for *ethane* are also available in the same solvents for comparison with those for *propane*, *2-methylpropane* and *butane* (8).

Solubilities are available at least at one temperature for *propane* and *butane* in (a) octanamide (1), (b) hexamethylphosphoric triamide (4), (c) N,N-dimethylbenzenamine (dimethylaniline) (1), (d) benzonitrile (1), (e) benzenemethanamine (benzylamine) (1), (f) N-methylbenzenamine (methylaniline) (1), (g) nitrobenzene (1), (h) 1-methyl-2-pyrrolidinone (4), (i) N,N-dimethylformic acid (dimethyl formamide) (3,1, respectively) and in (j) benzenamine (aniline) (4). The above data, listed in Table 1 and shown in Figure 1 for a temperature of 298.15 K, are all classified as tentative. Also classified as tentative are the data for the solubility of *2-methylpropane* in (g) nitrobenzene (5,7), and (h) 1-methyl-2-pyrrolidinone (4). The letters shown in front of the solvents correspond to the same solvents as shown in Figure 1 and listed in Table 1 while the numbers refer to the data sources. In addition to the data listed in Table 1 are the solubility of *propane* in quinoline (1) and in (k) cyclohexylamine (6), and also of *butane* in 1-methyl-2-nitrobenzene (1) and in quinoline (1). The latter data are also classified as tentative.

A comparison of the data for the solubility of *propane* in (g) nitrobenzene suggests that the data of Lenoir (4) and Ezheleva (5) are too low so that these data are rejected. The solubility of *propane* in (i) N,N-dimethylformic acid (1 and 2) and in (j) benzenamine (aniline) (1) appear at variance with data of others, and are also rejected.

Table 1. Mole fraction solubility at 298.15 K and classification

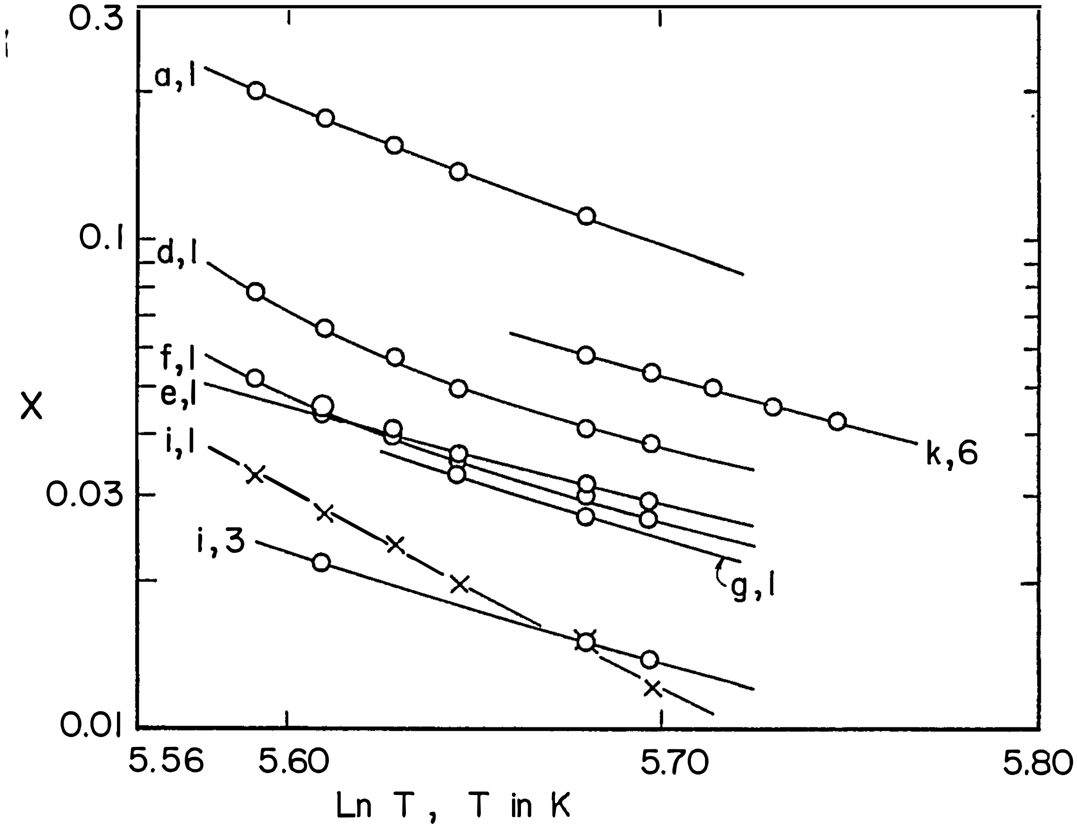
Solvent	*Propane*	*Butane*	*2-Methylpropane*	Classification
(a) Octanamide	0.111(1)		0.31[1] (1)	Tentative
(b) Hexamethylphosphoric triamide	0.0503(4)		0.164 (4)	Tentative
(c) N,N-Dimethylbenzenamine (N,N-dimethylaniline)	0.054[1] (1)		0.156 (1)	Tentative
(d) Benzonitrile	0.0375(1)		0.111 (1)	Tentative
(e) Benzenemethanamine (benzylamine)	0.0291(1)		0.0942(1)	Tentative
(f) N-Methylbenzenamine (N-methylaniline)	0.0267		0.0934(1)	Tentative
(g) Nitrobenzene	0.025[1] (1)	0.067 (5,7)	0.072[1] (1)	Tentative
	0.023[1] (4)			Rejected
	0.018[1] (5)			Rejected
(h) 1-Methyl-2-pyrrolidinone	0.0175(4)	0.030 (4)	0.0543(4)	Tentative
(i) N,N-Dimethyl formic acid	0.0139(3)		0.040[1] (1)	Tentative
	0.0119(1)			Rejected
(j) Benzenamine (aniline)	0.0412(4)		0.0395(4,1)	Tentative
	0.124 (1)			Rejected

[1] Extrapolated

COMPONENTS:	EVALUATOR:
(1) Propane; C_3H_8; [74-98-6] Butane; C_4H_{10}; [106-97-8] 2-Methylpropane; C_4H_{10}; [75-28-5] (2) Nitrogen-containing solvents	Walter Hayduk Department of Chemical Engineering University of Ottawa Ottawa, Canada K1N 9B4 March, 1984

CRITICAL EVALUATION:

Figure 2. Solubility of *propane* in several solvents as a function of temperature.



To show the temperature variation of solubility, selected data for the solubilities of *propane* are shown in Figure 2 as a function of temperature on log scales. It may be observed that there is a nearly systematic temperature coefficient of solubility for the various solvents, as usually obtained. The two comparable data for the solvent, N,N-dimethylformamide (1,3) are also shown. Because the temperature coefficient is much higher of worker (1) than for comparable solubilities in other solvents, it is expected that the data of (3) are more reliable for this solvent. Some other data (not shown) were also observed to have an inconsistent solubility behavior. Hence, the representation of data as shown in Figure 2 was also useful for checking the consistency of the data.

References

1. Gerrard, W., *J. Appl. Chem. Biotechnol.* 1973, *23*, 1-17.
2. Rosenthal, W. *Thès. fac. sci. Univ. Strasbourg (France)* 1954.
3. Howard, W.B.; Schoch, E.P.; Mayforth, F.R. *Petrol. Refiner* 1954, *33*, 143-156.
4. Lenoir, J.-Y.; Renault, P.; Renon, H. *J. Chem. Eng. Data* 1971, *16*, 340-342.

COMPONENTS:	EVALUATOR:
(1) Propane; C_3H_8; [74-98-6] Butane; C_4H_{10}; [106-97-8] 2-Methylpropane; C_4H_{10}; [75-28-5] (2) Nitrogen-containing solvents	Walter Hayduk Department of Chemical Engineering University of Ottawa Ottawa, Canada K1N 9B4 March, 1984

CRITICAL EVALUATION:

5. Ezheleva, A.E.; Zorin, A.D. *Tr. Khim. Khim. Tech. (Gorkii)* 1961, *1*, 37-40.

6. Keevil, T.A.; Taylor, D.R.; Steitwieser, A. *J. Chem. Eng. Data* 1978, *23*, 237-239.

7. Gerrard, W. *Solubility of Gases and Liquids*, Plenum, New York, 1976, Chapter 12.

8. Hayduk, W., Ed. *Solubility Data Series, Vol.9, Ethane* Pergamon Press, Oxford, England 1982, 195-199.

9. Linford, R.G.; Hildebrand, J.H. *Trans. Far. Soc.* 1970, *66*, 577-581.

10. Fleury, D.; Hayduk, W. *Can. J. Chem. Eng.* 1975, *53*, 195-199.

COMPONENTS:

(1) Propane: C_3H_8: [74-98-6]

(2) N,N -Dimethylformamide; C_3H_7NO; [68-12-2]

ORIGINAL MEASUREMENTS:

Rosenthal, W.

Thès. fac. sci. Univ. Strasbourg (France) 1954.

VARIABLES:

T/K: 293.15

P/kPa: 101.325

PREPARED BY:

W. Hayduk

EXPERIMENTAL VALUES:

T/K	Ostwald Coefficient[1] $L/\text{cm}^3\text{cm}^{-3}$	Bunsen Coefficient[2] $\alpha/\text{cm}^3(\text{STP})\ \text{cm}^{-3}$	Mole Fraction[2] x_1
293.15	5.68	5.27	0.0182

[1] Original data.

[2] Calculated by compiler using real gas molar volumes.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The solvent was charged into an evacuated cell after degassing, and the mass of solvent was determined by weight. Gas was introduced into the cell from a measuring burette in which the gas was stored over mercury. The cell was agitated while the gas pressure was maintained by adjusting the gas volume. The Ostwald coefficient was determined from the mass of solvent and volume of gas used. Solubilities were measured at pressures above and below atmospheric.

SOURCE AND PURITY OF MATERIALS:

1. Source and purity not given.
2. S.E.P.P.I.C. of Paris. Purity not given. Exposure to air avoided. Distilled prior to use.

ESTIMATED ERROR:

$\delta T/\text{K} = 0.2$
$\delta P/\text{kPa} = 0.1$
$\delta x_1/x_1 = 0.02$ (compiler)

REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Propane; C_3H_8; [74-98-6] (2) N,N-Dimethyl formic acid (dimethyl formamide); C_3H_7NO; [68-12-2]	Howard, W.B.; Schoch, E.P.; Mayforth, F.R. *Petrol. Refiner* 1954, *33*, 143-146.
VARIABLES:	**PREPARED BY:**
T/K: 273.15-298.15	W. Hayduk

EXPERIMENTAL VALUES:

T/K	Bunsen Coefficient[1] α/cm^3 (STP)cm^{-3}atm^{-1}	Ostwald Coefficient[2] L/cm^3 cm^{-3}	Mole Fraction[2] x_1
273.15	6.5	6.50	0.0219
298.15	4.0	4.37	0.0139

[1] Data as listed in paper; original source indicated as Technical literature from Grasselli Chemicals Department, E.I. du Pont de Nemours.

[2] Ostwald coefficient and mole fraction calculated by compiler.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Description of apparatus and method not available.

SOURCE AND PURITY OF MATERIALS:

Source, purities, not available.

ESTIMATED ERROR:

$\delta\alpha/\alpha = 0.10$

(estimated by compiler)

REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Propane; C_3H_8; [74-98-6] (2) *N,N*-Dimethylformamide; C_3H_7NO; [68-12-2]	Gerrard, W. *J. Appl. Chem. Biotechnol.* 1973, *23*, 1-17.
VARIABLES: *T*/K: 268.2-298.2 *P*/kPa: 101.3	PREPARED BY: C. L. Young

EXPERIMENTAL VALUES:

Total pressure = 101.3 kPa

T/K	Mole ratio	Mole fraction of propane[#]
268.2	0.034	0.033
273.2	0.0283	0.0275
278.2	0.0244	0.0238
283.2	0.020	0.0196
293.2	0.0150	0.0148
298.2	0.0120	0.0119

[#] Calculated by compiler.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Gas was passed into a known weight of pure liquid in a bubbler tube at a total pressure measured using a manometer assembly. The amount of absorbed gas was estimated by weighing. The temperature was controlled to within 0.2 K. The apparatus and procedure are described by Gerrard, ref. (1).

SOURCE AND PURITY OF MATERIALS:

No details given except that "all compounds were purified by conventional procedures".

ESTIMATED ERROR:

$\delta T/K = \pm 0.1$; $\delta x/x = \pm 3\%$ (estimated by compiler).

REFERENCES:

1. Gerrard, W. *J. Appl. Chem. Biotechnol.* 1972, *22*, 623.

COMPONENTS: (1) Propane; C_3H_8; [74-98-6] (2) 1-Methyl-2-pyrrolidinone; C_5H_9NO; [872-50-4]	**ORIGINAL MEASUREMENTS:** Lenoir, J-Y.; Renault, P.; Renon, H. *J. Chem. Eng. Data* 1971, *16*, 340-2
VARIABLES: T/K: 298.15 P/kPa: 101.325	**PREPARED BY:** C.L. Young

EXPERIMENTAL VALUES:

T/K	Henry's Constant $H_{C_3H_8}$/atm	Mole fraction at 1 atm* $x_{C_3H_8}$
298.15	57.2	0.0175

* Calculated by compiler assuming a linear function of $p_{C_3H_8}$ vs $x_{C_3H_8}$, ie. $x_{C_3H_8}$ (1 atm) = $1/H_{C_3H_8}$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

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

SOURCE AND PURITY OF MATERIALS:

(1) L'Air Liquide sample; minimum purity 99.9 mole per cent.

(2) Touzart and Matignon or Serlabo sample; purity 99 mole per cent.

ESTIMATED ERROR:

$\delta T/K = \pm 0.1$; $\delta H/\text{atm} = \pm 6\%$ (estimated by compiler).

REFERENCES:

COMPONENTS: (1) Propane; C_3H_8; [74-98-6] (2) Nitrobenzene; $C_6H_5NO_2$; [98-95-3]	**ORIGINAL MEASUREMENTS:** Lenoir, J.-Y.; Renault, P.; Renon, H. *J. Chem. Eng. Data* 1971, *16*, 340-2.
VARIABLES: T/K: 298 P/kPa: 101.3	**PREPARED BY:** C.L. Young

EXPERIMENTAL VALUES:

T/K	Henry's constant $H_{C_3H_8}$/atm	Mole fraction at 1 atm* $x_{C_3H_8}$
298	44.1	0.0227

* Calculated by compiler assuming a linear function of $p_{C_3H_8}$ vs $x_{C_3H_8}$, i.e., $x_{C_3H_8}$(1 atm) = $1/H_{C_3H_8}$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

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

SOURCE AND PURITY OF MATERIALS:

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

ESTIMATED ERROR:

δT/K = ±0.1; δH/atm = ±6%
(estimated by compiler).

REFERENCES:

COMPONENTS:

(1) Propane; C_3H_8; [74-98-6]

(2) Nitrobenzene; $C_6H_5NO_2$; [98-95-3]

ORIGINAL MEASUREMENTS:

Ezheleva, A.E.; Zorin, A.D.

Tr. Khim. Khim. Tech. (Gorkii) 1961, *1*, 37-40.

VARIABLES:

T/K: 303.15-343.15

P/kPa: 101.325 and above

PREPARED BY:

W. Hayduk

EXPERIMENTAL VALUES:

T/K	Ostwald Coefficient[2] L/cm^{3}cm^{-3}	Bunsen Coefficient[2] α/cm^3(STP)cm^{-3}atm^{-1}	Mole Fraction[1] x_1
303.15	4.25	3.81	0.0175(0.0161)[3]
313.15	2.99	2.59	0.0120(0.0136)
323.15	2.91	2.44	0.0113(0.0116)
333.15	2.89	2.35	0.0109(0.0100)
343.15	2.29	1.80	0.0084(0.0086)

[1] Original data given as the inverse of Henry's constant which is equivalent to mole fraction at a gas partial pressure of 101.325 kPa.

[2] Ostwald and Bunsen coefficients calculated by compiler using authors' assumption that solvent is non-volatile.

[3] From equation of smoothed data:

$$\ln x_1 = 24.787 - 5.0607 \ln T$$

Correlation coefficient = 0.9391

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The apparatus consisted of a two-chamber, rocking device with separate gas and liquid chambers joined by two tubes and microvalves. The gas chamber was equipped with a pressure gauge. After evacuation, gas and deaerated solvent were separately charged, and then contacted by opening the microvalves and by rocking. The solubility was calculated from a knowledge of the volume of the solvent charged, and the initial and final gas pressures.

The solvent was considered non-volatile and the gas pressure was considered to be the total pressure.

SOURCE AND PURITY OF MATERIALS:

1. Source and purity not given. Gas purified by low temperature fractionation and analyzed by gas chromatography.
2. Source and purity not given. Refractive index measured:

$n_D^{20} = 1.5560$

ESTIMATED ERROR:

δT/K = 0.05

$\delta x_1/x_1$ = 0.05

(estimated by compiler)

REFERENCES:

COMPONENTS:

(1) Propane; C_3H_6; [115-07-1]

(2) Benzenamine, (Aniline); C_6H_7N; [62-53-3]

ORIGINAL MEASUREMENTS:

Lenoir, J-Y.; Renault, P.; Renon, H.

J. Chem. Eng. Data 1971, *16*, 340-2

VARIABLES:

T/K: 298.15

P/kPa: 101.3

PREPARED BY:

C.L. Young

EXPERIMENTAL VALUES:

T/K	Henry's constant $H_{C_3H_6}$/atm	Mole fraction at 1 atm* $x_{C_3H_6}$
298.15	43.5	0.0230

* Calculated by compiler assuming a linear function of $p_{C_3H_6}$ vs $x_{C_3H_6}$, i.e. $x_{C_3H_6}$ (1 atm) = $1/H_{C_3H_6}$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

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

SOURCE AND PURITY OF MATERIALS:

(1) L'Air Liquide sample; minimum purity 99.9 mole per cent.

(2) Touzart and Matignon or Serlabo sample; purity 99 mole per cent.

ESTIMATED ERROR:

$\delta T/K = \pm 0.1$; $\delta H/\text{atm} = \pm 6\%$ (estimated by compiler).

REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Propane; C_3H_8; [74-98-6] (2) Cyclohexylamine; $C_6H_{13}N$; [108-91-8]	Keevil, T.A.; Taylor, D.R. Streitwieser, A. *J. Chem. Eng. Data.* 1978, *23*, 237-239.

VARIABLES:	PREPARED BY:
T/K: 298.4-313.1 P/kPa: 101.325	C.L. Young

EXPERIMENTAL VALUES:

Partial pressure of propane = 1 atm = 101.3 kPa.

T/K	Mole fraction of propane, $x_{C_3H_8}$
298.4	0.0537
303.2	0.0497
308.1	0.0455
313.1	0.0421

$$\log x_{C_3H_8} = 11.368 - 5.107 \log (T/K)$$

Std. dev. = 0.0015.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Volumetric apparatus of moderate accuracy. Solvent confined to glass bulb and known amount of gas added. Pressure measured using a mercury manometer together with a null point manometer in which the gas pressure was balanced by dry air. Details in source.

SOURCE AND PURITY OF MATERIALS:

1. No details given
2. Degassed and dried over lithium cyclohexylamide.

ESTIMATED ERROR:

$\delta T/K = \pm 0.1$; $\delta x_{C_3H_8} = \pm 1\%$

REFERENCES:

COMPONENTS:

(1) Propane; C_3H_8; [74-98-6]

(2) Benzenamine, (Aniline); C_6H_7N; [62-53-3]

ORIGINAL MEASUREMENTS:

Lenoir, J-Y.; Renault, P.; Renon, H.

J. Chem. Eng. Data 1971, *16*, 340-2

VARIABLES:

T/K: 298

P/kPa: 101.3

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	Henry's constant $H_{C_3H_8}$/atm	Mole fraction at 1 atm* $x_{C_3H_8}$
298	70.5	0.0142

* Calculated by compiler assuming a linear function of $p_{C_3H_8}$ vs $x_{C_3H_8}$, i.e., $x_{C_3H_8}$(1 atm) = $1/H_{C_3H_8}$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

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

SOURCE AND PURITY OF MATERIALS:

(1) L'Air Liquide sample; minimum purity 99.9 mole per cent.

(2) Touzart and Matignon or Serlabo sample; purity 99 mole per cent.

ESTIMATED ERROR:

δT/K = ±0.1; δH/atm = ±6% (estimated by compiler).

REFERENCES:

COMPONENTS:

(1) Propane; C_3H_8; [74-98-6]

(2) 1-Phenylethanone (acetophenone); C_8H_8O; [98-86-2]
Nitrobenzene; $C_6H_5NO_2$; [98-95-3]

ORIGINAL MEASUREMENTS:

Gerrard, W.
J. Appl. Chem. Biotechnol.
1973, *23*, 1-17.

VARIABLES:

T/K: 283.2, 293.2
P/kPa: 101.3

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

Total pressure = 101.3 kPa

T/K	Mole ratio	Mole fraction of propane[#]
	Nitrobenzene; $C_6H_5NO_2$; [98-95-3]	
283.2	0.034	0.033
293.2	0.0279	0.0271
	1-Phenylethanone; C_8H_8O; [98-86-2]	
293.2	0.0284	0.0276

[#] Calculated by compiler.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Gas was passed into a known weight of pure liquid in a bubbler tube at a total pressure measured using a manometer assembly. The amount of absorbed gas was estimated by weighing. The temperature was controlled to within 0.2 K. The apparatus and procedure are described by Gerrard, ref. (1).

SOURCE AND PURITY OF MATERIALS:

No details given except that "all compounds were purified by conventional procedures".

ESTIMATED ERROR:

$\delta T/K = \pm 0.1$; $\delta x/x = \pm 3\%$
(estimated by compiler).

REFERENCES:

1. Gerrard, W.
J. Appl. Chem. Biotechnol.
1972, *22*, 623.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Propane; C_3H_8; [74-98-6] (2) Quinoline; C_9H_7N; [91-22-5] or Benzenamine; C_6H_7N; [62-53-3]	Gerrard, W. *J. Appl. Chem. Biotechnol.* 1973, *23*, 1-17.
VARIABLES: *T*/K: 268.2-298.2 *P*/kPa: 101.3	PREPARED BY: C. L. Young

EXPERIMENTAL VALUES:

Total pressure = 101.3 kPa

T/K	Mole ratio	Mole fraction of propane#
	Quinoline; C_9H_7N; [91-22-5]	
293.2	0.0242	0.0236
	Benzenamine; C_6H_7N; [62-53-3]	
268.2	0.0176	0.0173
298.2	0.0126	0.0124

Calculated by compiler.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Gas was passed into a known weight of pure liquid in a bubbler tube at a total pressure measured using a manometer assembly. The amount of absorbed gas was estimated by weighing. The temperature was controlled to within 0.2 K. The apparatus and procedure are described by Gerrard, ref. (1).

SOURCE AND PURITY OF MATERIALS:

No details given except that "all compounds were purified by conventional procedures".

ESTIMATED ERROR:

$\delta T/K = \pm 0.1$; $\delta x/x = \pm 3\%$
(estimated by compiler).

REFERENCES:

1. Gerrard, W.
J. Appl. Chem. Biotechnol.
1972, *22*, 623.

COMPONENTS:

(1) Propane; C_3H_8; [74-98-6]

(2) Hexamethylphosphoric triamide; $C_6H_{18}N_3OP$; [680-31-9]

ORIGINAL MEASUREMENTS:

Lenoir, J.-Y.; Renault, P.; Renon, H.

J. Chem. Eng. Data 1971, *16*, 340-2.

VARIABLES:

T/K: 298.2

P/kPa: 101.3

PREPARED BY:

C.L. Young

EXPERIMENTAL VALUES:

T/K	Henry's constant $H_{C_3H_8}$/atm	Mole fraction at 1 atm* $x_{C_3H_8}$
298.2	19.9	0.0503

* Calculated by compiler assuming a linear function of $p_{C_3H_8}$ vs $x_{C_3H_8}$, i.e., $x_{C_3H_8}$(1 atm) = $1/H_{C_3H_8}$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

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

SOURCE AND PURITY OF MATERIALS:

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

ESTIMATED ERROR:

δT/K = ±0.1; δH/atm = ±6%

(estimated by compiler).

REFERENCES:

COMPONENTS:

(1) Propane; C_3H_8; [74-98-6]

(2) Benzonitrile; C_7H_5N; [100-47-0]

ORIGINAL MEASUREMENTS:

Gerrard, W.

J. Appl. Chem. Biotechnol.

1973, *23*, 1-17.

VARIABLES:

T/K: 268.2-298.2

P/kPa: 101.3

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

Total pressure = 101.3 kPa

T/K	Mole ratio	Mole fraction of propane[#]
268.2	0.085	0.0783
273.2	0.0705	0.0659
278.2	0.0612	0.0577
283.2	0.0518	0.0492
293.2	0.0426	0.0409
298.2	0.0390	0.0375

[#] Calculated by compiler.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Gas was passed into a known weight of pure liquid in a bubbler tube at a total pressure measured using a manometer assembly. The amount of absorbed gas was estimated by weighing. The temperature was controlled to within 0.2 K. The apparatus and procedure are described by Gerrard, ref. (1).

SOURCE AND PURITY OF MATERIALS:

No details given except that "all compounds were purified by conventional procedures".

ESTIMATED ERROR:

$\delta T/K = \pm 0.1$; $\delta x/x = \pm 3\%$

(estimated by compiler).

REFERENCES:

1. Gerrard, W.
   J. Appl. Chem. Biotechnol.
   1972, *22*, 623.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Propane; C_3H_8; [74-98-6] (2) *N*-Methylbenzenamine (*N*-methylaniline); C_7H_9N; [100-61-8]	Gerrard, W. *J. Appl. Chem. Biotechnol.* 1973, *23*, 1-17.
VARIABLES: *T*/K: 268.2-298.2 *P*/kPa: 101.3	PREPARED BY: C. L. Young

EXPERIMENTAL VALUES:

Total pressure = 101.3 kPa

T/K	Mole ratio	Mole fraction of propane#
268.2	0.055	0.052
273.2	0.0471	0.0450
278.2	0.0415	0.0398
283.2	0.0372	0.0359
293.2	0.0310	0.0301
298.2	0.0274	0.0267

Calculated by compiler.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Gas was passed into a known weight of pure liquid in a bubbler tube at a total pressure measured using a manometer assembly. The amount of absorbed gas was estimated by weighing. The temperature was controlled to within 0.2 K. The apparatus and procedure are described by Gerrard, ref. (1).

SOURCE AND PURITY OF MATERIALS:

No details given except that "all compounds were purified by conventional procedures".

ESTIMATED ERROR:

$\delta T/K = \pm 0.1$; $\delta x/x = \pm 3\%$ (estimated by compiler).

REFERENCES:

1. Gerrard, W. *J. Appl. Chem. Biotechnol.* 1972, *22*, 623.

COMPONENTS:

(1) Propane; C_3H_8; [74-98-6]

(2) *N,N*-Dimethylbenzenamine (*N,N-Dimethylaniline*); $C_8H_{11}N$; [121-69-7]
or Benzenemethanamine (*Benzylamine*); C_7H_9N; [100-46-9]

ORIGINAL MEASUREMENTS:

Gerrard, W.

J. Appl. Chem. Biotechnol. 1973, *23*, 1-17.

VARIABLES:

T/K: 278.2-298.2

P/kPa: 101.3

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

Total pressure = 101.3 kPa

T/K	Mole ratio	Mole fraction of propane#
	N,N-Dimethylbenzenamine; $C_8H_{11}N$; [121-69-7]	
278.2	0.070	0.065
293.2	0.0610	0.0575
	Benzenemethanamine; C_7H_9N; [100-46-9]	
273.2	0.046	0.044
278.2	0.042	0.040
283.2	0.0365	0.0352
293.2	0.0318	0.0308
298.2	0.030	0.0291

Calculated by compiler.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Gas was passed into a known weight of pure liquid in a bubbler tube at a total pressure measured using a manometer assembly. The amount of absorbed gas was estimated by weighing. The temperature was controlled to within 0.2 K. The apparatus and procedure are described by Gerrard, ref. (1).

SOURCE AND PURITY OF MATERIALS:

No details given except that "all compounds were purified by conventional procedures".

ESTIMATED ERROR:

$\delta T/K = \pm 0.1$; $\delta x/x = \pm 3\%$ (estimated by compiler).

REFERENCES:

1. Gerrard, W. *J. Appl. Chem. Biotechnol.* 1972, *23*, 623.

COMPONENTS:

(1) Propane; C_3H_8; [74-98-6]
(2) 1-Octanamine; $C_8H_{19}N$; [111-86-4]

ORIGINAL MEASUREMENTS:

Gerrard, W.
J. Appl. Chem. Biotechnol.
1973, *23*, 1-17.

VARIABLES:

T/K: 268.2-293.2
P/kPa: 101.3

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

Total pressure = 101.3 kPa

T/K	Mole ratio	Mole fraction of propane[#]
268.2	0.250	0.200
273.2	0.217	0.178
278.2	0.184	0.155
283.2	0.161	0.139
293.2	0.125	0.111

[#] Calculated by compiler.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Gas was passed into a known weight of pure liquid in a bubbler tube at a total pressure measured using a manometer assembly. The amount of absorbed gas was estimated by weighing. The temperature was controlled to within 0.2 K. The apparatus and procedure are described by Gerrard, ref. (1).

SOURCE AND PURITY OF MATERIALS:

No details given except that "all compounds were purified by conventional procedures".

ESTIMATED ERROR:

$\delta T/K = \pm 0.1$; $\delta x/x = \pm 3\%$
(estimated by compiler).

REFERENCES:

1. Gerrard, W.
J. Appl. Chem. Biotechnol.
1972, *22*, 623.

COMPONENTS:

(1) Butane; C_4H_{10}; [106-97-8]

(2) *N,N*-Dimethylformamide; C_3H_7NO; [68-12-2]

ORIGINAL MEASUREMENTS:

Gerrard, W.

J. Appl. Chem. Biotechnol. 1973, *23*, 1-17.

VARIABLES:

T/K: 278.2-293.2

P/kPa: 101.3

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

Total pressure = 101.3 kPa

T/K	Mole ratio	Mole fraction of butane[#]
278.2	0.105	0.0950
283.2	0.0725	0.0676
293.2	0.050	0.0476

[#] Calculated by compiler.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Gas was passed into a known weight of pure liquid in a bubbler tube at a total pressure measured using a manometer assembly. The amount of absorbed gas was estimated by weighing. The temperature was controlled to within 0.2 K. The apparatus and procedure are described by Gerrard, ref. (1).

SOURCE AND PURITY OF MATERIALS:

No details given except that "all compounds were purified by conventional procedures".

ESTIMATED ERROR:

$\delta T/K = \pm 0.1$; $\delta x/x = \pm 3\%$ (estimated by compiler).

REFERENCES:

1. Gerrard, W. *J. Appl. Chem. Biotechnol.* 1972, *22*, 623.

COMPONENTS:

(1) Butane; C_4H_8; [106-97-8]

(2) 1-Methyl-2-pyrrolidinone ; C_5H_9NO; [872-50-4]

ORIGINAL MEASUREMENTS:

Lenoir, J-Y.; Renault, P.; Renon, H.

J. Chem. Eng. Data 1971, *16*, 340-2

VARIABLES:

T/K: 298.15

P/kPa: 101.3

PREPARED BY:

C.L. Young

EXPERIMENTAL VALUES:

T/K	Henry's Constant $H_{C_4H_{10}}$/atm	Mole fraction at 1 atm* $x_{C_4H_{10}}$
298.15	18.4	0.0543

* Calculated by compiler assuming a linear function of $p_{C_4H_{10}}$ vs $x_{C_4H_{10}}$, i.e. $x_{C_4H_{10}}$ (1 atm) = $1/H_{C_4H_{10}}$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

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

SOURCE AND PURITY OF MATERIALS:

(1) L'Air Liquide sample; minimum purity, 99.9 mole per cent.

(2) Touzart and Matignon or Serlabo sample; purity 99 mole per cent.

ESTIMATED ERROR:

$\delta T/K = \pm 0.1$; $\delta H/\text{atm} = \pm 6\%$ (estimated by compiler).

REFERENCES:

COMPONENTS:

(1) Butane; C_4H_{10}; [106-97-8]

(2) Hexamethylphosphoric triamide, $C_6H_{18}N_3OP$; [680-31-9]

ORIGINAL MEASUREMENTS:

Lenoir, J.-Y.; Renault, P.; Renon, H.

J. Chem Eng. Data 1971, *16*, 340-2.

VARIABLES:

T/K: 298.2

P/kPa: 101.3

PREPARED BY:

C.L. Young

EXPERIMENTAL VALUES:

T/K	Henry's constant C_4H_{10}/atm	Mole fraction at 1 atm* C_4H_{10}
298.2	6.09	0.164

* Calculated by compiler assuming a linear function of $p_{C_4H_{10}}$ vs $x_{C_4H_{10}}$, i.e., $x_{C_4H_{10}}(1\text{atm}) = 1/H_{C_4H_{10}}$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

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

SOURCE AND PURITY OF MATERIALS:

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

ESTIMATED ERROR:

δT/K = ±0.1; δH/atm = ±6% (estimated by compiler).

REFERENCES:

COMPONENTS: (1) Butane; C_4H_{10}; [106-97-8] (2) Quinoline; C_9H_7N; [91-22-5] or Benzenamine; C_6H_7N; [62-53-3]	ORIGINAL MEASUREMENTS: Gerrard, W. *J. Appl. Chem. Biotechnol.* 1973, *23*, 1-17.
VARIABLES: *T*/K: 278.2 *P*/kPa: 101.3	PREPARED BY: C. L. Young

EXPERIMENTAL VALUES:

Total pressure = 101.3 kPa

T/K	Mole ratio	Mole fraction of butane[#]
	Quinoline; C_9H_7N; [91-22-5]	
278.2	0.333	0.250
	Benzenamine; C_6H_7N; [62-53-3]	
278.2	0.074	0.0689

[#] Calculated by compiler.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Gas was passed into a known weight of pure liquid in a bubbler tube at a total pressure measured using a manometer assembly. The amount of absorbed gas was estimated by weighing. The temperature was controlled to within 0.2 K. The apparatus and procedure are described by Gerrard, ref. (1).

SOURCE AND PURITY OF MATERIALS:

No details given except that "all compounds were purified by conventional procedures".

ESTIMATED ERROR:

$\delta T/K = \pm 0.1$; $\delta x/x = \pm 3\%$
(estimated by compiler).

REFERENCES:

1. Gerrard, W.
J. Appl. Chem. Biotechnol.
1972, *22*, 623.

COMPONENTS:

(1) Butane; C_4H_{10}; [106-97-8]

(2) Benzenamine,(Aniline); C_6H_7N; [62-53-3]

ORIGINAL MEASUREMENTS:

Lenoir, J-Y.; Renault, P.; Renon, H.

J. Chem. Eng. Data 1971, *16*, 340-2

VARIABLES:

T/K: 298.2

P/kPa: 101.3

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	Henry's constant $H_{C_4H_{10}}$/atm	Mole fraction at 1 atm* $x_{C_4H_{10}}$
298.2	25.3	0.0395

* Calculated by compiler assuming a linear function of $p_{C_4H_{10}}$ vs $x_{C_4H_{10}}$, i.e., $x_{C_4H_{10}}$(1 atm) = $1/H_{C_4H_{10}}$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

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

SOURCE AND PURITY OF MATERIALS:

(1) L'Air Liquide sample; minimum purity 99.9 mole per cent.

(2) Touzart and Matignon or Serlabo sample; purity 99 mole per cent.

ESTIMATED ERROR:

$\delta T/K = \pm 0.1$; $\delta H/\text{atm} = \pm 6\%$ (estimated by compiler).

REFERENCES:

COMPONENTS:

(1) Butane; C_4H_{10}; [106-97-8]

(2) Nitrobenzene; $C_6H_5NO_2$; [98-95-3]

1-Methyl-2-nitrobenzene; $C_7H_7NO_2$; [88-72-2]

ORIGINAL MEASUREMENTS:

Gerrard, W.

J. Appl. Chem. Biotechnol. 1973, *23*, 1-17.

VARIABLES:

T/K: 278.2-298.2

P/kPa: 101.3

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

Total pressure = 101.3 kPa

T/K	Mole ratio	Mole fraction of butane[#]
	Nitrobenzene; $C_6H_5NO_2$; [98-95-3]	
278.2	0.244	0.196
283.2	0.166	0.142
293.2	0.100	0.0909
	1-Methyl-2-nitrobenzene; $C_7H_7NO_2$; [88-72-2]	
278.2	0.376	0.273
283.2	0.269	0.212
293.2	0.170	0.145
298.2	0.147	0.128

[#] Calculated by compiler.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Gas was passed into a known weight of pure liquid in a bubbler tube at a total pressure measured using a manometer assembly. The amount of absorbed gas was estimated by weighing. The temperature was controlled to within 0.2 K. The apparatus and procedure are described by Gerrard, ref. (1).

SOURCE AND PURITY OF MATERIALS:

No details given except that "all compounds were purified by conventional procedures".

ESTIMATED ERROR:

$\delta T/K = \pm 0.1$; $\delta x/x = \pm 3\%$ (estimated by compiler).

REFERENCES:

1. Gerrard, W. *J. Appl. Chem. Biotechnol.* 1972, *22*, 623.

COMPONENTS:

(1) Butane; C_4H_{10}; [106-97-8]

(2) Benzonitrile; C_7H_5N; [100-47-0]

Benzenemethanamine (*Benzylamine*); C_7H_9N; [100-46-9]

ORIGINAL MEASUREMENTS:

Gerrard, W.

J. Appl. Chem. Biotechnol. 1973, *23*, 1-17.

VARIABLES:

T/K: 278.2-298.2

P/kPa: 101.3

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

Total pressure = 101.3 kPa

T/K	Mole ratio	Mole fraction of butane[#]
	Benzonitrile; C_7H_5N; [100-47-0]	
278.2	0.420	0.296
283.2	0.227	0.185
293.2	0.139	0.122
298.2	0.125	0.111
	Benzenemethanamine; C_7H_9N; [100-46-9]	
278.2	0.330	0.248
283.2	0.195	0.163
293.2	0.121	0.108
298.2	0.104	0.0942

[#] Calculated by compiler.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Gas was passed into a known weight of pure liquid in a bubbler tube at a total pressure measured using a manometer assembly. The amount of absorbed gas was estimated by weighing. The temperature was controlled to within 0.2 K. The apparatus and procedure are described by Gerrard, ref. (1).

SOURCE AND PURITY OF MATERIALS:

No details given except that "all compounds were purified by conventional procedures".

ESTIMATED ERROR:

$\delta T/K = \pm 0.1$; $\delta x/x = \pm 3\%$ (estimated by compiler).

REFERENCES:

1. Gerrard, W. *J. Appl. Chem. Biotechnol.* 1972, *22*, 623.

COMPONENTS:

(1) Butane; C_4H_{10}; [106-97-8]

(2) *N*-Methylbenzenamine (*N-methylaniline*); C_7H_9N; [100-61-8]

or *N*,*N*-Dimethylbenzenamine (*N,N-dimethylaniline*); $C_8H_{11}N$; [121-69-7]

ORIGINAL MEASUREMENTS:

Gerrard, W.

J. Appl. Chem. Biotechnol.

1973, *23*, 1-17.

VARIABLES:

T/K: 278.2-298.2

P/kPa: 101.3

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

Total pressure = 101.3 kPa

T/K	Mole ratio	Mole fraction of butane#
	N-Methylbenzenamine; C_7H_9N; [100-61-8]	
278.2	0.351	0.260
283.2	0.190	0.160
293.2	0.116	0.104
298.2	0.103	0.0934
	N,*N*-Dimethylbenzenamine; $C_8H_{11}N$; [121-69-7]	
278.2	1.94	0.660
283.2	0.662	0.398
293.2	0.290	0.225
298.2	0.185	0.156

Calculated by compiler.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Gas was passed into a known weight of pure liquid in a bubbler tube at a total pressure measured using a manometer assembly. The amount of absorbed gas was estimated by weighing. The temperature was controlled to within 0.2 K. The apparatus and procedure are described by Gerrard, ref. (1).

SOURCE AND PURITY OF MATERIALS:

No details given except that "all compounds were purified by conventional procedures".

ESTIMATED ERROR:

$\delta T/K = \pm 0.1$; $\delta x/x = \pm 3\%$ (estimated by compiler).

REFERENCES:

1. Gerrard, W. *J. Appl. Chem. Biotechnol.* 1972, *22*, 623.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Butane; C_4H_{10}; [106-97-8] (2) 1-Octanamine; $C_8H_{19}N$; [111-86-4]	Gerrard, W. *J. Appl. Chem. Biotechnol.* 1973, *23*, 1-17.
VARIABLES:	**PREPARED BY:**
T/K: 278.2-293.2 P/kPa: 101.3	C. L. Young

EXPERIMENTAL VALUES:

Total pressure = 101.3 kPa

T/K	Mole ratio	Mole fraction of butane[#]
278.2	2.83	0.739
283.2	1.33	0.571
293.2	0.625	0.385

[#] Calculated by compiler.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Gas was passed into a known weight of pure liquid in a bubbler tube at a total pressure measured using a manometer assembly. The amount of absorbed gas was estimated by weighing. The temperature was controlled to within 0.2 K. The apparatus and procedure are described by Gerrard, ref. (1).

SOURCE AND PURITY OF MATERIALS:

No details given except that "all compounds were purified by conventional procedures".

ESTIMATED ERROR:

$\delta T/K = \pm 0.1$; $\delta x/x = \pm 3\%$ (estimated by compiler).

REFERENCES:

1. Gerrard, W. *J. Appl. Chem. Biotechnol.* 1972, *22*, 623.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) 2-Methylpropane; (isobutane); C_4H_{10}; [75-28-5] (2) 1-Methyl-2-pyrrolidinone; C_5H_9NO; [872-50-4]	Lenoir, J-Y.; Renault, P.; Renon, H. *J. Chem. Eng. Data* 1971, *16*, 340-2
VARIABLES: T/K: 298.15 P/kPa: 101.3	PREPARED BY: C.L. Young

EXPERIMENTAL VALUES:

T/K	Henry's Constant $H_{C_4H_{10}}$/atm	Mole fraction at 1 atm* $x_{C_4H_{10}}$
298.15	33.3	0.0300

* Calculated by compiler assuming a linear function of $p_{C_4H_{10}}$ vs $x_{C_4H_{10}}$, ie. $x_{C_4H_{10}}$ (1 atm) = $1/H_{C_4H_{10}}$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

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

SOURCE AND PURITY OF MATERIALS:

(1) L'Air Liquide sample; minimum purity 99.9 mole per cent.

(2) Touzart and Matignon or Serlabo sample; purity 99 mole per cent.

ESTIMATED ERROR:

δT/K = ±0.1; δH/atm = ±6% (estimated by compiler).

REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) 2-Methylpropane, (isobutane); C_4H_{10}; [75-28-5] (2) Nitrobenzene; $C_6H_5NO_2$; [98-95-3]	Gerrard, W. *Solubility of Gases and Liquids, Plenum, New York,* 1976, Chapter 12.
VARIABLES: T/K: 273.15 P/kPa: 13.3-101.3	PREPARED BY: C.L. Young

EXPERIMENTAL VALUES:

T/K	P/mmHg	P/kPa	Mole fraction of 2-methyl propane in liquid, $x_{C_4H_{10}}$
273.15	100	13.3	0.012
	200	26.7	0.027
	300	40.0	0.041
	400	53.3	0.053
	500	66.7	0.068
	600	80.0	0.087
	700	93.3	0.111
	760	101.3	0.134

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Gas was passed into a known weight of pure liquid in a bubbler tube at a total pressure measured by a manometer assembly. The amount of absorbed gas was estimated by weighing. The temperature was manually controlled to within 0.2K. The apparatus and procedure are described by Gerrard (1,2).

SOURCE AND PURITY OF MATERIALS:

No details given.

ESTIMATED ERROR:

$\delta T/K = \pm 0.1$; $\delta x/x = \pm 3\%$

(estimated by compiler).

REFERENCES:

1. Gerrard, W.
J. Appl. Chem. Biotechnol. 1972 *22*, 623-650.

2. Gerrard, W.
Solubility of Gases and Liquids, Plenum Press, New York, 1976 Chapter 1.

COMPONENTS:

(1) 2-Methylpropane (isobutane); C_4H_{10}; [75-28-5]

(2) Nitrobenzene; $C_6H_5NO_2$; [98-95-3]

ORIGINAL MEASUREMENTS:

Ezheleva, A.E.; Zorin, A.D.

Tr. Khim. Khim. Tech. (Gorkii) 1961, *1*, 37-40.

VARIABLES:

T/K: 303.15-343.15

P/kPa: 101.325 and above

PREPARED BY:

W. Hayduk

EXPERIMENTAL VALUES:

T/K	Ostwald Coefficient[2] $L/\mathrm{cm^3\,cm^{-3}}$	Bunsen Coefficient[2] $\alpha/\mathrm{cm^3(STP)\,cm^{-3}\,atm^{-1}}$	Mole Fraction[1] x_1
303.15	12.3	10.9	0.0495(0.0501)[3]
313.15	11.6	9.97	0.0455(0.0435)
323.15	9.40	7.80	0.0360(0.0364)
333.15	7.76	6.23	0.0290(0.0296)
343.15	6.53	5.08	0.0238(0.0234)

[1] Original data given as the inverse of Henry's constant which is equivalent to mole fraction at a gas partial pressure of 101.325 kPa.

[2] Ostwald and Bunsen coefficients calculated by compiler using authors' assumption that solvent is non-volatile.

[3] From equation of smoothed data:

$$\ln x_1 = 293.07 - 44.650 \ln T - 12405.7/T$$

Correlation coefficient = 0.9947

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The apparatus consisted of a two-chamber, rocking device with separate gas and liquid chambers joined by two tubes and microvalves. The gas chamber was equipped with a pressure gauge. After evacuation, gas and deaerated solvent were separately charged, and then contacted by opening the microvalves and by rocking. The solubility was calculated from a knowledge of the volume of the solvent charged, and the initial and final gas pressures.

The solvent was considered non-volatile and the gas pressure was considered to be the total pressure.

SOURCE AND PURITY OF MATERIALS:

1. Source and purity not given. Gas purified by low temperature fractionation and analyzed by gas chromatography.
2. Source and purity not given. Refractive index measured:

   $n_D^{20} = 1.5560$

ESTIMATED ERROR:

δT/K = 0.05

$\delta x_1/x_1$ = 0.05

(estimated by compiler)

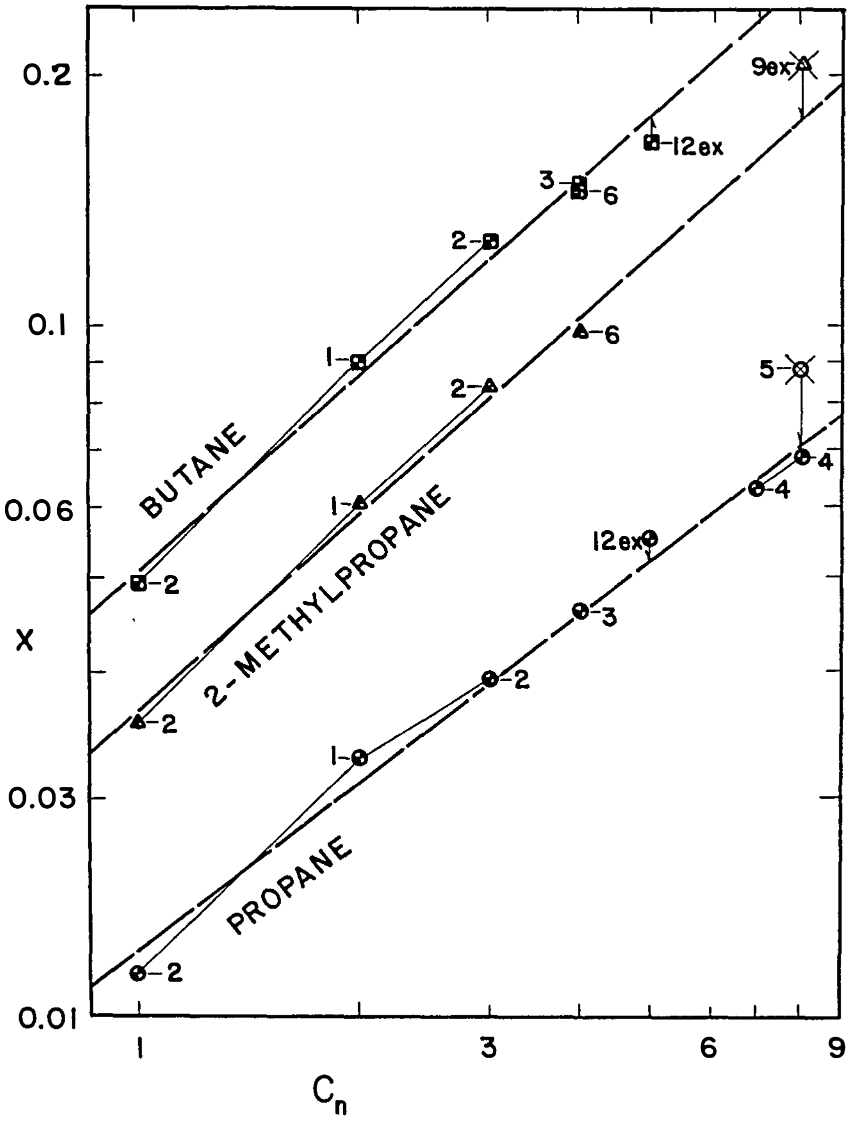
REFERENCES:

COMPONENTS:	EVALUATOR:
(1) Propane: C_3H_8; [74-98-6] Butane; C_4H_{10}; [106-97-8] 2-Methylpropane; C_4H_{10}; [75-28-5] (2) Alcohols	Walter Hayduk Department of Chemical Engineering University of Ottawa Ottawa, Canada K1N 9B4 January, 1984

CRITICAL EVALUATION:

Nine groups of workers have reported solubilities of *propane*, *butane* and *2-methylpropane* in normal alcohols from methanol to octanol. In spite of the scarcity, there is a relatively high consistency for the data for all three gases. The sources of the data are listed separately for each gas; for *propane*: methanol (2), ethanol (1,10), butanol (3), heptanol (4) and octanol (4,5). The solubilities of *propane* in 2-propanol (2) and in 3-methyl-1-butanol (12) are compared with those in the normal alcohols. For *butane*: methanol (2,11), ethanol (1,13), butanol (3,6), and octanol (5). The solubilities of *butane* in 2-propanol (2) and 3-methyl-1-butanol (12) are also compared with those in the normal alcohols. Finally, for *2-methylpropane*: methanol (2,11), ethanol (1), butanol (6), and octanol (9). These latter solubilities are compared with those in 2-propanol (2).

Solubilities in normal alcohols at 298.15 K



COMPONENTS:	EVALUATOR:
(1) Propane; C_3H_8; [74-98-6] Butane; C_4H_{10}; [106-97-8] 2-Methylpropane; C_4H_{10} [75-28-5] (2) Alcohols	Walter Hayduk Department of Chemical Engineering University of Ottawa Ottawa, Canada K1N 9B4 January, 1984

CRITICAL EVALUATION: continued

Solubilities for the three gases are shown for a temperature of 298.15 K and a gas partial pressure of 101.325 kPa in the diagram above in which the mole fraction solubility, x, and the number of carbon atoms in the solvent, C_n, are shown on logarithmic scales. This method of obtaining a linear relation for solubilities in alcohols was previously used by Boyer and Bircher (14). It may be observed that the solubilities of all three gases in the tertiary alcohol 2-propanol (2), are completely consistent with the solubilities in the normal alcohols. Surprisingly, the early data of Friedel and Gorgeu (12) for *propane* and *butane* solubilities in 3-methyl-1-butanol correspond reasonably well to the expected solubilities in an alcohol of $C_n = 5$, and are classified as tentative. On the other hand, the early data of Frankland (13) and Lebeau (10,11), although of historic interest, are all very much too low and are rejected. The solubilities of Gerrard (5,9) for *propane* and *butane* in octanol are both estimated to be at least 20% too high and are also rejected. The remaining data are classified as tentative (1,2,3,4,6). These latter data were used to determine regression lines (on logarithmic scales) for the three gases. Included were the solubilities in 2-propanol of Kretschmer and Wiebe (2).

For *propane*:

$x_{C_3} = 0.01230\ C_n^{0.7774}$ Correlation coefficient = 0.997

For *butane*:

$x_{C_4} = 0.04131\ C_n^{0.9053}$ Correlation coefficient = 0.996

For *2-methylpropane*:

$x_{iC_4} = 0.02625\ C_n^{0.9128}$ Correlation coefficient = 0.997

The above equations are represented as dashed lines in the diagram.

Three groups of workers have reported solubilities of *propane*, *butane* and *2-methylpropane* in other alcohol solvents. The sources are listed separately for each gas; for *propane*: in 1,2-ethanediol (ethylene glycol) (7), 2-ethoxyethanol (ethylcellosolve) (8), oxybispropanol (dispropylene glycol) (7), phenol (7) and benzenemethanol (benzyl alcohol) (5,7), for *butane*: in 1,2-ethanediol (5), oxybispropanol (7), phenol (7), benzenemethanol (7) and 1,2,3-propanetriol (glycerol) (5), and for *2-methylpropane*: in 1,2-ethanediol (7), 2-ethoxyethanol (8), phenol (7), benzenemethanol (9) and oxybispropanol (7). Unfortunately none of the above data is considered reliable enough to warrant classification as tentative; instead, they are all classified as doubtful for reasons that are discussed below. These data appear generally too high by an amount ranging from 5% to several factors and are considered of qualitative value only.

An explanation for the above classification follows. In the Critical Evaluation of the solubilities of *Ethane* in polar solvents (15) it was possible to directly compare some of the Lenoir et al. data (7) with those of four other workers. It was found that the Lenoir et al. data were from 6% to 46% higher than those of the other workers. The data in question here are from the same paper. In addition it was possible to compare hydrogen-bonding factors in 1-2-ethanediol for all

COMPONENTS:	EVALUATOR:
(1) Propane; C_3H_8; [74-98-6] Butane; C_4H_{10}; [106-97-8] 2-methylpropane; C_4H_{10}; [75-28-5] (2) Alcohols	Walter Hayduk Department of Chemical Engineering University of Ottawa Ottawa, Canada K1N 9B4 January, 1984

CRITICAL EVALUATION: continued

three gases (5,7) with those of several other gases which formed a consistent relation on a hydrogen-bonding factor diagram (16). For all three gases, the indicated solubilities yielded hydrogen-bonding factors much higher (> 20%) than expected. Although by no means conclusive by itself, this test is often effective in discerning inaccurate data. Hence, although copious, the data of Lenoir et al. (7) are classified as doubtful. In the first part of this Critical Evaluation, the data of Gerrard for the solubility of *propane* and *butane* in octanol (5) were considered to be too high by at least 20%. It is expected that while this order of error may be present for the solubility of *propane* in benzenemethanol, that it is probably much higher in the reported solubility of *butane* in 1,2-ethanediol. Most hydrocarbon gases have a very low solubility in the highly polar 1,2-ethanediol so that the relatively high solubility indicated by Gerrard (5) appears several factors too high. Again sufficient doubt is associated with these data to warrant classification as doubtful. Finally, some doubt is also cast on the solubilities of Ezheleva and Zorin (8,in Russian) on examination of an example given in their paper explaining the method of data treatment. The example shows a linear plot of mole fraction solubility versus different values of gas partial pressure. When the resulting lines are extrapolated to zero partial pressure, they do not pass through the origin even approximately, but were nonetheless, apparently (incorrectly) used to evaluate Henry's law constants. If a similar method was followed in the calculation for other gas solubilities, large errors would have resulted. Hence, there appears to be reason to doubt the accuracy of the data for *propane* and *2-methylpropane* in 2-ethoxyethanol (8).

References

1. Kretschmer, C.B.; Wiebe, R. *J. Am. Chem. Soc.* 1951, *73*, 3778-3781.
2. Kretschmer, C.B.; Wiebe, R. *J. Am. Chem. Soc.* 1952, *74* 1276-1277.
3. Hayduk, W.; Castañeda, R. *Can. J. Chem. Eng.* 1973, *51*, 353-358.
4. Dim, A.; Gardner, G.R.; Ponter, A.B.; Wood, T. *J. Chem. Eng. Japan* 1971, *4*, 92-95.
5. Gerrard, W. *J. Appl. Chem. Biotechnol.* 1973, *23*, 1-17.
6. Blais, C.; Hayduk, W. *J. Chem. Eng. Data* 1983, *28*, 181-184.
7. Lenoir, J.-Y.; Renault, P.; Renon, H. *J. Chem. Eng. Data* 1971, *16*, 340-342.
8. Ezheleva, A.E.; Zorin, A.D. *Tr. Khim. Khim. Tech. (Gorkii)* 1961, *1*, 37-40.
9. Gerrard, W. *Solubility of Gases and Liquids, Plenum Press, New York,* 1976, *Chapter 1.*
10. Lebeau, P. *Comt. Rend.* 1905, *140*, 1454-1456 and 1572; *Bull. Soc. Chim.* [3] 1905, *33*, 1137-1139.
11. Lebeau, P. *Bull. Acad. Roy. Belg.* 1908, 300-304.

COMPONENTS:	EVALUATOR:
(1) Propane; C_3H_8; [74-98-6] Butane; C_4H_{10}; [106-97-8] 2-methylpropane; C_4H_{10};[75-28-5] (2) Alcohols	Walter Hayduk Department of Chemical Engineering University of Ottawa Ottawa, Canada K1N 9B4 January, 1984

CRITICAL EVALUATION: continued

12. Friedel, C.; Gorgeu, A. *Compt. rendu* 1908, *127*, 590-594.

13. Frankland, E. *J. Chem. Soc.* 1849, *2*, 263-296; *Leibig's Ann.* 1849, *71*, 171-213.

14. Boyer, F.L.; Bircher, L.J. *J. Phys. Chem.* 1960, *64*, 1330-1331.

15. Hayduk, W. Ed. *IUPAC Solubility Data Series, Ethane, Pergamon Press, Oxford, England* 1982, *9*, 195-199.

16. Short, I.; Sahgal, A.; Hayduk, W. *J. Chem. Eng. Data* 1983, *28*, 63-66.

COMPONENTS:

(1) Propane; C_3H_8; [74-98-6]

(2) Methanol; CH_4O; [67-56-1]

ORIGINAL MEASUREMENTS:

Kretschmer, C.B.; Wiebe, R.

J. Am. Chem. Soc. 1952, *74*, 1276-7.

VARIABLES:

T/K = 273.15-323.15

P/kPa = 11.86-101.27

PREPARED BY:

H.L. Clever

W. Hayduk

EXPERIMENTAL VALUES:

T/K	Pressure p/mm Hg Total[1]	Partial[2]	Mole fraction[1,2] $/x_1$	Ostwald Coefficient[2] $L/cm^3 cm^{-3}$	Bunsen Coefficient[2] $\alpha/cm^3(STP)cm^{-3}atm^{-1}$
273.15	756.4	727.9	0.02039		
		760.0	0.0213	12.1	12.1
298.15	464.0	339.3	0.004988		
	598.1	473.6	0.007040		
	759.6	635.4	0.009569		
		760.0	0.0115	6.88	6.37
323.15	758.4	346.2	0.003232		
		760.0	0.00709	4.46	3.73

[1] Original data.

[2] Calculations for 101.325 kPa (760 mm) were by compilers assuming Henry's law, and Raoult's law for solvent partial pressure.

Mole fractions at 101.325 kPa were used to determine the following equation for ln x_1 and table of smoothed values:

$\ln x_1 = 1942.9/T - 10.9689$ Correlation coefficient = 0.9998

T/K	x_1	T/K	x_1
273.15	0.0212	303.15	0.0105
283.15	0.0165	313.15	0.00853
293.15	0.0130	323.15	0.00704

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The apparatus was an all glass system which consisted of a monometer, gas handling system, gas buret and solubility bulb equipped with a magnetic stirrer.

The solubility bulb was evacuated and weighed. About 15 cm^3 of solvent was distilled into the bulb, the solvent degassed and the bulb reweighed.

A sample of hydrocarbon was condensed into a calibrated tube; it was vaporized into a known volume and the pressure measured. Equilibrium was established between the gas and the solvent. Pressure was again measured.

A detailed description of the apparatus and values of the gas molal volume and 2nd virial coefficient are in (1).

SOURCE AND PURITY OF MATERIALS:

(1) Phillips Petroleum Co., Research Grade. Specified 99.9 mole percent pure. Treated to remove dissolved gases and moisture.

(2) Source not given. Treated to remove acetone and aldehydes. Fractionated through a 50-plate column, dried with Mg, stored in a sealed container. Density at 25°C 0.78653 g cm^{-3}.

ESTIMATED ERROR:

$\delta T/K$ = 0.005

δp/mm Hg = 0.05

$\delta x_1/x_1$ = 0.005 (compilers)

REFERENCES:

1. Kretschmer, C.B.; Wiebe, R. *J. Am. Chem. Soc.* 1951, *73*, 3778.

COMPONENTS:

(1) Propane; C_3H_8; [74-98-6]

(2) Ethanol; C_2H_6O; [64-17-5]

ORIGINAL MEASUREMENTS:

Kretschmer, C.B.; Wiebe, R.

J. Am. Chem. Soc. 1951, *73*, 3778-81.

VARIABLES:

T/K = 273.15-323.15

P/kPa = 33.10-101.91

PREPARED BY:

H.L. Clever

W. Hayduk

EXPERIMENTAL VALUES:

T/K	Pressure P/mm Hg Total[1]	Partial[2]	Mole fraction[1,2] $/x_1$	Ostwald Coefficient[2] L/cm^{3}cm^{-3}	Bunsen Coefficient[2] α/cm^3(STP)cm^{-3}atm^{-1}
273.15	309.8	297.8	0.01497		
	532.0	520.1	0.02706		
	762.2	750.5	0.04054		
		760.0	0.0411	16.5	16.5
298.15	248.3	188.8	0.005089		
	427.5	368.3	0.01003		
	579.8	520.9	0.01434		
	755.3	696.7	0.01941		
		760.0	0.0228	9.55	8.71
323.15	412.0	191.1	0.003201		
	596.4	376.2	0.006349		
	764.4	544.9	0.009245		
		760.0	0.0129	5.67	4.75

continued

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The apparatus was an all-glass system which consisted of a manometer, gas handling system, gas buret and solubility bulb equipped with a magnetic stirrer.

The solubility bulb was evacuated and weighed. About 15 cm^3 of solvent was distilled into the bulb, the solvent degassed and the bulb reweighed.

A sample of hydrocarbon was condensed into a calibrated tube; it was vaporized into a known volume and the pressure measured. Equilibrium was established between the gas and the solvent. Pressure was again measured.

SOURCE AND PURITY OF MATERIALS:

(1) Phillips Petroleum Co. Research grade, 99.99 mole per cent. Removed dissolved air and moisture.

(2) Commercial absolute alcohol sample fractionated, treated with Mg ethylate, stored in sealed container until used. Density, at 25°C 0.78505 g cm^{-3}.

ESTIMATED ERROR:

δT/K = ± 0.005

δp/mmHg = ± 0.05

$\delta x_1/x_1$ = ± 0.005 (compilers)

REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Propane; C_3H_8; [74-98-6] (2) Ethanol; C_2H_6O; [64-17-5]	Kretschmer, C.B.; Wiebe, R. *J. Am. Chem. Soc.* <u>1951</u>, *73*, 3778-81.
VARIABLES: T/K = 273.15-323.15 P/kPa = 33.10-101.91	**PREPARED BY:** H.L. Clever W. Hayduk

EXPERIMENTAL VALUES: - concluded

[1] Original data

[2] Calculations for 101.325 kPa (760 mm) were by compilers by extrapolation of data from lower pressures, and by assuming Raoult's law for solvent partial pressure.

Mole fractions at 101.325 kPa were used to determine the following equation for ln x_1 and table of smoothed values:

$\ln x_1 = 35.471 - 6.891 \ln T_1$ Correlation coefficient = 0.9998

T/K	x_1	T/K	x_1
273.15	0.0413	303.15	0.0201
283.15	0.0322	313.15	0.0161
293.15	0.0254	323.15	0.0130
298.15	0.0226		

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

SOURCE AND PURITY OF MATERIALS:

ESTIMATED ERROR:

REFERENCES:

COMPONENTS:

(1) Propane; C_3H_8; [74-98-6]

(2) Water, Benzene, Ethanol, Diethylether, Chloroform, Turpentine

ORIGINAL MEASUREMENTS:

Lebeau, P.

Compt. Rend. <u>1905</u>, *140*, 1454-6 and 1572.

Bull. Soc. Chim. [*3*] <u>1905</u>, *33*, 1137-9.

VARIABLES:

T/K = 290.8 - 294.8
p/kPa = 100.4 - 100.9

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

Temperature t/°C	 T/K	Pressure[a] p/mmHg	Solubility Volume propane/100 Volumes Solvent
Water; H_2O; [7732-18-5]			
17.8	291.0	753	6.5
Benzene; C_6H_6O; [71-43-2]			
21.5	294.7	757	1452
Ethanol; C_2H_6O; [64-17-5]			
16.6	290.8	754	790
1,1'-Oxybisethane or diethylether; $C_4H_{10}O$; [60-29-7]			
16.6	290.8	757	926
Chloroform or trichloromethane; $CHCl_3$; [67-66-3]			
21.6	294.8	757	1299
Oil of turpentine			
17.7	290.9	757	1587

[a] Not clear whether this is total pressure or propane partial pressure. It is probably total pressure.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Details not given.

The data are reported in both papers.

SOURCE AND PURITY OF MATERIALS:

(1) Propane. Prepared by author from carefully purified propyl iodide by reaction with sodium in liquid ammonia.
Melting point/°C = -195
Boiling point/°C = -44.5
Critical temperature/°C = 102.

(2) Solvents. No information.

ESTIMATED ERROR:

REFERENCES:

COMPONENTS: (1) Propane; C_3H_8; [74-98-6] (2) 1,2-Ethanediol (Ethylene glycol); [107-21-1]	ORIGINAL MEASUREMENTS: Lenoir, J-Y.; Renault, P.; Renon, H. *J. Chem. Eng. Data*, 1971, *16*, 340-2.
VARIABLES: T/K: 298 P/kPa: 101.3	PREPARED BY: C. L. Young

EXPERIMENTAL VALUES:

T/K	Henry's constant $H_{C_3H_8}$/atm	Mole fraction at 1 atm* $x_{C_3H_8}$
298	409	0.00244

* Calculated by compiler assuming a linear function of $p_{C_3H_8}$ vs $x_{C_3H_8}$, i.e., $x_{C_3H_8}$(1 atm) = $1/H_{C_3H_8}$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

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

SOURCE AND PURITY OF MATERIALS:

(1) L'Air Liquide sample; minimum purity 99.9 mole per cent.

(2) Touzart and Matignon or Serlabo sample; purity 99 mole per cent.

ESTIMATED ERROR:

$\delta T/K = \pm 0.1$; $\delta H/\text{atm} = \pm 6\%$ (estimated by compiler).

REFERENCES:

COMPONENTS:

(1) Propane; C_3H_8; [74-98-6]

(2) 2-Propanol; C_3H_8O; [67-63-0]

ORIGINAL MEASUREMENTS:

Kretschmer, C.B.; Wiebe, R.

J. Am. Chem. Soc. 1952, *74*, 1276-7.

VARIABLES:

T/K = 273.15-323.15

P/kPa = 67.71-101.39

PREPARED BY:

H.L. Clever

W. Hayduk

EXPERIMENTAL VALUES:

T/K	Pressure p/mm Hg Total[1]	Partial[2]	Mole Fraction[1,2] $/x_1$	Ostwald Coefficient[2] $L/\text{cm}^3\text{cm}^{-3}$	Bunsen Coefficient[2] $\alpha/\text{cm}^3(\text{STP})\text{cm}^{-3}\text{atm}^{-1}$
273.15	754.9	747.1	0.05804		
		760.0	0.0590	18.4	18.4
298.15	507.9	463.5	0.01830		
	626.7	582.6	0.02317		
	760.5	716.6	0.02783		
		760.0	0.0295	9.52	8.68
323.15	754.7	577.8	0.01423		
		760.0	0.0187	6.31	5.29

[1] Original data.

[2] Calculations for 101.325 kPa (760 mm) were by compilers assuming Henry's law, and Raoult's law for solvent partial pressure.

Mole fractions at 101.325 kPa were used to determine the following equation for ln x_1 and table of smoothed values:

$$\ln x_1 = 20.274 \ln T + 8044.04/T - 146.016 \quad \text{Correlation coeff.} = 0.9999.$$

T/K	x_1	T/K	x_1
273.15	0.0591	303.15	0.0265
283.15	0.0433	313.15	0.0219
193.15	0.0332	323.15	0.0187

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The apparatus was an all glass system which consisted of a monometer, gas handling system, gas buret and solubility bulb equipped with a magnetic stirrer.

The solubility bulb was evacuated and weighed. About 15 cm³ of solvent was distilled into the bulb, the solvent degassed and the bulb reweighed.

A sample of hydrocarbon was condensed into a calibrated tube; it was vaporized into a known volume and the pressure measured. Equilibrium was established between the gas and the solvent. Pressure was again measured.

A detailed description of the apparatus and values of the gas molal volume and 2nd virial coefficient are in (1).

SOURCE AND PURITY OF MATERIALS:

(1) Philipps Petroleum Co., Research Grade. Specified 99.99 mole percent pure. Treated to remove dissolved gases and moisture

(2) Source not given. Fractionated through a 50-plate column, dried with Mg, stored in a sealed container. Density at 25°C 0.78081 g cm⁻³.

ESTIMATED ERROR:

δT/K = 0.005

δp/mm Hg = 0.05

$\delta x_1/x_1$ = 0.005 (compilers)

REFERENCES:

1. Kretschmer, C.B.; Wiebe, R.
J. Am. Chem. Soc. 1951, *73*, 3778.

COMPONENTS:

(1) Propane; C_3H_8; [74-98-6]

(2) 2-Ethoxyethanol (Ethylcellosolve); $C_4H_{10}O_2$; [110-80-5]

ORIGINAL MEASUREMENTS:

Ezheleva, A.E.; Zorin, A.D.

Tr. Khim. Khim. Tech. (Gorkii) 1961, *1*, 37-40.

VARIABLES:

T/K: 303.15-343.15

P/kPa: 101.325 and above

PREPARED BY:

W. Hayduk

EXPERIMENTAL VALUES:

T/K	Ostwald Coefficient[2] $L/\text{cm}^3\text{cm}^{-3}$	Bunsen Coefficient[2] $\alpha/\text{cm}^3(\text{STP})\text{cm}^{-3}\text{atm}^{-1}$	Mole Fraction[1] x_1
303.15	10.80	9.67	0.042 (0.0419)[3]
313.15	8.98	7.78	0.035 (0.0342)
323.15	6.98	5.85	0.0274 (0.0267)
333.15	4.94	4.01	0.0196 (0.0200)
343.15	3.60	2.83	0.0145 (0.0145)

[1] Original data given as the inverse of Henry's constant which is equivalent to mole fraction at a gas partial pressure of 101.325 kPa.

[2] Ostwald and Bunsen coefficients calculated by compiler using authors' assumption that solvent is non-volatile.

[3] From equation of smoothed data:

$$\ln x_1 = 391.17 - 59.530 \ln T - 16423/T$$

Correlation coefficient = 0.9988

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The apparatus consisted of a two-chamber, rocking device with separate gas and liquid chambers joined by two tubes and microvalves. The gas chamber was equipped with a pressure gauge. After evacuation, gas and deaerated solvent were separately charged, and then contacted by opening the microvalves and by rocking. The solubility was calculated from a knowledge of the volume of the solvent charged, and the initial and final gas pressures.

The solvent was considered non-volatile and the gas pressure was considered to be the total pressure.

SOURCE AND PURITY OF MATERIALS:

1. Source and purity not given. Gas purified by low temperature fractionation and analyzed by gas chromatography.
2. Source and purity not given. Refractive index measured:

   $n_D^{20} = 1.4078$

ESTIMATED ERROR:

δT/K = 0.05

$\delta x_1/x_1$ = 0.05

(estimated by compiler)

REFERENCES:

COMPONENTS:

(1) Propane; C_3H_8; [74-98-6]

(2) 1-Butanol; $C_4H_{10}O$; [71-36-3]

ORIGINAL MEASUREMENTS:

Hayduk, W.; Castañeda, R.

Can. J. Chem. Eng. 1973, *51*, 353-358.

VARIABLES:

T/K: 273.15-323.15

P/kPa: 101.325

PREPARED BY:

W. Hayduk

EXPERIMENTAL VALUES:

T/K	Ostwald Coefficient[1] L/cm^3 cm^{-3}	Bunsen Coefficient[2] α/cm (STP) cm^{-3}atm^{-1}	Mole Fraction[1] x_1
273.15	18.60	18.60	0.0706 (0.0706)[3]
298.15	10.07	9.23	0.0367 (0.0367)
323.15	6.43	5.44	0.0226 (0.0226)

[1] Original data.

[2] Calculated by compiler.

[3] The mole fraction solubility of the original data was used to determine the following equations for ΔG° and ln x_1 and table of smoothed values:

$$\Delta G°/\text{J mol}^{-1} = -RT \ln x_1 = 669.59\ T - 87.560\ T \ln T - 42705$$

$$\ln x_1 = 5136.5/T + 10.5316 \ln T - 80.538$$

Std. deviation for ΔG° = 0.6 J mol^{-1}

T/K	ΔG°/J mol^{-1}	x_1	T/K	ΔG°/J mol^{-1}	x_1
273.15	6019	0.0706	303.15	8604	0.0329
283.15	6911	0.0531	313.15	9406	0.0270
293.15	7772	0.0412	323.15	10181	0.0226
298.15	8192	0.0367			

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

A volumetric method using a glass apparatus was employed. Degassed solvent contacted the gas while flowing as a thin film, at a constant rate, through an absorption spiral into a solution buret. A constant solvent flow was obtained by means of a calibrated syringe pump. The solution at the end of the spiral was considered saturated. Dry gas was maintained at atmospheric pressure in a gas buret by mechanically raising the mercury level in the buret at an adjustable rate. The solubility was calculated from the constant slope of volume of gas dissolved and volume of solvent injected.

Degassing was accomplished using a two stage vacuum process described by Clever et al. (1).

SOURCE AND PURITY OF MATERIALS:

1. Matheson Co. Specified as instrument grade of minimum purity 99.5 per cent.
2. Fisher Scientific. Specified minimum purity 99.0 per cent.

ESTIMATED ERROR:

δT/K = 0.1

$\delta x_1/x_1$ = 0.01

REFERENCES:

1. Clever, H.L.; Battino, R.; Saylor, J.H.; Gross, P.M. *J. Phys. Chem.* 1971, *61*, 1078.

COMPONENTS:

(1) Propane; C_3H_8; [74-98-6]

(2) 3-Methyl-1-butanol; $C_5H_{12}O$; [123-51-3]

ORIGINAL MEASUREMENTS:

Friedel, C.; Gorgeu, A.

Compt. rendu 1908, *127*, 590-4.

VARIABLES:

T/K = 289, 296
p/kPa = 100.0, 101.3

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

Temperature $t/^0C$	Temperature T/K	Pressure p/m Hg	Solubility Volume Propane/ Volume Alcohol
16	289	0.750	12
23	296	0.760	11

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

In the original paper the alcohol was named simply amyl alcohol. However, the boiling point corresponds to the alcohol later named primary isoamyl alcohol or 3-methyl-1-butanol.

SOURCE AND PURITY OF MATERIALS:

(1) Propane. Prepared by authors from isopropyl iodide and zinc plus a small amount of hydrochloric acid.

(2) 3-Methyl-1-butanol. Prepared by the authors. Boiling point 130-132 ^0C.

ESTIMATED ERROR:

REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Propane; C_3H_8; [74-98-6] (2) 1-Heptanol; $C_7H_{16}O$; [111-70-6]	Dim, A.; Gardner, G.R.; Ponter, A.B.; Wood, T. *J. Chem. Eng. Japan* 1971, *4*, 92-95

VARIABLES:	PREPARED BY:
T/K: 298.15 P/kPa: 101.325	W. Hayduk

EXPERIMENTAL VALUES:

T/K	Solubility[1] $c_1/10^5$(mol cm^{-3})	Ostwald Coefficient[2] L/cm^{3}cm^{-3}	Bunsen Coefficient[2] α/cm^3 (STP) cm^{-3}atm^{-1}	Mole Fraction[2] x_1
298.15	40.8	9.82	8.95	0.0546

[1] Original data.

[2] Calculated by compiler using the real gas molar volume.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Not available.

SOURCE AND PURITY OF MATERIALS:

Not available.

ESTIMATED ERROR:

$\delta c_1/c_1$ = 0.03 (compiler)

REFERENCES:

COMPONENTS:

(1) Propane; C_3H_8; [74-98-6]

(2) Benzenemethanol, (Benzyl alcohol); C_7H_8O; [100-51-6]

ORIGINAL MEASUREMENTS:

Lenoir, J-Y.; Renault, P.; Renon, H.

J. Chem. Eng. Data, 1971, *16*, 340-2

VARIABLES:

T/K: 298

P/kPa: 101.3

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	Henry's constant $H_{C_3H_8}$/atm	Mole fraction at 1 atm* $x_{C_3H_8}$
298	50.8	0.0197

* Calculated by compiler assuming a linear function of $p_{C_3H_8}$ vs $x_{C_3H_8}$, i.e., $x_{C_3H_8}$(1 atm) = $1/H_{C_3H_8}$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

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

SOURCE AND PURITY OF MATERIALS:

(1) L'Air Liquide sample; minimum purity 99.9 mole per cent.

(2) Touzart and Matignon or Serlabo sample; purity 99 mole per cent.

ESTIMATED ERROR:

$\delta T/K = \pm 0.1$; $\delta H/\text{atm} = \pm 6\%$ (estimated by compiler).

REFERENCES:

COMPONENTS: (1) Propane; C_3H_8; [74-98-6] (2) Phenol; C_6H_6O; [108-95-2]	ORIGINAL MEASUREMENTS: Lenoir, J-Y.; Renault, P.; Renon, H. *J. Chem. Eng. Data*, <u>1971</u>, *16*, 340-3
VARIABLES: T/K: 323.2 P/kPa: 101.3	PREPARED BY: C. L. Young

EXPERIMENTAL VALUES:

T/K	Henry's constant $H_{C_3H_8}$/atm	Mole fraction at 1 atm* $x_{C_3H_8}$
323.2	101	0.00990

* Calculated by compiler assuming a linear function of $p_{C_3H_8}$ vs $x_{C_3H_8}$, i.e., $x_{C_3H_8}$(1 atm) = $1/H_{C_3H_8}$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

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

SOURCE AND PURITY OF MATERIALS:

(1) L'Air Liquide sample; minimum purity 99.9 mole per cent.

(2) Touzart and Matignon or Serlabo sample; purity 99 mole per cent.

ESTIMATED ERROR:

δT/K = ±0.1; δH/atm = ±6% (estimated by compiler).

REFERENCES:

COMPONENTS:

(1) Propane; C_3H_8; [74-98-6]
(2) Benzenemethanol (Benzyl alcohol); C_7H_8O; [100-51-6]

ORIGINAL MEASUREMENTS:

Gerrard, W.
J. Appl. Chem. Biotechnol.
<u>1973</u>, *23*, 1-17.

VARIABLES:
T/K: 273.2-298.2
P/kPa: 101.3

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

Total pressure = 101.3 kPa

T/K	Mole ratio	Mole fraction of propane#
273.2	0.039	0.038
278.2	0.0339	0.0328
283.2	0.0296	0.0287
293.2	0.0243	0.0237
298.2	0.0224	0.0219

Calculated by compiler.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Gas was passed into a known weight of pure liquid in a bubbler tube at a total pressure measured using a manometer assembly. The amount of absorbed gas was estimated by weighing. The temperature was controlled to within 0.2 K. The apparatus and procedure are described by Gerrard, ref. (1).

SOURCE AND PURITY OF MATERIALS:

No details given except that "all compounds were purified by conventional procedures".

ESTIMATED ERROR:
$\delta T/K = \pm 0.1$; $\delta x/x = \pm 3\%$
(estimated by compiler).

REFERENCES:

1. Gerrard, W.
J. Appl. Chem. Biotechnol.
<u>1972</u>, *22*, 623.

COMPONENTS:

(1) Propane; C_3H_8; [74-98-6]

(2) 1-Octanol; $C_8H_{18}O$; [111-87-5]

ORIGINAL MEASUREMENTS:

Dim, A.; Gardner, G.R.;
Ponter, A.B.; Wood, T.

J. Chem. Eng. Japan 1971, *4*, 92-95.

VARIABLES:

T/K: 298.15

P/kPa: 101.325

PREPARED BY:

W. Hayduk

EXPERIMENTAL VALUES:

T/K	Solubility[1] $c_1/10^5$ (mol cm^{-3})	Ostwald Coefficient[2] L/cm^{3}cm^{-3}	Bunsen Coefficient[2] α/cm^3(STP) cm^{-3}atm^{-1}	Mole Fraction[2] x_1
298.15	40.3	9.70	8.85	0.0602

[1] Original data.

[2] Calculated by compiler using the real gas molar volume.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Not available.

SOURCE AND PURITY OF MATERIALS:

Not available.

ESTIMATED ERROR:

$\delta c_1/c_1 = 0.03$ (compiler)

REFERENCES:

COMPONENTS:

(1) Propane; C_3H_8; [74-98-6]

(2) 1-Octanol; $C_8H_{18}O$; [111-87-5]

ORIGINAL MEASUREMENTS:

Gerrard, W.

J. Appl. Chem. Biotechnol.

1973, *23*, 1-17.

VARIABLES:

T/K: 268.2-298.2

P/kPa: 101.3

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

Total pressure = 101.3 kPa

T/K	Mole ratio	Mole fraction of propane[#]
268.2	0.190	0.160
273.2	0.162	0.139
278.2	0.137	0.120
283.2	0.120	0.107
293.2	0.093	0.0851
298.2	0.086	0.0792

[#] Calculated by compiler.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Gas was passed into a known weight of pure liquid in a bubbler tube at a total pressure measured using a manometer assembly. The amount of absorbed gas was estimated by weighing. The temperature was controlled to within 0.2 K. The apparatus and procedure are described by Gerrard, ref. (1).

SOURCE AND PURITY OF MATERIALS:

No details given except that "all compounds were purified by conventional procedures".

ESTIMATED ERROR:

$\delta T/K = \pm 0.1$; $\delta x/x = \pm 3\%$

(estimated by compiler).

REFERENCES:

1. Gerrard, W.
   J. Appl. Chem. Biotechnol.
   1972, *22*, 623.

COMPONENTS:

(1) Butane; C_4H_{10}; [106-97-8]

(2) Methanol; CH_4O; [67-56-1]

ORIGINAL MEASUREMENTS:

Kretschmer, C.B.; Wiebe, R.

J. Am. Chem. Soc. 1952, *74*, 1276-7.

VARIABLES:

T/K = 298.15-323.15

P/kPa = 65.94-101.59

PREPARED BY:

H.L. Clever
W. Hayduk

EXPERIMENTAL VALUES:

T/K	Pressure p/mm Hg Total[1]	Partial[2]	Mole Fraction[1,2] /x_1	Ostwald Coefficient[2] L/cm^{3}cm^{-3}	Bunsen Coefficient[2] α/cm^3(STP)cm^{-3}atm^{-1}
298.15	494.6	371.3	0.01651		
	635.6	513.2	0.02410		
	762.0	640.6	0.03171		
		760.0	0.0398	24.1	21.8
308.15	750.6	547.3	0.01920		
		760.0	0.0267	16.4	14.3
323.15	756.8	346.6	0.008075		
		760.0	0.0177	11.1	9.23

[1] Original data.

[2] Calculations for 101.325 kPa (760 mm) were by compilers assuming Henry's law, and Raoult's law for solvent partial pressure.

Mole fractions at 101.325 kPa were used to determine the following equation for ln x_1 and table of smoothed values:

$\ln x_1 = 75.474 \ln T + 26544/T - 522.274$ Correlation coeff. = 0.9999

T/K	x_1	T/K	x_1
298.15	0.0398	313.15	0.0227
303.15	0.0321	323.15	0.0177

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The apparatus was an all glass system which consisted of a monometer, gas handling system, gas buret and solubility bulb equipped with a magnetic stirrer.

The solubility bulb was evacuated and weighed. About 15 cm^3 of solvent was distilled into the bulb, the solvent degassed and the bulb reweighed.

A sample of hydrocarbon was condensed into a calibrated tube; it was vaporized into a known volume and the pressure measured. Equilibrium was established between the gas and the solvent. Pressure was again measured.

A detailed description of the apparatus and values of the gas molal volume and 2nd virial coefficient are in (1).

SOURCE AND PURITY OF MATERIALS:

(1) Phillips Petroleum Co., Research Grade. Specified 99.78 mole percent pure. Treated to remove dissolved gases and moisture.

(2) Source not given. Treated to remove acetone and aldehydes. Fractionated through a 50-plate column, dried with Mg, stored in a sealed container. Density at 25°C 0.78653 g cm^{-3}.

ESTIMATED ERROR:

δT/K = 0.005
δp/mm Hg = 0.05
$\delta x_1/x_1$ = 0.005

REFERENCES:

1. Kretschmer, C.B.; Wiebe, R. *J. Am. Chem. Soc.* 1951, *73*, 3778.

COMPONENTS:

(1) Butane; C_4H_{10}; [106-97-8]

(2) Ethanol; C_2H_6O; [64-17-5]

ORIGINAL MEASUREMENTS:

Kretschmer, C.B.; Wiebe, R.

J. Am. Chem. Soc. 1951, *73*, 3778-81.

VARIABLES:

T/K = 298.15-323.15

P/kPa = 23.88-98.59

PREPARED BY:

H.L. Clever

W. Hayduk

EXPERIMENTAL VALUES:

T/K	Pressure p/mm Hg Total[1]	Pressure p/mm Hg Partial[2]	Mole fraction[1,2] $/x_1$	Ostwald Coefficient[2] $L/\text{cm}^3\text{cm}^{-3}$	Bunsen Coefficient[2] $\alpha/\text{cm}^3(\text{STP})\text{cm}^{-3}\text{atm}^{-1}$
298.15	238.0	179.1	0.01517		
	325.8	267.4	0.02334		
	393.3	335.3	0.02999		
	436.8	379.1	0.03440		
	589.9	533.2	0.05144		
	739.5	683.9	0.07092		
		760.0	0.0815	35.9	32.5
308.15	233.0	130.0	0.008298		
	330.1	227.7	0.01484		
	430.5	328.9	0.02198		
	713.3	620.0	0.04476		
		760.0	0.0560	24.6	21.5
323.15	337.8	117.4	0.005210		
	487.5	268.6	0.01218		
	590.6	372.8	0.01716		
	733.5	517.3	0.02442		
		760.0	0.0368	16.4	13.6

[1] Original data.

[2] Calculations for 101.325 kPa (760 mm) were by compilers by extrapolation of data for lower pressures, and by assuming Raoult's law for solvent partial pressure.

continued..

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The apparatus was an all-glass system which consisted of a manometer, gas handling system, gas buret and solubility bulb equipped with a magnetic stirrer.

The solubility bulb was evacuated and weighed. About 15 cm^3 of solvent was distilled into the bulb, the solvent degassed and the bulb reweighed.

A sample of hydrocarbon was condensed into a calibrated tube; it was vaporized into a known volume and the pressure measured. Equilibrium was established between the gas and the solvent. Pressure was again measured.

SOURCE AND PURITY OF MATERIALS:

(1) Phillips Petroleum Co. Research grade, 99.78 mole per cent. Removed dissolved air and moisture.

(2) Commercial absolute alcohol sample fractionated, treated with Mg ethylate, stored in sealed container until used. Density, at 25°C 0.78505 g cm^{-3}.

ESTIMATED ERROR:

δT/K = 0.005

δp/mm Hg = 0.05

$\delta x_1/x_1$ = 0.005 (compilers)

REFERENCES:

COMPONENTS:

(1) Butane; C_4H_{10}; [106-97-8]

(2) Ethanol; C_2H_6O; [64-17-5]

ORIGINAL MEASUREMENTS:

Kretschmer, C.B.; Wiebe, R.

J. Am. Chem. Soc. 1951, *73*, 3778-81.

VARIABLES:

T/K = 298.15-323.15

P/kPa = 23.88-98.59

PREPARED BY:

H.L. Clever

W. Hayduk

EXPERIMENTAL VALUES: concluded

Mole fraction solubilities at 101.325 kPa were used to determine the following equation for ln x_1 and table of smoothed values:

$$\ln x_1 = 53.1055 \ln T + 19544.3/T - 370.633$$

Correlation coefficient = 0.9999

T/K	x_1	T/K	x_1
298.15	0.0815	313.15	0.0478
303.15	0.0668	323.15	0.0368
308.15	0.0560		

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

SOURCE AND PURITY OF MATERIALS:

ESTIMATED ERROR:

REFERENCES:

COMPONENTS:

(1) Butane; C_4H_{10}; [106-97-8]

(2) Water; H_2O; [7732-18-5]
Ethanol; C_2H_6O; [64-17-5]
Diethylether; $C_4H_{10}O$; [60-29-7]
Chloroform; $CHCl_3$; [67-66-3]

ORIGINAL MEASUREMENTS:

Lebeau, P.

Bull. Acad. Roy. Belg. 1908, 300-4.

VARIABLES:

T/K = 290, 291
p/kPa = 102.9 - 104.8

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

Temperature		Pressure[a]	Solubility
t/°C	T/K	p/mmHg	Volume Butane/Volume Solvent
Water			
17	290	772	0.15
Ethanol			
17	290	775	18.83
Diethylether or 1'1'-oxybisethane			
18	291	773	29.8
Chloroform or trichloromethane			
17	290	786	32.5

[a] Not clear whether this is total pressure or butane partial pressure. It is probably the total pressure.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Details not given.

SOURCE AND PURITY OF MATERIALS:

(1) Butane. Prepared by author by the reaction of sodium in liquid ammonia on butyl iodide. The normal boiling point is 0.5 °C, and the critical temperature is 151-2 °C.

(2) Solvents. No information.

ESTIMATED ERROR:

REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Butane; C_4H_{10}; [106-97-8] (2) 1,2-Ethanediol (*ethylene glycol*); $C_2H_6O_2$; [107-21-1] or 1,2,3-Propanetriol (*glycerol*); $C_3H_8O_3$; [56-81-5]	Gerrard, W. *J. Appl. Chem. Biotechnol.* 1973, *23*, 1-17.
VARIABLES:	**PREPARED BY:**
T/K: 275.2 P/kPa: 101.3	C. L. Young

EXPERIMENTAL VALUES:

Total pressure = 101.3 kPa

T/K	p/mmHg	Mole ratio	Mole fraction of butane[#]
	1,2-Ethanediol; $C_2H_6O_2$; [107-21-1]		
275.2	742	0.0598	0.0564
	1,2,3-Propanetriol; $C_3H_8O_3$; [56-81-5]		
275.2	742	0.010	0.0099

[#] Calculated by compiler.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Gas was passed into a known weight of pure liquid in a bubbler tube at a total pressure measured using a manometer assembly. The amount of absorbed gas was estimated by weighing. The temperature was controlled to within 0.2 K. The apparatus and procedure are described by Gerrard, ref. (1).

SOURCE AND PURITY OF MATERIALS:

No details given except that "all compounds were purified by conventional procedures".

ESTIMATED ERROR:

δT/K = ±0.1; $\delta x/x$ = ±3% (estimated by compiler).

REFERENCES:

1. Gerrard, W.
J. Appl. Chem. Biotechnol.
1972, *22*, 623.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Butane; C_4H_{10}; [106-97-8] (2) Ethanol; C_2H_6O; [64-17-5]	Frankland, E. *J. Chem. Soc.* 1849, *2*, 263-96. *Liebig's Ann.* 1849, *71*, 171-213.
VARIABLES:	**PREPARED BY:**
$T/K = 287.4$ $p_1/kPa = 99.3$	H. L. Clever

EXPERIMENTAL VALUES:

Temperature $t/^{\circ}C$	T/K	Pressure p_1/mmHg	Solubility, Volume gas/ volume alcohol
14.2	287.4	744.8	18.13

The author states that most of the gas is evolved from the alcohol on the addition of a small amount of water.

The author also describes an experiment in which 1 volume of ethanol takes up 1.22 volumes of ethane at 8.8 °C (282.0 K) at a pressure of 665.5 mmHg (88.7 kPa).

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Eudiometer. The dry gas was treated with sulfuric acid before the solubility experiment.

SOURCE AND PURITY OF MATERIALS:

(1) Butane. Prepared by the reaction of ethyl iodide with zinc at 150 °C.

(2) Ethanol. Described as freshly boiled absolute ethanol.

ESTIMATED ERROR:

REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Butane; C_4H_{10}; [106-97-8] (2) 2-Propanol; C_3H_8O; [67-63-0]	Kretschmer, C.B.; Wiebe, R. *J. Am. Chem. Soc.* 1952, *74*, 1276-7.

VARIABLES:	PREPARED BY:
T/K = 298.15-323.15 P/kPa = 57.36-101.36	H.L. Clever W. Hayduk

EXPERIMENTAL VALUES:

T/K	Pressure p/mm Hg Total[1]	Pressure p/mm Hg Partial[2]	Mole Fraction[1,2] $/x_1$	Ostwald Coefficient[2] $L/\mathrm{cm^3\,cm^{-3}}$	Bunsen Coefficient[2] $\alpha/\mathrm{cm^3(STP)\,cm^{-3}atm^{-1}}$
298.15	430.2	387.4	0.05285		
	479.5	537.8	0.07755		
	752.7	712.5	0.11056		
		760.0	0.1179	41.2	38.2
308.15	760.3	685.4	0.07531		
		760.0	0.0835	28.8	25.2
323.15	752.1	580.1	0.04149		
		760.0	0.0544	18.8	15.6

[1] Original data.

[2] Calculations for 101.325 kPa (760 mm) were by compilers assuming Henry's law, and Raoult's law for solvent partial pressure.

Mole fractions at 101.325 kPa were used to determine the following equation for ln x_1 and table of smoothed values:

$$\ln x_1 = 26.142 \ln T + 11093.4/T - 188.292 \quad \text{Correlation coeff.} = 0.9999.$$

T/K	x_1	T/K	x_1
298.15	0.1179	313.15	0.0716
303.15	0.0986	323.15	0.0544

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The apparatus was an all glass system which consisted of a monometer, gas handling system, gas buret and solubility bulb equipped with a magnetic stirrer.

The solubility bulb was evacuated and weighed. About 15 cm^3 of solvent was distilled into the bulb, the solvent degassed and the bulb reweighed.

A sample of hydrocarbon was condensed into a calibrated tube; it was vaporized into a known volume and the pressure measured. Equilibrium was established between the gas and the solvent. Pressure was again measured.

A detailed description of the apparatus and values of the gas molal volume and 2nd virial coefficient are in (1).

SOURCE AND PURITY OF MATERIALS:

(1) Phillips Petroleum Co., Research Grade. Specified 99.78 mole percent pure. Treated to remove dissolved gases and moisture.

(2) Source not given. Fractionated through a 50-plate column, dried with Mg, stored in a sealed container. Density at 25°C 0.78081 g cm^{-3}.

ESTIMATED ERROR:

δT/K = 0.005

δp/mm Hg = 0.05

$\delta x_1/x_1$ = 0.005 (compilers)

REFERENCES:

1. Kretschmer, C.B.; Wiebe, R. *J. Am. Chem. Soc.* 1951, *73*, 3778.

COMPONENTS:

(1) Butane; C_4H_{10}; [106-97-8]

(2) 1-Butanol; $C_4H_{10}O$; [71-36-3]

ORIGINAL MEASUREMENTS:

Hayduk, W.; Castañeda, R.

Can. J. Chem. Eng. 1973, *51*, 353-358.

VARIABLES:

T/K: 278.15-323.15

P/kPa: 101.325

PREPARED BY:

W. Hayduk

EXPERIMENTAL VALUES:

T/K	Ostwald Coefficient[1] $L/\mathrm{cm^3\ cm^{-3}}$	Bunsen Coefficient[2] $\alpha/\mathrm{cm^3\ (STP)\,cm^{-3}atm^{-1}}$	Mole Fraction[1] x_1
278.15	157.4	154.6	0.393 (0.393)[3]
298.15	42.4	38.8	0.141 (0.141)
323.15	20.3	17.2	0.0686 (0.0687)

[1] Original data.

[2] Calculated by compiler.

[3] The mole fraction solubility of the original data was used to determine the following equations for $\Delta G°$ and ln x_1 and table of smoothed values:

$$\Delta G°/\mathrm{J\ mol^{-1}} = -RT \ln x_1 = 3788.47\,T - 548.330\,T \ln T - 193210$$

$$\ln x_1 = 23238.9/T + 65.9526 \ln T - 455.674$$

Std. deviation for $\Delta G°$ = 2.4 J mol^{-1}

T/K	$\Delta G°/\mathrm{J\ mol^{-1}}$	x_1	T/K	$\Delta G°/\mathrm{J\ mol^{-1}}$	x_1
278.15	2159.5	0.3929	303.15	5412.4	0.1167
283.15	2905.3	0.2910	313.15	6391.2	0.0858
293.15	4252.1	0.1746	323.15	7195.5	0.0687
298.15	4855.3	0.1410			

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

A volumetric method using a glass apparatus was employed. Degassed solvent contacted the gas while flowing as a thin film, at a constant rate, through an absorption spiral into a solution buret. A constant solvent flow was obtained by means of a calibrated syringe pump. The solution at the end of the spiral was considered saturated. Dry gas was maintained at atmospheric pressure in a gas buret by mechanically raising the mercury level in the buret at an adjustable rate. The solubility was calculated from the constant slope of volume of gas dissolved and volume of solvent injected.

Degassing was accomplished using a two stage vacuum process described by Clever et al. (1).

SOURCE AND PURITY OF MATERIALS:

1. Matheson Co. Specified as instrument grade of purity 99.5 per cent.
2. Fisher Scientific. Specified minimum purity 99.0 per cent.

ESTIMATED ERROR:

δT/K = 0.1

$\delta x_1/x_1$ = 0.01

REFERENCES:

1. Clever, H.L.; Battino, R.; Saylor, J.H.; Gross, P.M. *J. Phys. Chem.* 1971, *61*, 1078.

COMPONENTS:

(1) Butane; C_4H_{10}; [106-97-8]

(2) 1-Butanol; $C_4H_{10}O$; [71-36-3]

ORIGINAL MEASUREMENTS:

Blais, C.; Hayduk, W.

J. Chem. Eng. Data 1983, *28*, 181-184.

VARIABLES:

T/K: 298.15,323.15

P/kPa: 101.325

PREPARED BY:

W. Hayduk

EXPERIMENTAL VALUES:

T/K	Ostwald Coefficient[1] L/cm^3 cm^{-3}	Bunsen Coefficient[2] α/cm^3 (STP)cm^{-3}atm^{-1}	Mole Fraction[1] x_1
298.15	41.6	38.11	0.139 (0.1390)[3]
323.15	21.5	18.17	0.0725(0.0725)

[1] Original data.

[2] Calculated by compiler.

[3] The mole fraction solubility of the original data was used to determine the following equations for $\Delta G°$ and ln x_1 and table of smoothed values:

$$\Delta G°/\text{J mol}^{-1} = -RT \ln x_1 = 663.30\, T \ln T - 3617.3\, T$$

$$\ln x_1 = 44.0836 - 8.08356 \ln T$$

T/K	$10^{-4}\Delta G°$/J mol^{-1}	x_1
298.15	4.828	0.1390
303.15	5.243	0.1215
313.15	6.090	0.0935
323.15	6.958	0.0725

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

A volumetric method using a glass apparatus was employed. Degassed solvent contacted the gas while flowing as a thin film, at a constant rate, through an absorption spiral into a solution buret. A constant solvent flow was obtained by means of a calibrated syringe pump. The solution at the end of the spiral was considered saturated. Dry gas was maintained at atmospheric pressure in a gas buret by mechanically raising the mercury level in the buret at an adjustable rate. The solubility was calculated from the constant slope of volume of gas dissolved and volume of solvent injected.

Degassing was accomplished using a two stage vacuum process described by Clever et al. (1).

SOURCE AND PURITY OF MATERIALS:

1. Liquid Carbonic. Pure grade of minimum purity 99.0 per cent.
2. Canlab (J.T. Baker Company). Spectrophotometric grade of minimum specified purity 99.5 per cent.

ESTIMATED ERROR:

δT/K = 0.1

$\delta x_1/x_1$ = 0.01

REFERENCES:

1. Clever, H.L.; Battino, R.; Saylor, J.H.; Gross, P.M. *J. Phys. Chem.* 1957, *61*, 1078.

COMPONENTS:

(1) Butane; C_4H_{10}; [106-97-8]

(2) 3-Methyl-1-butanol; $C_5H_{12}O$; [123-51-3]

ORIGINAL MEASUREMENTS:

Friedel, C.; Gorgeu, A.

Compt. rendu 1908, *127*, 590-4.

VARIABLES:

T/K = 286, 295
p/kPa = 98.7, 101.3

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

Temperature $t/^\circ C$	Temperature T/K	Pressure p/mHg	Solubility Volume Butane/ Volume Alcohol
13	286	0.740	72
22	295	0.760	44

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

In the original paper the alcohol was named simply amyl alcohol. However the boiling point corresponds to the alcohol later named primary iso amyl alcohol or 3-methyl-1-butanol.

SOURCE AND PURITY OF MATERIALS:

(1) Butane. Prepared by authors from *sec*-butyl iodide, zinc and hydrochloric acid.

(2) 3-Methyl-1-butanol. Prepared by the authors. Boiling point 130-132 °C.

ESTIMATED ERROR:

REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Butane; C_4H_{10}; [106-97-8] (2) Phenol; C_6H_6O; [108-95-2]	Lenoir, J-Y.; Renault, P.; Renon, H. *J. Chem. Eng. Data*, 1971, *16*, 340-2.
VARIABLES: T/K: 323.2 P/kPa: 101.3	PREPARED BY: C. L. Young

EXPERIMENTAL VALUES:

T/K	Henry's constant $H_{C_4H_{10}}$/atm	Mole fraction at 1 atm* $x_{C_4H_{10}}$
323.2	37.5	0.0267

* Calculated by compiler assuming a linear function of $p_{C_4H_{10}}$ vs $x_{C_4H_{10}}$, i.e., $x_{C_4H_{10}}$(1 atm) = $1/H_{C_4H_{10}}$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

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

SOURCE AND PURITY OF MATERIALS:

(1) L'Air Liquide sample; minimum purity 99.9 mole per cent.

(2) Touzart and Matignon or Serlabo sample; purity 99 mole per cent.

ESTIMATED ERROR:

δT/K = ±0.1; δH/atm = ±6% (estimated by compiler).

REFERENCES:

COMPONENTS: (1) Butane; C_4H_{10}; [106-97-8] (2) Benzenemethanol, (Benzyl alcohol); C_7H_8O; [100-51-6]	**ORIGINAL MEASUREMENTS:** Lenoir, J-Y.; Renault, P. Renon, H. *J. Chem. Eng. Data* 1971, *16*, 340-2
VARIABLES: T/K: 298.15 P/kPa: 101.3	**PREPARED BY:** C.L. Young

EXPERIMENTAL VALUES:

T/K	Henry's Constant $H_{C_4H_{10}}$/atm	Mole fraction at 1 atm* $x_{C_4H_{10}}$
298.15	15.7	0.0637

* Calculated by compiler assuming a linear function of $p_{C_4H_{10}}$ vs $x_{C_4H_{10}}$, ie., $x_{C_4H_{10}}$ (1 atm) = $1/H_{C_4H_{10}}$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

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

SOURCE AND PURITY OF MATERIALS:

(1) L'Air Liquide sample; minimum purity 99.9 mole per cent.

(2) Touzart and Matignon or Serlabo sample; purity 99 mole per cent.

ESTIMATED ERROR:

$\delta T/K = \pm 0.1$; δH/atm = ±6% (estimated by compiler).

REFERENCES:

COMPONENTS: (1) Butane; C_4H_{10}; [106-97-8] (2) 1-Octanol; $C_8H_{18}O$; [111-87-5]	ORIGINAL MEASUREMENTS: Gerrard, W. *J. Appl. Chem. Biotechnol.* 1973, *23*, 1-17.
VARIABLES: T/K: 278.2-293.2 P/kPa: 101.3	PREPARED BY: C. L. Young

EXPERIMENTAL VALUES:

Total pressure = 101.3 kPa

T/K	Mole ratio	Mole fraction of butane[#]
278.2	1.78	0.640
283.2	0.702	0.412
293.2	0.400	0.286

[#] Calculated by compiler.

AUXILIARY INFORMATION

METHOD APPARATUS/PROCEDURE:

Gas was passed into a known weight of pure liquid in a bubbler tube at a total pressure measured using a manometer assembly. The amount of absorbed gas was estimated by weighing. The temperature was controlled to within 0.2 K. The apparatus and procedure are described by Gerrard, ref. (1).

SOURCE AND PURITY OF MATERIALS:

No details given except that "all compounds were purified by conventional procedures".

ESTIMATED ERROR:

$\delta T/K = \pm 0.1$; $\delta x/x = \pm 3\%$ (estimated by compiler).

REFERENCES:

1. Gerrard, W. *J. Appl. Chem. Biotechnol.* 1972, *22*, 623.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) 2-Methylpropane (isobutane); C_4H_{10}; [75-28-5] (2) Methanol; CH_4O; [67-56-1]	Kretschmer, C.B.; Wiebe, R. *J. Am. Chem. Soc.* 1952, *74*, 1276-7.

VARIABLES:	PREPARED BY:
T/K = 298.15-323.15 P/kPa = 48.53-101.9	H.L. Clever W. Hayduk

EXPERIMENTAL VALUES:

T/K	Pressure p/mm Hg Total[1]	Pressure p/mm Hg Partial[2]	Mole Fraction[1,2] $/x_1$	Ostwald Coefficient[2] $L/\mathrm{cm^3\,cm^{-3}}$	Bunsen Coefficient[2] $\alpha/\mathrm{cm^3(STP)\,cm^{-3}\,atm^{-1}}$
298.15	364.0	293.5	0.00710		
	548.2	424.5	0.01316		
	764.3	641.5	0.02103		
		760.0	0.0256	15.3	13.9
308.15	757.7	553.2	0.01370		
		760.0	0.0188	11.4	10.0
323.15	758.1	347.1	0.00600		
		760.0	0.01314	8.22	6.82

[1] Original data.

[2] Calculations for 101.325 kPa (760 mm) were by compilers assuming Henry's law, and Raoult's law for solvent partial pressure.

Mole fractions at 101.325 kPa were used to determine the following equation for ln x_1 and table of smoothed values:

$$\ln x_1 = 36.912 \ln T + 14{,}025/T - 261.016 \quad \text{Correlation coeff.} = 0.9999.$$

T/K	x_1	T/K	x_1
298.15	0.0256	313.15	0.0165
303.15	0.0218	323.15	0.0131

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The apparatus was an all glass system which consisted of a monometer, gas handling system, gas buret and solubility bulb equipped with a magnetic stirrer.

The solubility bulb was evacuated and weighed. About 15 cm^3 of solvent was distilled into the bulb, the solvent degassed and the bulb reweighed.

A sample of hydrocarbon was condensed into a calibrated tube; it was vaporized into a known volume and the pressure measured. Equilibrium was established between the gas and the solvent. Pressure was again measured.

A detailed description of the apparatus and values of the gas molal volume and 2nd virial coefficient are in (1).

SOURCE AND PURITY OF MATERIALS:

(1) Phillips Petroleum Co., Research Grade. Specified 99.88 mole percent pure. Treated to remove dissolved gases and moisture.

(2) Source not given. Treated to remove acetone and aldehydes. Fractionated through a 50-plate column, dried with Mg, stored in a sealed container. Density at 25°C 0.78653 g cm^{-3}.

ESTIMATED ERROR:

δT/K = 0.005
δp/mm Hg = 0.05
$\delta x_1/x_1$ = 0.005 (compilers)

REFERENCES:

1. Kretschmer, C.B.; Wiebe, R. *J. Am. Chem. Soc.* 1951, *73*, 3778.

COMPONENTS: (1) 2-Methylpropane (isobutane); C_4H_{10}; [75-28-5] (2) Ethanol; C_2H_6O; [64-17-5]	**ORIGINAL MEASUREMENTS:** Kretschmer, C.B.; Wiebe, R. *J. Am. Chem. Soc.* 1951, *73*, 3778-81.
VARIABLES: T/K = 283.15-323.15 P/kPa = 30.25-101.38	**PREPARED BY:** H.L. Clever W. Hayduk

EXPERIMENTAL VALUES: concluded

Mole fraction solubilities at 101.325 kPa (760 mm) were used to determine the following equation for ln x_1 and table of smoothed values:

$\ln x_1 = 18.020 \ln T + 8122.2/T - 132.89$ Correlation coeff. = 0.9999.

T/K	x_1	T/K	x_1
283.15	0.0851	303.15	0.0439
293.15	0.0598	313.15	0.0335
298.15	0.0509	323.15	0.0264

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

SOURCE AND PURITY OF MATERIALS:

ESTIMATED ERROR:

REFERENCES:

COMPONENTS:

(1) 2-Methylpropane (isobutane); C_4H_{10}; [75-28-5]

(2) Ethanol; C_2H_6O; [64-17-5]

ORIGINAL MEASUREMENTS:

Kretschmer, C.B.; Wiebe, R.

J. Am. Chem. Soc. 1951, *73*, 3778-81.

VARIABLES:

T/K = 283.15-323.15

P/kPa = 30.25-101.38

PREPARED BY:

H.L. Clever

W. Hayduk

EXPERIMENTAL VALUES:

T/K	Pressure p/mm Hg Total[1]	Pressure p/mm Hg Partial[2]	Mole Fraction[1,2] $/x_1$	Ostwald Coefficient[2] $L/\text{cm}^3\text{cm}^{-3}$	Bunsen Coefficient[2] $\alpha/\text{cm}^3(\text{STP})\text{cm}^{-3}\text{atm}^{-1}$
283.15	389.7	366.6	0.03528		
	549.6	526.9	0.05443		
		760.0	0.0852	36.2	34.7
298.15	226.9	167.7	0.009739		
	305.8	246.9	0.01454		
	439.5	381.1	0.02316		
	725.4	668.2	0.04368		
		760.0	0.0512	21.8	19.8
308.15	313.1	210.2	0.00955		
	455.2	353.0	0.01643		
	602.4	501.0	0.02391		
	760.4	659.9	0.03241		
		760.0	0.0381	16.4	14.4
323.15	317.3	96.4	0.003121		
	542.3	323.1	0.01064		
	758.7	541.2	0.01828		
		760.0	0.0265	11.7	9.71

[1] Original data.

[2] Calculations for 101.325 kPa (760 mm) were by compilers by extrapolation of data from lower pressures, and by assuming Raoult's law for solvent partial pressure.

continued..

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The apparatus was an all glass system which consisted of a manometer, gas handling system, gas buret and solubility bulb equipped with a magnetic stirrer.

The solubility bulb was evacuated and weighed. About 15 cm^3 of solvent was distilled into the bulb, the solvent degassed and the bulb reweighed.

A sample of hydrocarbon was condensed into a calibrated tube; it was vaporized into a known volume and the pressure measured. Equilibrium was established between the gas and the solvent. Pressure was again measured.

SOURCE AND PURITY OF MATERIALS:

(1) Phillips Petroleum Co. Research grade, 99.88 mole per cent. Removed dissolved air and moisture.

(2) Commercial absolute alcohol sample fractionated, treated with Mg ethylate, stored in sealed container until used. Dentity, at 25°C 0.78505 g cm^{-3}.

ESTIMATED ERROR:

δT/K = ± 0.005

δp/mm Hg = ± 0.05

$\delta x_1/x_1$ = ± 0.005 (compilers)

REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) 2-Methylpropane or isobutane; C_4H_{10}; [75-28-5] (2) Water; H_2O; [7732-18-5] Ethanol; C_2H_6O; [64-17-5] Diethylether; $C_4H_{10}O$; [60-29-7] Chloroform; $CHCl_3$; [67-66-3]	Lebeau, P. *Bull. Acad. Roy. Belg.* 1908, 300-4.
VARIABLES:	**PREPARED BY:**
T/K = 290, 291 p/kPa = 102.9 - 104.8	H. L. Clever

EXPERIMENTAL VALUES:

Temperature t/°C	T/K	Pressure[a] p/mmHg	Solubility Volume Isobutane/Volume Solvent
Water			
17	290	772	0.13
Ethanol			
17	290	775	13.2
Diethylether or 1'1'-oxybisethane			
18	291	773	27.9
Chloroform or trichloromethane			
17	290	786	39.5

[a] Not clear whether this is total pressure or isobutane partial pressure. It is probably the total pressure.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Details not given.

SOURCE AND PURITY OF MATERIALS:

(1) Isobutane. Prepared by the author by the reaction of sodium or calcium in liquid ammonia on isobutyl chloride. The normal boiling point is -10.5 °C and the critical temperature is 134-5 °C.

(2) Solvents. No information.

ESTIMATED ERROR:

REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) 2-Methylpropane; (isobutane); C_4H_{10}; [75-28-5] (2) 1,2-Ethanediol, (Ethylene glycol); $C_2H_6O_2$; [107-21-1]	Lenoir J-Y.; Renault, P.; Renon, H. *J. Chem. Eng. Data*, <u>1971</u>, *16*, 340-2
VARIABLES: *T*/K: 298.2 *P*/kPa: 101.3	PREPARED BY: C. L. Young

EXPERIMENTAL VALUES:

T/K	Henry's constant $H_{C_4H_{10}}$/atm	Mole fraction at 1 atm* $x_{C_4H_{10}}$
298.2	320	0.00313

* Calculated by compiler assuming a linear function of $p_{C_4H_{10}}$ vs $x_{C_4H_{10}}$, i.e., $x_{C_4H_{10}}$(1 atm) = $1/H_{C_4H_{10}}$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

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

SOURCE AND PURITY OF MATERIALS:

(1) L'Air Liquide sample; minimum purity 99.9 mole per cent.

(2) Touzart and Matignon or Serlabo sample; purity 99 mole per cent.

ESTIMATED ERROR:

δT/K = ±0.1; δH/atm = ±6% (estimated by compiler).

REFERENCES:

COMPONENTS:

(1) 2-Methylpropane (isobutane); C_4H_{10}; [75-28-5]

(2) 2-Propanol; C_3H_8O; [67-63-0]

ORIGINAL MEASUREMENTS:

Kretschmer, C.B.; Wiebe, R.

J. Am. Chem. Soc. 1952, *74*, 1276-7.

VARIABLES:

T/K = 298.15-323.15

P/kPa = 41.46-101.6

PREPARED BY:

H.L. Clever

W. Hayduk

EXPERIMENTAL VALUES:

T/K	Pressure p/mm Hg Total[1]	Pressure p/mm Hg Partial[2]	Mole Fraction[1,2] /x_1	Ostwald Coefficient[2] L/cm^{3}cm^{-3}	Bunsen Coefficient[2] α/cm^3(STP)cm^{-3}atm^{-1}
298.15	355.0	311.0	0.02758		
	525.6	482.4	0.04441		
	753.1	711.0	0.06930		
		760.0	0.0741	24.7	22.8
308.15	761.0	684.0	0.04984		
		760.0	0.0554	18.6	16.6
323.15	762.0	587.8	0.02977		
		760.0	0.0385	13.1	11.1

[1] Original data.

[2] Calculations for 101.325 kPa (760 mm) were by compilers assuming Henry's law, and Raoult's law for solvent partial pressure.

Mole fractions at 101.325 kPa were used to determine the following equation for ln x_1 and table of smoothed values:

$\ln x_1 = 2516.7/T - 11.050$ Correlation coefficient = 0.9996

T/K	x_1	T/K	x_1
298.15	0.0736	313.15	0.0491
303.15	0.0640	323.15	0.0383

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The apparatus was an all glass system which consisted of a monometer, gas handling system, gas buret and solubility bulb equipped with a magnetic stirrer.

The solubility bulb was evacuated and weighed. About 15 cm^3 of solvent was distilled into the bulb, the solvent degassed and the bulb reweighed.

A sample of hydrocarbon was condensed into a calibrated tube; it was vaporized into a known volume and the pressure measured. Equilibrium was established between the gas and the solvent. Pressure was again measured.

A detailed description of the apparatus and values fo the gas molal volume and 2nd virial coefficient are in (1).

SOURCE AND PURITY OF MATERIALS:

(1) Phillips Petroleum Co., Research Grade. Specified 99.88 mole percent pure. Treated to remove dissolved gases and moisture.

(2) Source not given. Fractionated through a 50-plate column, dried with Mg, stored in a sealed container. Density at 25°C 0.78081 g cm^{-3}

ESTIMATED ERROR:

δT/K = 0.005

δp/mm Hg = 0.05

$\delta x_1/x_1$ = 0.005 (compilers)

REFERENCES:

1. Kretschmer, C.B.; Wiebe, R. *J. Am. Chem. Soc.* 1951, *73*, 3778.

COMPONENTS:

(1) 2-Methylpropane (isobutane); C_4H_{10}; [75-28-5]

(2) 1-Butanol; $C_4H_{10}O$; [71-36-3]

ORIGINAL MEASUREMENTS:

Blais, C.; Hayduk, W.

J. Chem. Eng. Data 1983, *28*, 181-184.

VARIABLES:

T/K: 298.15,323.15

P/kPa: 101.325

PREPARED BY:

W. Hayduk

EXPERIMENTAL VALUES:

T/K	Ostwald Coefficient[1] $L/\text{cm}^3\ \text{cm}^{-3}$	Bunsen Coefficient[2] $\alpha/\text{cm}^3\ (\text{STP})\text{cm}^{-3}\text{atm}^{-1}$	Mole Fraction[1] x_1
298.15	25.3	23.18	0.0889 (0.08890)[3]
323.15	14.1	11.92	0.0486 (0.04860)

[1] Original data.

[2] Calculated by compiler.

[3] The mole fraction solubility of the original data was used to determine the following equations for $\Delta G°$ and $\ln x_1$ and table of smoothed values:

$$\Delta G°/\text{J mol}^{-1} = -RT \ln x_1 = 615.41\ T \ln T - 3307.76\ T$$

$$\ln x_1 = 40.311 - 7.49987 \ln T$$

T/K	$10^{-4}\Delta G°/\text{J mol}^{-1}$	x_1
298.15	5.921	0.08890
303.15	6.331	0.07848
313.15	7.165	0.06152
323.15	8.019	0.04860

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

A volumetric method using a glass apparatus was employed. Degassed solvent contacted the gas while flowing as a thin film, at a constant rate, through an absorption spiral into a solution buret. A constant solvent flow was obtained by means of a calibrated syringe pump. The solution at the end of the spiral was considered saturated. Dry gas was maintained at atmospheric pressure in a gas buret by mechanically raising the mercury level in the buret at an adjustable rate. The solubility was calculated from the constant slope of volume of gas dissolved and volume of solvent injected.

Degassing was accomplished using a two stage vacuum process described by Clever et al. (1).

SOURCE AND PURITY OF MATERIALS:

1. Liquid Carbonic. Pure grade of minimum purity 99.0 per cent.
2. Canlab (J.T. Baker Company). Spectrophotometric grade of minimum specified purity 99.5 per cent.

ESTIMATED ERROR:

δT/K = 0.1

$\delta x_1/x_1$ = 0.01

REFERENCES:

1. Clever, H.L.; Battino, R.; Saylor, J.H.; Gross, P.M. *J. Phys. Chem.* 1957, *61*, 1078.

COMPONENTS:

(1) 2-Methylpropane (iso-butane); C_4H_{10}; [75-28-5]

(2) 2-Ethoxyethanol (ethylcellosolve); $C_4H_{10}O_2$; [110-80-5]

ORIGINAL MEASUREMENTS:

Ezheleva, A.E.; Zorin, A.D.

Tr. Khim. Khim. Tech. (Gorkii) 1961, *1*, 37-40.

VARIABLES:

T/K: 303.15-343.15

P/kPa: 101.325 and above

PREPARED BY:

W. Hayduk

EXPERIMENTAL VALUES:

T/K	Ostwald Coefficient[2] L/cm^{3}cm^{-3}	Bunsen Coefficient[2] α/cm^3(STP)cm^{-3}atm^{-1}	Mole Fraction[1] x_1
303.15	20.6	18.3	0.0780(0.0777)[3]
313.15	16.3	14.0	0.0625(0.0628)
323.15	13.7	11.3	0.0527(0.0514)
333.15	10.3	8.28	0.0404(0.0426)
343.15	9.27	7.21	0.0368(0.0357)

[1] Original data given as the inverse of Henry's constant which is equivalent to mole fraction at a gas partial pressure of 101.325 kPa.

[2] Ostwald and Bunsen coefficients calculated by compiler using authors' assumption that solvent is non-volatile.

[3] From equation of smoothed data:

$$\ln x_1 = 2020.3/T - 9.2195$$

Correlation coefficient = 0.9942

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The apparatus consisted of a two-chamber, rocking device with separate gas and liquid chambers joined by two tubes and microvalves. The gas chamber was equipped with a pressure gauge. After evacuation, gas and deaerated solvent were separately charged, and then contacted by opening the microvalves and by rocking. The solubility was calculated from a knowledge of the volume of the solvent charged, and the initial and final gas pressures.

The solvent was considered non-volatile and the gas pressure was considered to be the total pressure.

SOURCE AND PURITY OF MATERIALS:

1. Source and purity not given. Gas purified by low temperature fractionation and analyzed by gas chromatography.
2. Source and purity not given. Refractive index measured:

n_D^{20} = 1.4078

ESTIMATED ERROR:

δT/K = 0.05

$\delta x_1/x_1$ = 0.05

(estimated by compiler)

REFERENCES:

COMPONENTS: (1) 2-Methylpropane; (isobutane) C_4H_{10}; [75-28-5] (2) Phenol; C_6H_6O; [108-95-2]	ORIGINAL MEASUREMENTS: Lenoir, J-Y.; Renault, P.; Renon, H. *J. Chem. Eng. Data*, 1971, *16*, 340-2
VARIABLES: T/K: 323.2 P/kPa: 101.3	PREPARED BY: C. L. Young

EXPERIMENTAL VALUES:

T/K	Henry's constant $H_{C_4H_{10}}$/atm	Mole fraction at 1 atm* $x_{C_4H_{10}}$
323.2	67.0	0.0149

* Calculated by compiler assuming a linear function of $p_{C_4H_{10}}$ vs $x_{C_4H_{10}}$, i.e., $x_{C_4H_{10}}$(1 atm) = $1/H_{C_4H_{10}}$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

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

SOURCE AND PURITY OF MATERIALS:

(1) L'Air Liquide sample; minimum purity 99.9 mole per cent.

(2) Touzart and Matignon or Serlabo sample; purity 99 mole per cent.

ESTIMATED ERROR:

δT/K = ±0.1; δH/atm = ±6% (estimated by compiler).

REFERENCES:

COMPONENTS:

1. Propane, 2-methyl-, (isobutane) C_4H_{10}; [75-28-5]

2. Propanol, oxybis-, (Dipropylene glycol); $C_6H_{14}O_3$; [25265-71-8]

ORIGINAL MEASUREMENTS:

Lenoir, J-Y.; Renault, P.; Renon, H.

J. Chem. Eng. Data 1971, *16*, 340-2

VARIABLES:

T/K: 298.2-343.2

P/kPa: 101.3

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	Henry's constant $H_{C_4H_{10}}$/atm	Mole fraction at 1 atm* $x_{C_4H_{10}}$
298.2	42.4	0.0236
323.2	53.7	0.0186
343.2	74.3	0.0135

* Calculated by compiler assuming a linear function of $p_{C_4H_{10}}$ vs $x_{C_4H_{10}}$, i.e., $x_{C_4H_{10}}$(1 atm) = $1/H_{C_4H_{10}}$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

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

SOURCE AND PURITY OF MATERIALS:

(1) L'Air Liquide sample, minimum purity 99.9 mole per cent.

(2) Touzart and Matignon or Serlabo sample, purity 99 mole per cent.

ESTIMATED ERROR:

δT/K = ±0.1; δH/atm = ±6% (estimated by compiler).

REFERENCES:

COMPONENTS:

(1) 2-Methylpropane, (isobutane); C_4H_{10}; [75-28-5]

(2) Benzyl alcohol, (Benzenemethanol) C_7H_8O; [100-51-6]

ORIGINAL MEASUREMENTS:

Gerrard, W.

Solubility of Gases and Liquids, Plenum, New York, 1976, Chapter 12.

VARIABLES:

T/K: 273.15

P/kPa: 13.3-101.3

PREPARED BY:

C.L. Young

EXPERIMENTAL VALUES:

T/K	P/mmHg	P/kPa	Mole fraction of 2-methyl propane in liquid, $x_{C_4H_{10}}$
273.15	100	13.3	0.012
	200	26.7	0.020
	300	40.0	0.028
	400	53.3	0.037
	500	66.7	0.049
	600	80.0	0.064
	700	93.3	0.086
	760	101.3	0.107

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Gas was passed into a known weight of pure liquid in a bubbler tube at a total pressure measured by a manometer assembly. The amount of absorbed gas was estimated by weighing. The temperature was manually controlled to within 0.2K. The apparatus and procedure are described by Gerrard (1,2).

SOURCE AND PURITY OF MATERIALS:

No details given.

ESTIMATED ERROR:

$\delta T/K = \pm 0.1$; $\delta x/x = \pm 3\%$

(estimated by compiler).

REFERENCES:

1. Gerrard, W.
J. Appl. Chem. Biotechnol. 1972 *22*, 623-650.
2. Gerrard, W.
Solubility of Gases and Liquids, Plenum Press. New York, 1976 Chapter 1.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) 2-Methylpropane, (isobutane); C_4H_{10}; [75-28-5] (2) 1-Octanol; $C_8H_{18}O$; [111-87-5]	Gerrard, W. *Solubility of Gases and Liquids, Plenum, New York*, 1976, Chapter 12.
VARIABLES: T/K: 273.15 P/kPa: 13.3-101.3	PREPARED BY: C.L. Young

EXPERIMENTAL VALUES:

T/K	P/mmHg	P/kPa	Mole fraction of 2-methyl propane in liquid, $x_{C_4H_{10}}$
273.15	100	13.3	0.045
	200	26.7	0.088
	300	40.0	0.132
	400	53.3	0.178
	500	66.7	0.224
	600	80.0	0.282
	700	93.3	0.344
	760	101.3	0.386

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Gas was passed into a known weight of pure liquid in a bubbler tube at a total pressure measured by a manometer assembly. The amount of absorbed gas was estimated by weighing. The temperature was manually controlled to within 0.2K. The apparatus and procedure are described by Gerrard (1,2).

SOURCE AND PURITY OF MATERIALS:

No details given.

ESTIMATED ERROR:

$\delta T/K = \pm 0.1$; $\delta x/x = \pm 3\%$
(estimated by compiler)

REFERENCES:

1. Gerrard, W.
   J. Appl. Chem. Biotechnol. 1972 *22*, 623-650.
2. Gerrard, W.
   Solubility of Gases and Liquids, Plenum Press, New York, 1976, Chapter 1.

COMPONENTS:	EVALUATOR:
(1) Propane; C_3H_8; [74-98-6] Butane; C_4H_{10}; [106-97-8] 2-Methylpropane; C_4H_{10}; [75-28-5] (2) Polar solvents excluding water, alcohols and nitrogen-containing compounds	Walter Hayduk Department of Chemical Engineering University of Ottawa Ottawa, Canada K1N 9B4 March, 1984

CRITICAL EVALUATION:

In only one instance in this section is there a check on a solubility by two independent groups of workers. Hence, because it was impossible to independently ascertain their accuracy, most of the data listed are classified as tentative. Some of the data of Lenoir et al. (1) were previously shown to be from 6% to 46% too high (2); the error was ascribed, in part, to the extrapolation of data, obtained at effectively very low gas partial pressures using gas chromatography, to atmospheric pressure by means of Henry's law. The Lenoir data, which may be useful for qualitative purposes, are classified as doubtful. Other data for the solubility of *propane* and *2-methylpropane* in ethyl hexyl sebacate of Carter and Esterson (3) may be subject to the same uncertainty since they also were obtained by gas chromatography at low gas partial pressures. Consistency tests were performed with most of the data to check for the presence of gross deviations (in excess of 20%) from most probable solubility behavior. In certain cases significant deviations were apparent, and the data, in those instances, were classified as doubtful.

A consistency check, or method of extrapolation for solubility data was developed by Linford and Hildebrand (4) for gases of similar chemical nature such as alkanes, in solvents which formed regular solutions. A linear relation was expected when the log of the solubility at constant temperature was plotted as a function of the energy of vaporization at the gas normal boiling points. For solvents which do not form regular solutions, a consistent (nonlinear) relation is usually observed (5). Thus such a plot provides a useful consistency check especially if data are available for several of the alkane gases. Because data are available for solubilities of *ethane* in many solvents (2), it is possible to compare with those of *propane*, *2-methylpropane* and *butane*. A plot of mole fraction solubility at 298.15 K on a log scale is shown as a function of the energy of vaporization of the gases at their normal boiling points in Figure 1. The solubilities of the four gases in butanol are shown in Figure 1, designated as solvent "h" as an example for comparison. The latter data are those of Kretschmer and Wiebe (6).

Table 1 shows the solubility at 298.15 K of one or more of the gases in various solvents along with the classification of the data. If extrapolation to 298.15 K was required, it is so indicated. The letter designation for each solvent in Table 1 corresponds to the solvent in Figure 1. The numbers in Table 1 and in Figure 1 refer to the data sources.

The single value for the solubility of *propane* in (j) acetone of Rosenthal (11) is approximately 5% higher than that of Reference (10). It is considered that the latter data, spanning a wider temperature range, are the more accurate.

The data of Gerrard (7,8) appear to be frequently too high (see Critical Evaluation for alcohols and Critical Evaluation for non-polar solvents) although some data are of acceptable accuracy. It may be interpreted from Figure 1 that the solubilities of *2-methylpropane* in (c) hexanoic acid and of *butane* in (g) dioxane of Gerrard (7) are probably too high based on the additional available data. The data of Ezheleva and Zorin (12) for the solubility of *2-methylpropane* in (k) furfural appear to be identical to that of *propane* in the same solvent, a most unlikely possibility. The latter data are considered doubtful. The variation of solubility of *2-methylpropane* with temperature also appears inconsistent.

Data not listed in Table 1 include those of Lebeau (14) for all three gases in diethylether. As with the other early data of Lebeau, discussed elsewhere in this volume, the values are considered too low and are rejected. Solubilities of *propane* and *butane* in dipentyl ether and acetophenone of Gerrard (7) are classified as tentative as are the solubilities of butane in benzyl alcohol. Finally, the solubilities of *propane* and *butane* in the various esters of phosphoric acid of Lenoir et al. (1) and of *2-methylpropane* in propylene carbonate are classified as doubtful.

COMPONENTS:	EVALUATOR:
(1) Propane; C_3H_8; [74-98-6] Butane; C_4H_{10}; [106-97-8] 2-Methylpropane; C_4H_{10}; [75-28-5] (2) Polar solvents excluding water, alcohols and nitrogen-containing compounds	Walter Hayduk Department of Chemical Engineering University of Ottawa Ottawa, Canada K1N 9B4 March, 1984

CRITICAL EVALUATION:

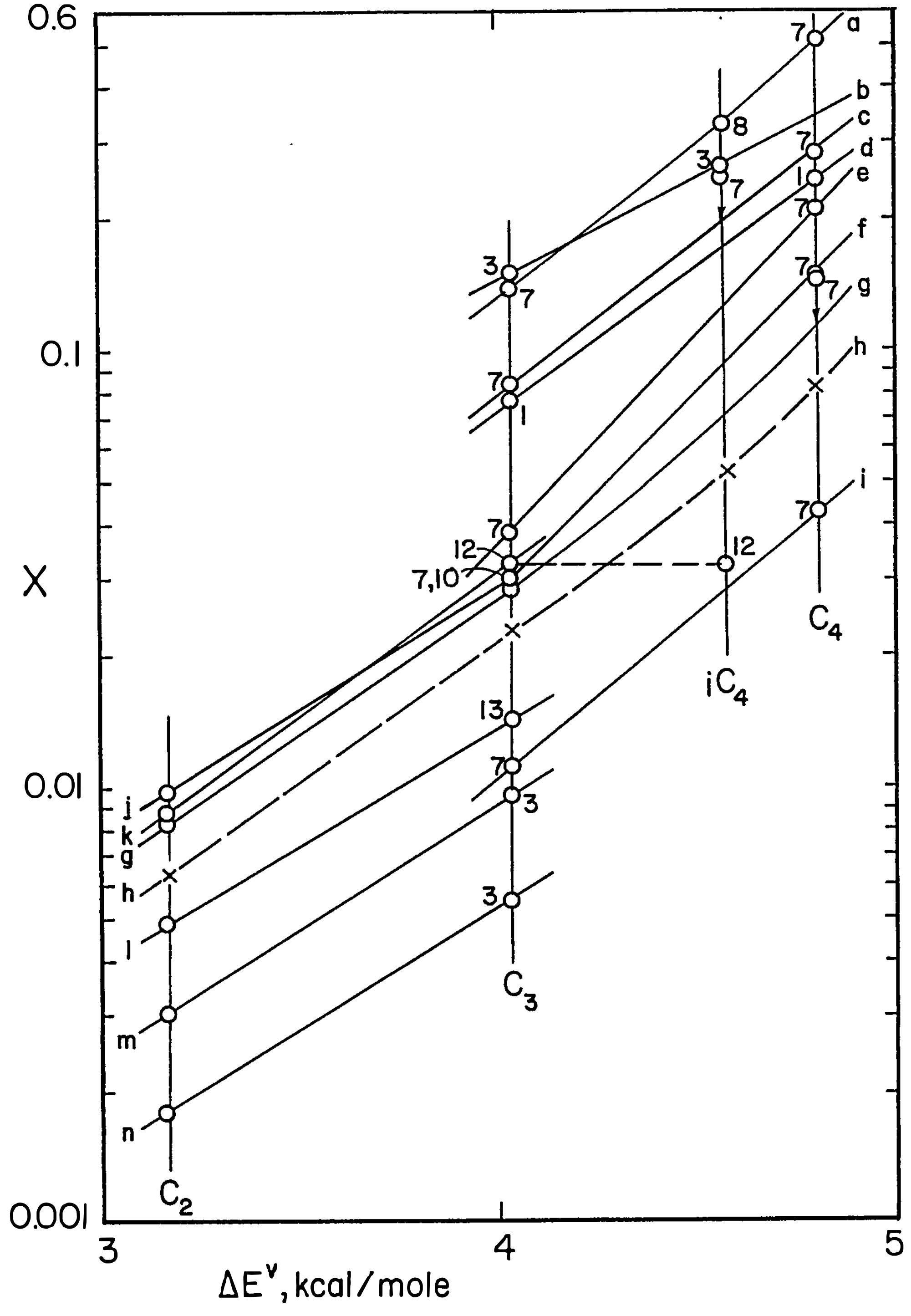


Figure 1. Solubilities at 298.15 K versus heat of vaporization of gas at the normal boiling point.

COMPONENTS:	EVALUATOR:
(1) Propane; C_3H_8; [74-98-6] Butane; C_4H_{10}; [106-97-8] 2-Methylpropane; C_4H_{10}; [75-28-5] (2) Polar solvents excluding water, alcohols and nitrogen-containing compounds	Walter Hayduk Department of Chemical Engineering University of Ottawa Ottawa, Canada K1N 9B4 March, 1984

CRITICAL EVALUATION:

It may be concluded that reliable data for solubilities of *propane*, *butane* and *2-methylpropane* are scarce.

Table 1. Mole fraction solubility at 298.15 K and classification

Solvent	*Propane*	*Butane*	*2-Methylpropane*	Classification
(a) Dioctyl ether	0.138(7)	0.512(7)	0.33[1] (8)	Tentative
(b) Ethyl hexyl sebacate (3)	0.15[1]	-	0.26[1]	Tentative
(c) Hexanoic acid (7)	0.083[1]	0.281	0.25[1]	Tentative
(d) Phosphoric acid tripropyl ester (1)	0.0763	0.248	-	Doubtful
e) Ethoxybenzene (7)	0.038[1]	0.21[1]	-	Tentative
(f) 2-Hydroxybenzoic acid, methyl ester (7)	0.030[1]	0.149	-	Tentative
(g) Dioxane	0.0284(9)	0.145[1] (7)	-	Tentative
(h) Ethanol (6)	0.0228	0.0815	0.0512	-
(i) Acetic anhydride (7)	0.011[1]	0.042[1]	-	Tentative
(j) Acetone (10,11)	0.0302	-	-	Tentative
(k) Furfural (12)	0.032[1]	-	0.032[1]	Doubtful
(l) Acetic acid (13)	0.0143[1]	-	-	Tentative
(m) Propylene carbonate	0.00935(3)	-	0.0151(1)	Doubtful
(n) Dimethyl sulfoxide (3)	0.00538	-	-	Doubtful

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[1] Extrapolated

References

1. Lenoir, J.-Y.; Renault, P.; Renon, H. *J. Chem. Eng. Data* 1971, *16*, 340-342.
2. Hayduk, W., Ed. *Solubility Data Series, Vol. 9, Ethane* Pergamon Press, Oxford, England 1982, 195-199.
3. Carter, D.; Esterson, G.L. *J. Chem. Eng. Data* 1973, *18*, 166-169.
4. Linford, R.G.; Hildebrand, J.H. *Trans. Far. Soc.* 1970, *66*, 577-581.
5. Fleury, D.; Hayduk, W. *Can. J. Chem. Eng.* 1975, *53*, 195-199.
6. Kretschmer, C.B.; Wiebe, R. *J. Am. Chem. Soc.* 1951, *73*, 3778-3781.
7. Gerrard, W., *J. Appl. Chem. Biotechnol.* 1973, *23*, 1-17.
8. Gerrard, W. *Solubility of Gases and Liquids*, Plenum, New York, 1976, Chapter 12.
9. Thomsen, E.S.; Gjaldbaek, J.C. *Acta Chem. Scand.* 1963, *17*, 134-138.

COMPONENTS:	EVALUATOR:
(1) Propane; C_3H_8; [74-98-6] Butane; C_4H_{10}; [106-97-8] 2-Methylpropane; C_4H_{10}; [75-28-5] (2) Polar solvents excluding water, alcohols and nitrogen-containing compounds	Walter Hayduk Department of Chemical Engineering University of Ottawa Ottawa, Canada K1N 9B4

CRITICAL EVALUATION:

10. Hayduk, W.; Castañeda, R. *Can. J. Chem. Eng.* 1973, *51*, 353-358.

11. Rosenthal, W. *Thès. fac. sci. Univ. Strasbourg (France)* 1954.

12. Ezheleva, A.E.; Zorin, A.D. *Tr. Khim. Khim. Tech. (Gorkii)* 1961, *1*, 37-40.

13. Barton, J.R.; Hsu, C.C. *Chem. Eng. Sci.* 1972, *27*, 1315-1323.

14. Lebeau, P. *Compt. Rend.* 1905, *140*, 1454-6, 1572.

COMPONENTS:

(1) Propane; C_3H_8 [74-98-6]

(2) Acetic acid; $C_2H_4O_2$; [64-19-7]

ORIGINAL MEASUREMENTS:

Barton, J.R.; Hsu, C.C.

Chem. Eng. Sci. 1972, *27*, 1315-1323.

VARIABLES:

T/K = 294.65
P/kPa = 101.325

PREPARED BY:

W. Hayduk

EXPERIMENTAL VALUES:

T/°C	T/K	Ostwald Coefficient[1] L/cm^3 cm^{-1}	Bunsen Coefficient[1] α/cm^3 (STP)cm^{-3}atm^{-1}	Mole fraction[2] x_1
21.5	294.65	6.35	5.86	0.01506

[1] Calculated by compiler.

[2] Original data.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The solubility apparatus (1) consisted of two glass bulbs of accurately measured volume, mounted together and immersed in a bath. The bulbs could be separately charged, interconnected, as well as agitated when required. Vapor-saturated gas was charged to one bulb while deaerated solvent was charged to the other, completely filling the bulb in each case. Saturated gas was stored above mercury in one leg of a manometer which served as a pressure measuring device as well as a variable volume reservoir. Precision tubing was used in the manometer permitting accurate determinations of gas volume. Deaeration was by distillation at total reflux.

SOURCE AND PURITY OF MATERIALS:

1. Source, purity, not given.
2. Baker. Reagent grade. Specified purity 99.9 per cent.

ESTIMATED ERROR:

δT/K = 0.05
$\delta\alpha/\alpha$ = 0.005 (authors)

REFERENCES:

1. Barton, J.R.; Hsu, C.C. *J. Chem. Eng. Data,* 1971, *16* 93.

COMPONENTS:

(1) Propane; C_3H_8; [74-98-6]

(2) Sulfinylbismethane, (Dimethylsulfoxide); C_2H_6SO; [67-68-5]

ORIGINAL MEASUREMENTS:

Lenoir, J-Y.; Renault, P.; Renon, H.

J. Chem. Eng. Data, 1971, *16*, 340-2

VARIABLES:

T/K: 298

P/kPa: 101.3

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	Henry's constant $H_{C_3H_8}$/atm	Mole fraction at 1 atm* $x_{C_3H_8}$
298	186	0.00538

* Calculated by compiler assuming a linear function of $p_{C_3H_8}$ vs $x_{C_3H_8}$, i.e., $x_{C_3H_8}(1\ \text{atm}) = 1/H_{C_3H_8}$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

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

SOURCE AND PURITY OF MATERIALS:

(1) L'Air Liquide sample; minimum purity 99.9 mole per cent.

(2) Touzart and Matignon or Serlabo sample; purity 99 mole per cent.

ESTIMATED ERROR:

$\delta T/\text{K} = \pm 0.1$; $\delta H/\text{atm} = \pm 6\%$ (estimated by compiler).

REFERENCES:

COMPONENTS:

(1) Propane; C_3H_8; [74-98-6]

(2) 2-Propanone (acetone); C_3H_6O; [67-64-1]

ORIGINAL MEASUREMENTS:

Hayduk, W.; Castañeda, R.

Can. J. Chem. Eng. 1973, *51*, 353-358.

VARIABLES:

T/K: 273.15-323.15

P/kPa: 101.325

PREPARED BY:

W. Hayduk

EXPERIMENTAL VALUES:

T/K	Ostwald Coefficient[1] L/cm^3 cm^{-3}	Bunsen Coefficient[2] α/cm^3 (STP)cm^{-3}atm^{-1}	Mole Fraction[1] 10^4x_1
273.15	17.3	17.3	532 (534)[3]
298.15	10.09	9.24	302 (299)
323.15	6.33	5.35	183 (184)

[1] Original data.

[2] Calculated by compiler.

[3] The mole fraction solubility of the original data was used to determine the following equations for $\Delta G°$ and $\ln x_1$ and table of smoothed values:

$$\Delta G°/\text{J mol}^{-1} = -RT \ln x_1 = 81.745\ T - 15676$$

$$\ln x_1 = 1885.5/T - 9.8322$$

Std. deviation for $\Delta G°$ = 17.3 J mol^{-1}; Correlation coefficient = 0.9999

T/K	$\Delta G°$/J mol^{-1}	10^4x_1	T/K	$\Delta G°$/J mol^{-1}	10^4x_1
273.15	6652	534	303.15	9105	270
283.15	7470	419	313.15	9922	221
293.15	8287	334	323.15	10740	184
298.15	8696	299			

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

A volumetric method using a glass apparatus was employed. Degassed solvent contacted the gas while flowing as a thin film, at a constant rate, through an absorption spiral into a solution buret. A constant solvent flow was obtained by means of a calibrated syringe pump. The solution at the end of the spiral was considered saturated. Dry gas was maintained at atmospheric pressure in a gas buret by mechanically raising the mercury level in the buret at an adjustable rate. The solubility was calculated from the constant slope of volume of gas dissolved and volume of solvent injected.

Degassing was accomplished using a two stage vacuum process described by Clever et al. (1).

SOURCE AND PURITY OF MATERIALS:

1. Matheson Co. Specified as instrument grade of minimum purity 99.5 per cent.
2. Fisher. Certified minimum purity 99.0 per cent.

ESTIMATED ERROR:

δT/K = 0.1

$\delta x_1/x_1$ = 0.01

REFERENCES:

1. Clever, H.L.; Battino, R.; Saylor, J.H.; Gross, P.M. *J. Phys. Chem.* 1971, *61*, 1078.

COMPONENTS:

(1) Propane; C_3H_8; [74-98-6]

(2) 2-Propanone (acetone); C_3H_6O; [67-64-1]

ORIGINAL MEASUREMENTS:

Rosenthal, W.

Thès. fac. sci. Univ. Strasbourg (France) 1954.

VARIABLES:

T/K: 293.15

P/kPa: 101.325

PREPARED BY:

W. Hayduk

EXPERIMENTAL VALUES:

T/K	Ostwald Coefficient[1] L/cm^3 cm^{-3}	Bunsen Coefficient[2] α/cm^3 (STP)cm^{-3}atm^{-1}	Mole Fraction[2] x_1
293.15	11.76	10.91	0.03526

[1] Original data.

[2] Calculated by compiler.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The solvent was charged into an evacuated cell after degassing, and the mass of solvent was determined by weight. Gas was introduced into the cell from a measuring burette in which the gas was stored over mercury. The cell was agitated while the gas pressure was maintained by adjusting the gas volume. The Ostwald coefficient was determined from the mass of solvent and volume of gas used. Solubilities were measured at pressures above and below atmospheric.

SOURCE AND PURITY OF MATERIALS:

1. Source and purity not given.
2. Research grade. Purity not given. Dried and distilled.

ESTIMATED ERROR:

δT/K = 0.2
δP/kPa = 0.1
$\delta x_1/x_1$ = 0.02

REFERENCES:

COMPONENTS:

(1) Propane; C_3H_8; [74-98-6]

(2) Acetic acid anhydride; $C_4H_6O_3$; [108-24-7]

ORIGINAL MEASUREMENTS:

Gerrard, W.

J. Appl. Chem. Biotechnol. 1973, *23*, 1-17.

VARIABLES:

T/K: 268.2-293.2

P/kPa: 101.3

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

Total pressure = 101.3 kPa

T/K	Mole ratio	Mole fraction of propane#
268.2	0.0283	0.0275
273.2	0.0238	0.0232
278.2	0.0203	0.0199
283.2	0.0166	0.0163
293.2	0.0130	0.0128

calculated by compiler

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Gas was passed into a known weight of pure liquid in a bubbler tube at a total pressure measured using a manometer assembly. The amount of absorbed gas was estimated by weighing. The temperature was controlled to within 0.2 K. The apparatus and procedure are described by Gerrard, ref. (1).

SOURCE AND PURITY OF MATERIALS:

No details given except that "all compounds were purified by conventional procedures".

ESTIMATED ERROR:

$\delta T/K = \pm 0.1$; $\delta x/x = \pm 3\%$ (estimated by compiler).

REFERENCES:

1. Gerrard, W. *J. Appl. Chem. Biotechnol.* 1972, *22*, 623.

COMPONENTS:

(1) Propane; C_3H_8; [74-98-6]

(2) 1,4-Dioxane; $C_4H_8O_2$; [123-91-1]

ORIGINAL MEASUREMENTS:

Thomsen, E.S.; Gjaldbaek, J.C.

Acta Chem. Scand. 1963, *17*, 134-138.

VARIABLES:

T/K: 298.15

P/kPa: 101.325

PREPARED BY:

E.S. Thomsen, W. Hayduk

EXPERIMENTAL VALUES:

T/K	Ostwald Coefficient[2] $L/\text{cm}^3\ \text{cm}^{-3}$	Bunsen Coefficient[1] $\alpha/\text{cm}^3\ (\text{STP})\ \text{cm}^{-3}\text{atm}^{-1}$	Mole Fraction[2] x_1
298.15	8.21	7.48	0.0284

[1] Original data.

[2] Calculated by compilers using the real gas molar volume.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The method utilizes a combined glass manometer and bulb enclosed in an air thermostat which is shaken until equilibrium is established. Mercury is used for calibrating the volumes and as the confining liquid. Details in reference 1.

The absorbed gas volume is calculated from the initial dry gas, and final solvent vapor-saturated gas volume. The amount of solvent is determined by measuring the mass of mercury displaced.

SOURCE AND PURITY OF MATERIALS:

1. Phillips Petroleum Co. Specified as research grade and GC analysis indicated 0.1 per cent air and 0.03 per cent ethane impurities.
2. British Drug House, Analar grade. Fractionated over sodium.

ESTIMATED ERROR:

$\delta T/\text{K} = 0.05$

$\delta x_1/x_1 = 0.015$

REFERENCES:

1. Gjaldbaek, J.C. *Acta Chem. Scand.* 1952, *6*, 623.

COMPONENTS:

(1) Propane; C_3H_8; [74-98-6]

(2) 4-Methyl-1,3-dioxolan-2-one, (Propylene carbonate); $C_4H_6O_3$; [108-32-7]

ORIGINAL MEASUREMENTS:

Lenoir, J.-Y.; Renault, P.; Renon, H.

J. Chem. Eng. Data 1971, *16*, 340-2.

VARIABLES:

T/K: 298-343

P/kPa: 101.3

PREPARED BY:

C.L. Young

EXPERIMENTAL VALUES:

T/K	Henry's constant $H_{C_3H_8}$/atm	Mole fraction at 1 atm* $x_{C_3H_8}$
298	107	0.00935
323	135	0.00741
343	150	0.00667

* Calculated by compiler assuming a linear function of $p_{C_3H_8}$ vs $x_{C_3H_8}$, i.e., $x_{C_3H_8}$(1 atm) = $1/H_{C_3H_8}$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

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

SOURCE AND PURITY OF MATERIALS:

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

ESTIMATED ERROR:

δT/K = ±0.1; δH/atm = ±6%

(estimated by compiler).

REFERENCES:

COMPONENTS:

(1) Propane; C_3H_8; [74-98-6]

(2) Water, Benzene, Ethanol, Diethylether, Chloroform, Turpentine

ORIGINAL MEASUREMENTS:

Lebeau, P.

Compt. Rend. 1905, *140*, 1454-6 and 1572.

Bull. Soc. Chim. [*3*] 1905, *33*, 1137-9.

VARIABLES:

T/K = 290.8 - 294.8
p/kPa = 100.4 - 100.9

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

Temperature t/°C	T/K	Pressure[a] p/mmHg	Solubility Volume propane/100 Volumes Solvent
Water; H_2O; [7732-18-5]			
17.8	291.0	753	6.5
Benzene; C_6H_6O; [71-43-2]			
21.5	294.7	757	1452
Ethanol; C_2H_6O; [64-17-5]			
16.6	290.8	754	790
1,1'-Oxybisethane or diethylether; $C_4H_{10}O$; [60-29-7]			
16.6	290.8	757	926
Chloroform or trichloromethane; $CHCl_3$; [67-66-3]			
21.6	294.8	757	1299
Oil of turpentine			
17.7	290.9	757	1587

[a] Not clear whether this is total pressure or propane partial pressure. It is probably total pressure.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Details not given.

The data are reported in both papers.

SOURCE AND PURITY OF MATERIALS:

(1) Propane. Prepared by author from carefully purified propyl iodide by reaction with sodium in liquid ammonia.
Melting point/°C = -195
Boiling point/°C = -44.5
Critical temperature/°C = 102.

(2) Solvents. No information.

ESTIMATED ERROR:

REFERENCES:

COMPONENTS:

(1) Propane; C_3H_8; [74-98-6]

(2) 2-Furancarboxaldehyde (furfural); $C_5H_4O_2$; [98-01-1]

ORIGINAL MEASUREMENTS:

Ezheleva, A.E.; Zorin, A.D.

Tr. Khim. Khim. Tech. (Gorkii) 1961, *1*, 37-40.

VARIABLES:

T/K: 303.15-343.15

P/kPa: 101.325 and above

PREPARED BY:

W. Hayduk

EXPERIMENTAL VALUES:

T/K	Ostwald Coefficient[2] $L/\mathrm{cm^3 cm^{-3}}$	Bunsen Coefficient[2] $\alpha/\mathrm{cm^3(STP)cm^{-3}atm^{-1}}$	Mole Fraction[1] x_1
303.15	7.89	7.07	0.0262(0.0262)[3]
313.15	7.70	6.66	0.0250(0.0252)
323.15	7.41	6.21	0.0236(0.0226)
333.15	5.74	4.66	0.0180(0.0189)
343.15	4.92	3.88	0.0152(0.0149)

[1] Original data given as the inverse of Henry's constant which is equivalent to mole fraction at a gas partial pressure of 101.325 kPa.

[2] Ostwald and Bunsen coefficients calculated by compiler using authors' assumption that solvent is non-volatile.

[3] From equation of smoothed data:

$$\ln x_1 = 520.02 - 77.978 \ln T - 23669/T$$

Correlation coefficient = 0.9889

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The apparatus consisted of a two-chamber, rocking device with separate gas and liquid chambers joined by two tubes and microvalves. The gas chamber was equipped with a pressure gauge. After evacuation, gas and deaerated solvent were separately charged, and then contacted by opening the microvalves and by rocking. The solubility was calculated from a knowledge of the volume of the solvent charged, and the initial and final gas pressures.

The solvent was considered non-volatile and the gas pressure was considered to be the total pressure.

SOURCE AND PURITY OF MATERIALS:

1. Source and purity not given. Gas purified by low temperature fractionation and analyzed by gas chromatography.
2. Source and purity not given. Refractive index measured:

$n_D^{20} = 1.5305$

ESTIMATED ERROR:

δT/K = 0.05

$\delta x_1/x_1$ = 0.05

(estimated by compiler)

REFERENCES:

COMPONENTS:

(1) Propane; C_3H_8; [74-98-6]

(2) Oxybispropanol, (dipropylene glycol); $C_6H_{14}O_3$; [25265-71-8]

ORIGINAL MEASUREMENTS:

Lenoir, J.-Y.; Renault, P.; Renon, H.

J. Chem. Eng. Data 1971, *16*, 340-2.

VARIABLES:

T/K: 298-343

P/kPa: 101.3

PREPARED BY:

C.L. Young

EXPERIMENTAL VALUES:

T/K	Henry's constant $H_{C_3H_8}$/atm	Mole fraction at 1 atm* $x_{C_3H_8}$
298	71.5	0.0140
323	85.0	0.0118
343	119	0.00840

* Calculated by compiler assuming a linear function of $p_{C_3H_8}$ vs $x_{C_3H_8}$ i.e., $x_{C_3H_8}$(1 atm) = $1/H_{C_3H_8}$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

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

SOURCE AND PURITY OF MATERIALS:

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

ESTIMATED ERROR:

δT/K = ±0.1; δH/atm = ±6%
(estimated by compiler)

REFERENCES:

COMPONENTS:

(1) Propane; C_3H_8; [74-98-6]
(2) Hexanoic acid; $C_6H_{12}O_2$;
[142-62-1]

ORIGINAL MEASUREMENTS:

Gerrard, W.
J. Appl. Chem. Biotechnol.
1973, *23*, 1-17.

VARIABLES:

T/K: 273.2-293.2
P/kPa: 101.3

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

Total pressure = 101.3 kPa

T/K	Mole ratio	Mole fraction of propane[#]
273.2	0.143	0.125
278.2	0.127	0.113
283.2	0.115	0.103
293.2	0.099	0.090

[#] Calculated by compiler.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Gas was passed into a known weight of pure liquid in a bubbler tube at a total pressure measured using a manometer assembly. The amount of absorbed gas was estimated by weighing. The temperature was controlled to within 0.2 K. The apparatus and procedure are described by Gerrard, ref. (1).

SOURCE AND PURITY OF MATERIALS:

No details given except that "all compounds were purified by conventional procedures".

ESTIMATED ERROR:

$\delta T/K = \pm 0.1$; $\delta x/x = \pm 3\%$
(estimated by compiler).

REFERENCES:

1. Gerrard, W.
J. Appl. Chem. Biotechnol.
1972, *22*, 623.

COMPONENTS:

(1) Propane; C_3H_8; [74-98-6]

(2) 2-Hydroxybenzoic acid, methyl ester; $C_8H_8O_3$; [119-36-8]

ORIGINAL MEASUREMENTS:

Gerrard, W.

J. Appl. Chem. Biotechnol. 1973, *23*, 1-17.

VARIABLES:

T/K: 268.2-293.2

P/kPa: 101.3

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

Total pressure = 101.3 kPa

T/K	Mole ratio	Mole fraction of propane#
268.2	0.0647	0.0608
273.2	0.0556	0.0527
278.2	0.0484	0.0462
283.2	0.0428	0.0410
293.2	0.0360	0.0347

Calculated by compiler.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Gas was passed into a known weight of pure liquid in a bubbler tube at a total pressure measured using a manometer assembly. The amount of absorbed gas was estimated by weighing. The temperature was controlled to within 0.2 K. The apparatus and procedure are described by Gerrard, ref. (1).

SOURCE AND PURITY OF MATERIALS:

No details given except that "all compounds were purified by conventional procedures".

ESTIMATED ERROR:

$\delta T/K = \pm 0.1$; $\delta x/x = \pm 3\%$ (estimated by compiler).

REFERENCES:

1. Gerrard, W. *J. Appl. Chem. Biotechnol.* 1972, *22*, 623.

COMPONENTS:

(1) Propane; C_3H_8; [74-98-6]
(2) Ethoxybenzene; $C_8H_{10}O$;
[103-73-1]

ORIGINAL MEASUREMENTS:

Gerrard, W.
J. Appl. Chem. Biotechnol.
1973, *23*, 1-17.

VARIABLES:
T/K: 268.2-293.2
P/kPa: 101.3

PREPARED BY:
C. L. Young

EXPERIMENTAL VALUES:

Total pressure = 101.3 kPa

T/K	Mole ratio	Mole fraction of propane[#]
268.2	0.112	0.1007
273.2	0.0950	0.0868
278.2	0.0810	0.0749
283.2	0.0635	0.0597
293.2	0.0468	0.0447

[#] Calculated by compiler.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Gas was passed into a known weight of pure liquid in a bubbler tube at a total pressure measured using a manometer assembly. The amount of absorbed gas was estimated by weighing. The temperature was controlled to within 0.2 K. The apparatus and procedure are described by Gerrard, ref. (1).

SOURCE AND PURITY OF MATERIALS:

No details given except that "all compounds were purified by conventional procedures".

ESTIMATED ERROR:
$\delta T/K = \pm 0.1$; $\delta x/x = \pm 3\%$
(estimated by compiler).

REFERENCES:

1. Gerrard, W.
J. Appl. Chem. Biotechnol.
1972, *22*, 623.

COMPONENTS:

(1) Propane; C_3H_8; [74-98-6]

(2) Esters of phosphoric acid

ORIGINAL MEASUREMENTS:

Lenoir, J-Y.; Renault, P.; Renon, H.

J. Chem. Eng. Data 1971, *16*, 340-2

VARIABLES:

T/K: 298.2-343.2

P/kPa: 101.3

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	Henry's constant $H_{C_3H_8}$/atm	Mole fraction at 1 atm* $x_{C_3H_8}$
Phosphoric acid, trimethyl ester; $C_3H_9O_4P$; [512-46-1]		
325.2	114	0.00877
Phosphoric acid, triethyl ester; $C_6H_{15}O_4P$; [78-40-0]		
325.2	37.2	0.0269
Phosphoric acid, tripropyl ester; $C_9H_{21}O_4P$; [513-08-6]		
298.2	13.1	0.0763
323.2	20.2	0.0495
343.2	28.2	0.0355
Phosphoric acid, tributyl ester; $C_{12}H_{27}O_4P$; [126-73-8]		
325.2	15.1	0.0662
Phosphoric acid, tri(2-methyl propyl)ester; $C_{12}H_{27}O_4P$; [126-71-6]		
325.2	14.4	0.0694

* Calculated by compiler assuming a linear function of $p_{C_3H_8}$ vs $x_{C_3H_8}$, i.e., $x_{C_3H_8}(1\ \text{atm}) = 1/H_{C_3H_8}$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

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

SOURCE AND PURITY OF MATERIALS:

(1) L'Air Liquide sample; minimum purity 99.9 mole per cent.

(2) Touzart and Matignon or Serlabo sample; purity 99 mole per cent.

ESTIMATED ERROR:

$\delta T/K = \pm 0.1$; $\delta H/\text{atm} = \pm 6\%$ (estimated by compiler).

REFERENCES:

COMPONENTS:

(1) Propane; C_3H_8; [74-98-6]

(2) 1,1'-Oxybispentane (dipentyl ether); $C_{10}H_{22}O$; [693-65-2]
1,1'-Oxybisoctane (dioctyl ether); $C_{16}H_{34}O$; [629-82-3]

ORIGINAL MEASUREMENTS:

Gerrard, W.
J. Appl. Chem. Biotechnol.
1973, *23*, 1-17.

VARIABLES:

T/K: 268.2-298.2
P/kPa: 101.3

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

Total pressure = 101.3 kPa

T/K	Mole ratio	Mole fraction of propane#
	dipentyl ether	
268.2	0.411	0.291
	dioctyl ether	
278.2	0.322	0.244
283.2	0.240	0.194
293.2	0.182	0.154
298.2	0.160	0.138

Calculated by compiler.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Gas was passed into a known weight of pure liquid in a bubbler tube at a total pressure measured using a manometer assembly. The amount of absorbed gas was estimated by weighing. The temperature was controlled to within 0.2 K. The apparatus and procedure are described by Gerrard, ref. (1).

SOURCE AND PURITY OF MATERIALS:

No details given except that "all compounds were purified by conventional procedures".

ESTIMATED ERROR:

$\delta T/K = \pm 0.1$; $\delta x/x = \pm 3\%$
(estimated by compiler).

REFERENCES:

1. Gerrard, W.
J. Appl. Chem. Biotechnol.
1972, *22*, 623.

COMPONENTS:

(1) Propane; C_3H_8; [74-98-6]

(2) Decanedioic acid, bis (2-ethylhexyl) ester (di-2-ethylhexyl sebacate); $C_{26}H_{50}O_4$; [122-62-3]

ORIGINAL MEASUREMENTS:

Carter, D.; Esterson, G.L.

J. Chem. Eng. Data 1973, *18*, 166-169.

VARIABLES:

T/K: 328.15

P/kPa: 101.325

PREPARED BY:

W. Hayduk

EXPERIMENTAL VALUES:

T/K	Modified Henry's constant[1], $h/$ $(\text{mol cm}^{-3})_g(\text{mol cm}^{-3})_l^{-1}$	Ostwald Coefficient[2] $L/\text{cm}^3\text{cm}^{-3}$	Bunsen Coefficient[2] $\alpha/$ $\text{cm}^3(\text{STP})\text{cm}^{-3}$	Mole Fraction[2] $/x_1$	Method
328.15	0.182	5.50	4.58	0.0890	A
328.15	0.196	5.10	4.25	0.0832	B

[1] Original data listed as a modified Henry's constant, *h*.

[2] Calculated by compiler assuming Henry's law and ideal gas law apply.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Two different methods were used: method A, chromatographic, and method B, liquid saturation.

A. A chromatography column containing a known amount of solvent was installed in an oven. Helium was used as a carrier gas. Pulses of solute gas and argon were consecutively injected into the gas stream. The solubility was determined from the total retention times. The solubilities were determined at effectively very low partial pressures and hence linear extrapolation to atmospheric pressure is subject to error.

B. The increase in mass of the solvent exposed to moderate pressures of gas was measured. Details not given.

SOURCE AND PURITY OF MATERIALS:

1. Matheson Co. Purity not specified.
2. Consolidated Electrodynamics Corp. Purity not specified.

ESTIMATED ERROR:

A. $\delta h/h = 0.10$

B. $\delta h/h = 0.03$ (by compiler)

REFERENCES:

COMPONENTS:

(1) Butane; C_4H_{10}; [106-97-8]

(2) Oxybispropanol, (Dipropylene glycol; $C_4H_{14}O_3$; [25265-71-8]

ORIGINAL MEASUREMENTS:

Lenoir, J.-Y.; Renault, P.;
Renon, H.

J. Chem. Eng. Data 1971, *16*, 340-2.

VARIABLES:

T/K: 298-343

P/kPa: 101.3

PREPARED BY:

C.L. Young

EXPERIMENTAL VALUES:

T/K	Henry's constant $H_{C_4H_{10}}$/atm	Mole fraction at 1 atm* $x_{C_4H_{10}}$
298	23.0	0.0435
323	30.7	0.0326
343	37.4	0.0267

* Calculated by compiler assuming a linear function of $p_{C_4H_{10}}$ vs $x_{C_4H_{10}}$, i.e., $x_{C_4H_{10}}$(1 atm) = $1/H_{C_4H_{10}}$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

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

SOURCE AND PURITY OF MATERIALS:

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

ESTIMATED ERROR:

δT/K = ±0.1; δH/atm = ±6%
(estimated by compiler).

REFERENCES:

COMPONENTS:

(1) Butane; C_4H_{10}; [106-97-8]

(2) 1,4-Dioxane; $C_4H_8O_2$;
[123-91-1]

ORIGINAL MEASUREMENTS:

Gerrard, W.
J. Appl. Chem. Biotechnol.
1973, *23*, 1-17.

VARIABLES:

T/K: 283.2, 293.2
P/kPa: 101.3

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

Total pressure = 101.3 kPa

T/K	Mole ratio	Mole fraction of butane#
283.2	0.406	0.289
293.2	0.20	0.167

Calculated by compiler.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Gas was passed into a known weight of pure liquid in a bubbler tube at a total pressure measured using a manometer assembly. The amount of absorbed gas was estimated by weighing. The temperature was controlled to within 0.2 K. The apparatus and procedure are described by Gerrard, ref. (1).

SOURCE AND PURITY OF MATERIALS:

No details given except that "all compounds were purified by conventional procedures".

ESTIMATED ERROR:

$\delta T/K = \pm 0.1$; $\delta x/x = \pm 3\%$
(estimated by compiler).

REFERENCES:

1. Gerrard, W.
J. Appl. Chem. Biotechnol.
1972, *22*, 623.

COMPONENTS:

(1) Butane; C_4H_{10}; [106-97-8]

(2) Acetic acid anhydride; $C_4H_6O_3$; [108-24-7]

ORIGINAL MEASUREMENTS:

Gerrard, W.

J. Appl. Chem. Biotechnol. 1973, *23*, 1-17.

VARIABLES:

T/K: 278.2-293.2

P/kPa: 101.3

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

Total pressure = 101.3 kPa

T/K	Mole ratio	Mole fraction of butane[#]
278.2	0.123	0.110
283.2	0.086	0.079
293.2	0.0525	0.0499

[#] Calculated by compiler.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Gas was passed into a known weight of pure liquid in a bubbler tube at a total pressure measured using a manometer assembly. The amount of absorbed gas was estimated by weighing. The temperature was controlled to within 0.2 K. The apparatus and procedure are described by Gerrard, ref. (1).

SOURCE AND PURITY OF MATERIALS:

No details given except that "all compounds were purified by conventional procedures".

ESTIMATED ERROR:

$\delta T/K = \pm 0.1$; $\delta x/x = \pm 3\%$ (estimated by compiler).

REFERENCES:

1. Gerrard, W.
J. Appl. Chem. Biotechnol. 1972, *22*, 623.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Butane; C_4H_{10}; [106-97-8] (2) Water; H_2O; [7732-18-5] Ethanol; C_2H_6O; [64-17-5] Diethylether; $C_4H_{10}O$; [60-29-7] Chloroform; $CHCl_3$; [67-66-3]	Lebeau, P. *Bull. Acad. Roy. Belg.* 1908, 300-4.
VARIABLES:	**PREPARED BY:**
T/K = 290, 291 p/kPa = 102.9 - 104.8	H. L. Clever

EXPERIMENTAL VALUES:

Temperature t/°C	 T/K	Pressure[a] p/mmHg	Solubility Volume Butane/Volume Solvent
Water			
17	290	772	0.15
Ethanol			
17	290	775	18.83
Diethylether or 1'1'-oxybisethane			
18	291	773	29.8
Chloroform or trichloromethane			
17	290	786	32.5

[a] Not clear whether this is total pressure or butane partial pressure. It is probably the total pressure.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Details not given.

SOURCE AND PURITY OF MATERIALS:

(1) Butane. Prepared by author by the reaction of sodium in liquid ammonia on butyl iodide. The normal boiling point is 0.5 °C, and the critical temperature is 151-2 °C.

(2) Solvents. No information.

ESTIMATED ERROR:

REFERENCES:

COMPONENTS:

(1) Butane; C_4H_{10}; [106-97-8]

(2) Hexanoic acid; $C_6H_{12}O_2$; [142-62-1]

ORIGINAL MEASUREMENTS:

Gerrard, W.

J. Appl. Chem. Biotechnol. 1973, *23*, 1-17.

VARIABLES:

T/K: 278.2-298.2

P/kPa: 101.3

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

Total pressure = 101.3 kPa

T/K	Mole ratio	Mole fraction of butane[#]
278.2	1.80	0.643
283.2	1.00	0.500
293.2	0.495	0.331
298.2	0.390	0.281

[#] Calculated by compiler.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Gas was passed into a known weight of pure liquid in a bubbler tube at a total pressure measured using a manometer assembly. The amount of absorbed gas was estimated by weighing. The temperature was controlled to within 0.2 K. The apparatus and procedure are described by Gerrard, ref. (1).

SOURCE AND PURITY OF MATERIALS:

No details given except that "all compounds were purified by conventional procedures".

ESTIMATED ERROR:

$\delta T/K = \pm 0.1$; $\delta x/x = \pm 3\%$ (estimated by compiler).

REFERENCES:

1. Gerrard, W. *J. Appl. Chem. Biotechnol.* 1972, *22*, 623.

COMPONENTS:

(1) Butane; C_4H_{10}; [106-97-8]
(2) Ethoxybenzene; $C_8H_{10}O$; [103-73-1]
or Benzenemethanol (*Benzyl alcohol*); C_7H_8O; [100-51-6]
or 1-Phenylethanone (*Acetophenone*); C_8H_8O; [98-86-2]

ORIGINAL MEASUREMENTS:

Gerrard, W.
J. Appl. Chem. Biotechnol.
1973, *23*, 1-17.

VARIABLES:

T/K: 278.2-293.2
P/kPa: 101.3

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

Total pressure = 101.3 kPa

T/K	Mole ratio	Mole fraction of butane[#]
	Ethoxybenzene; $C_8H_{10}O$; [103-73-1]	
278.2	3.35	0.770
283.2	0.941	0.485
293.2	0.410	0.291
	Benzenemethanol; C_7H_8O; [100-51-6]	
278.2	0.214	0.176
283.2	0.111	0.0999
293.2	0.073	0.0680
	1-Phenylethanone; C_8H_8O; [98-86-2]	
293.2	0.164	0.141

[#] Calculated by compiler.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Gas was passed into a known weight of pure liquid in a bubbler tube at a total pressure measured using a manometer assembly. The amount of absorbed gas was estimated by weighing. The temperature was controlled to within 0.2 K. The apparatus and procedure are described by Gerrard, ref. (1).

SOURCE AND PURITY OF MATERIALS:

No details given except that "all compounds were purified by conventional procedures".

ESTIMATED ERROR:

$\delta T/K = \pm 0.1$; $\delta x/x = \pm 3\%$ (estimated by compiler).

REFERENCES:

1. Gerrard, W.
J. Appl. Chem. Biotechnol.
1972, *22*, 623.

COMPONENTS:

(1) Butane; C_4H_{10}; [106-97-8]

(2) 2-Hydroxybenzoic acid, methyl ester; $C_8H_8O_3$; [119-36-8]

ORIGINAL MEASUREMENTS:

Gerrard, W.
J. Appl. Chem. Biotechnol.
1973, *23*, 1-17.

VARIABLES:

T/K: 278.2-298.2
P/kPa: 101.3

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

Total pressure = 101.3 kPa

T/K	Mole ratio	Mole fraction of butane[#]
278.2	0.582	0.368
283.2	0.370	0.270
293.2	0.215	0.177
298.2	0.175	0.149

[#] Calculated by compiler.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Gas was passed into a known weight of pure liquid in a bubbler tube at a total pressure measured using a manometer assembly. The amount of absorbed gas was estimated by weighing. The temperature was controlled to within 0.2 K. The apparatus and procedure are described by Gerrard, ref. (1).

SOURCE AND PURITY OF MATERIALS:

No details given except that "all compounds were purified by conventional procedures".

ESTIMATED ERROR:

$\delta T/K = \pm 0.1$; $\delta x/x = \pm 3\%$
(estimated by compiler).

REFERENCES:

1. Gerrard, W.
J. Appl. Chem. Biotechnol.
1972, *22*, 623.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Butane; C_4H_{10}; [106-97-8] (2) Esters of phosphoric acid	Lenoir, J-Y.; Renault, P.; Renon, H. *J. Chem. Eng. Data*, 1971, *16*, 340-2

VARIABLES:	PREPARED BY:
T/K: 298.2-343.2 P/kPa: 101.3	C. L. Young

EXPERIMENTAL VALUES:

T/K	Henry's constant $H_{C_4H_{10}}$/atm	Mole fraction at 1 atm* $x_{C_4H_{10}}$
Phosphoric acid, trimethyl ester; $C_3H_9O_4P$; [512-56-1]		
325.2	49.6	0.0202
Phosphoric acid, triethyl ester; $C_6H_{15}O_4P$; [78-40-0]		
325.2	14.2	0.0704
Phosphoric acid, tripropyl ester; $C_9H_{21}O_4P$; [513-08-6]		
298.2	4.04	0.248
323.2	7.19	0.139
343.2	10.6	0.0943
Phosphoric acid, tributyl ester; $C_{12}H_{27}O_4P$; [126-73-8]		
325.2	6.10	0.164
Phosphoric acid, tri(2-methylpropyl) ester; $C_{12}H_{27}O_4P$; [126-71-6]		
325.2	5.44	0.184

* Calculated by compiler assuming a linear function of $p_{C_4H_{10}}$ vs $x_{C_4H_{10}}$, i.e., $x_{C_4H_{10}}$(1 atm) = $1/H_{C_4H_{10}}$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

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

SOURCE AND PURITY OF MATERIALS:

(1) L'Air Liquide sample; minimum purity 99.9 mole per cent.

(2) Touzart and Matignon or Serlabo sample; purity 99 mole per cent.

ESTIMATED ERROR:

δT/K = ±0.1; δH/atm = ±6%

(estimated by compiler).

REFERENCES:

COMPONENTS:

(1) Butane; C_4H_{10}; [106-97-8]

(2) 1,1'-Oxybispentane (dipentyl ether); $C_{10}H_{22}O$; [693-65-2]

ORIGINAL MEASUREMENTS:

Gerrard, W.

J. Appl. Chem. Biotechnol.

1973, *23*, 1-17.

VARIABLES:

T/K: 278.2-293.2

P/kPa: 101.3

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

Total pressure = 101.3 kPa

T/K	Mole ratio	Mole fraction of butane#
278.2	4.917	0.831
283.2	2.480	0.713
293.2	1.081	0.519

\# Calculated by compiler.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Gas was passed into a known weight of pure liquid in a bubbler tube at a total pressure measured using a manometer assembly. The amount of absorbed gas was estimated by weighing. The temperature was controlled to within 0.2 K. The apparatus and procedure are described by Gerrard, ref. (1).

SOURCE AND PURITY OF MATERIALS:

No details given except that "all compounds were purified by conventional procedures".

ESTIMATED ERROR:

$\delta T/K = \pm 0.1$; $\delta x/x = \pm 3\%$ (estimated by compiler).

REFERENCES:

1. Gerrard, W. *J. Appl. Chem. Biotechnol.* 1972, *22*, 623.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Butane; C_4H_{10}; [106-97-8] (2) 1,1'-Oxybisoctane (dioctyl ether); $C_{16}H_{34}O$; [629-82-3]	Gerrard, W. *J. Appl. Chem. Biotechnol.* <u>1973</u>, *23*, 1-17.
VARIABLES: T/K: 278.2-298.2 P/kPa: 101.3	PREPARED BY: C.L. Young

EXPERIMENTAL VALUES:

Total pressure = 101.3 kPa

T/K	Mole ratio	Mole fraction of butane#
278.2	5.666	0.850
283.2	2.571	0.720
293.2	1.38	0.580
298.2	1.05	0.512

Calculated by compiler.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Gas was passed into a known weight of pure liquid in a bubbler tube at a total pressure measured using a manometer assembly. The amount of absorbed gas was estimated by weighing. The temperature was controlled to within 0.2 K. The apparatus and procedure are described by Gerrard, ref. (1).

SOURCE AND PURITY OF MATERIALS:

No details given except that "all compounds were purified by conventional procedures".

ESTIMATED ERROR:

$\delta T/K = \pm 0.1$; $\delta x/x = \pm 3\%$ (estimated by compiler).

REFERENCES:

1. Gerrard, W. *J. Appl. Chem. Biotechnol.* <u>1972</u>, *22*, 623.

COMPONENTS:

1. Propane, 2-methyl-; (isobutane) C_4H_{10}; [75-28-5]
2. 1,3-Dioxolan-2-one, 4-methyl-, (Propylene carbonate); $C_4H_6O_3$; [108-32-7]

ORIGINAL MEASUREMENTS:

Lenoir, J-Y.; Renault, P.; Renon, H.

J. Chem. Eng. Data 1971, *16*, 340-2

VARIABLES:

T/K: 298.2 - 343.2

P/kPa: 101.3

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	Henry's constant $H_{C_4H_{10}}$/atm	Mole fraction at 1 atm* $x_{C_4H_{10}}$
298.2	66.3	0.0151
323.2	94.3	0.0106
343.2	110	0.00909

* Calculated by compiler assuming a linear function of $p_{C_4H_{10}}$ vs $x_{C_4H_{10}}$, i.e., $x_{C_4H_{10}}$(1 atm) = $1/H_{C_4H_{10}}$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

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

SOURCE AND PURITY OF MATERIALS:

(1) L'Air Liquide sample, minimum purity 99.9 mole per cent.

(2) Touzart and Matignon or Serlabo sample, purity 99 mole per cent.

ESTIMATED ERROR:

$\delta T/K = \pm 0.1$; $\delta H/\text{atm} = \pm 6\%$ (estimated by compiler).

REFERENCES:

COMPONENTS:

(1) 2-Methylpropane or isobutane; C_4H_{10}; [75-28-5]

(2) Water; H_2O; [7732-18-5]
Ethanol; C_2H_6O; [64-17-5]
Diethylether; $C_4H_{10}O$; [60-29-7]
Chloroform; $CHCl_3$; [67-66-3]

ORIGINAL MEASUREMENTS:

Lebeau, P.

Bull. Acad. Roy. Belg. 1908, 300-4.

VARIABLES:

T/K = 290, 291
p/kPa = 102.9 - 104.8

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

Temperature t/°C	T/K	Pressure[a] p/mmHg	Solubility Volume Isobutane/Volume Solvent
Water			
17	290	772	0.13
Ethanol			
17	290	775	13.2
Diethylether or 1'1'-oxybisethane			
18	291	773	27.9
Chloroform or trichloromethane			
17	290	786	39.5

[a] Not clear whether this is total pressure or isobutane partial pressure. It is probably the total pressure.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Details not given.

SOURCE AND PURITY OF MATERIALS:

(1) Isobutane. Prepared by the author by the reaction of sodium or calcium in liquid ammonia on isobutyl chloride. The normal boiling point is -10.5 °C and the critical temperature is 134-5 °C.

(2) Solvents. No information.

ESTIMATED ERROR:

REFERENCES:

COMPONENTS:

(1) 2-Methylpropane (isobutane); C_4H_{10}; [75-28-5]

(2) 2-Furancarboxaldehyde (furfural); $C_5H_4O_2$; [98-01-1]

ORIGINAL MEASUREMENTS:

Ezheleva, A.E.; Zorin, A.D.

Tr. Khim. Khim. Tech. (Gorkii) <u>1961</u>, *1*, 37-40.

VARIABLES:

T/K: 303.15-343.15

P/kPa: 101.325 and above

PREPARED BY:

W. Hayduk

EXPERIMENTAL VALUES:

T/K	Ostwald Coefficient[2] L/cm^{3}cm^{-3}	Bunsen Coefficient[2] α/cm^3(STP)cm^{-3}atm^{-1}	Mole Fraction[1] x_1
303.15	8.19	7.28	0.0275(0.0276)[3]
313.15	7.98	6.85	0.0262(0.0263)
323.15	7.85	6.51	0.0252(0.0250)
333.15	7.66	6.15	0.0241(0.0238)
343.15	7.29	5.67	0.0225(0.0228)

[1] Original data given as the inverse of Henry's constant which is equivalent to mole fraction at a gas partial pressure of 101.325 kPa.

[2] Ostwald and Bunsen coefficients calculated by compiler using authors' assumption that solvent is non-volatile.

[3] From equation of smoothed data:

$$\ln x_1 = 5.3391 - 1.5624 \ln T$$

Correlation coefficient = 0.9928

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The apparatus consisted of a two-chamber, rocking device with separate gas and liquid chambers joined by two tubes and microvalves. The gas chamber was equipped with a pressure gauge. After evacuation, gas and deaerated solvent were separately charged, and then contacted by opening the microvalves and by rocking. The solubility was calculated from a knowledge of the volume of the solvent charged, and the initial and final gas pressures.

The solvent was considered non-volatile and the gas pressure was considered to be the total pressure.

SOURCE AND PURITY OF MATERIALS:

1. Source and purity not given. Gas purified by low temperature fractionation and analyzed by gas chromatography.
2. Source and purity not given. Refractive index measured:

n_D^{20} = 1.5305

ESTIMATED ERROR:

δT/K = 0.05

$\delta x_1/x_1$ = 0.05 (estimated by compiler)

REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) 2-Methylpropane, (*iso*butane); C_4H_{10}; [75-28-5] (2) Hexanoic acid; $C_6H_{12}O_2$; [142-62-1]	Gerrard, W. *Solubility of Gases and Liquids, Plenum, New York*, 1976, Chapter 12.
VARIABLES: T/k: 273.15 P/kPa: 13.3-101.3	PREPARED BY: C.L. Young

EXPERIMENTAL VALUES:

T/K	P/mmHg	P/kPa	Mole fraction 2-methylpropane in liquid, $x_{C_4H_{10}}$
273.15	100	13.3	0.040
	200	26.7	0.084
	300	40.0	0.128
	400	53.3	0.180
	500	66.7	0.228
	600	80.0	0.280
	700	93.3	0.360
	760	101.3	0.416

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Gas was passed into a known weight of pure liquid in a bubbler tube at a total pressure measured by a manometer assembly. The amount of absorbed gas was estimated by weighing. The temperature was manually controlled to within 0.2K. The apparatus and procedure are described by Gerrard (1,2).

SOURCE AND PURITY OF MATERIALS:

No details given.

ESTIMATED ERROR:

δT/K = ±0.1; $\delta x/x$ = ±3% (estimated by compiler)

REFERENCES:

1. Gerrard, W. *J. Appl. Chem. Biotechnol.* 1972 *22*, 623-650.
2. Gerrard, W. *Solubility of Gases and Liquids, Plenum Press, New York*, 1976 Chapter 1.

COMPONENTS:

(1) 2-Methylpropane, (isobutane); C_4H_{10}; [75-28-5]

(2) 1,1'-Oxybisoctane, (dioctyl ether); $C_{16}H_{34}O$; [629-82-3]

ORIGINAL MEASUREMENTS:

Gerrard, W.

Solubility of Gases and Liquids, Plenum, New York, 1976, Chapter 12.

VARIABLES:

T/K: 273.15

P/kPa: 13.3-101.3

PREPARED BY:

C.L. Young

EXPERIMENTAL VALUES:

T/K	*P*/mmHg	*P*/kPa	Mole fraction of 2-methylpropane in liquid, $x_{C_4H_{10}}$
273.15	100	13.3	0.101
	200	26.7	0.195
	300	40.0	0.286
	400	53.3	0.375
	500	66.7	0.457
	600	80.0	0.536
	700	93.3	0.615
	760	101.3	0.664

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Gas was passed into a known weight of pure liquid in a bubbler tube at a total pressure measured by a manometer assembly. The amount of absorbed gas was estimated by weighing. The temperature was manually controlled to within 0.2K. The apparatus and procedure are described by Gerrard (1,2).

SOURCE AND PURITY OF MATERIALS:

No details given.

ESTIMATED ERROR:

$\delta T/K = \pm 0.1$; $\delta x/x = \pm 3\%$

(estimated by compiler).

REFERENCES:

1. Gerrard, W.
   J. Appl. Chem. Biotechnol. 1972 *22*, 623-650.
2. Gerrard, W.
   Solubility of Gases and Liquids, Plenum Press, New York, 1976 Chapter 1.

COMPONENTS:

(1) 2-Methylpropane (isobutane); C_4H_{10}; [75-28-5]

(2) Decanedioic acid, bis (2-ethylhexyl) ester (di-2-ethylhexyl sebacate); $C_{26}H_{50}O_4$; [122-62-3]

ORIGINAL MEASUREMENTS:

Carter, D.; Esterson, G.L.

J. Chem. Eng. Data 1973, *18*, 166-169.

VARIABLES:

T/K: 328.15

P/kPa: 101.325

PREPARED BY:

W. Hayduk

EXPERIMENTAL VALUES:

T/K	Modified Henry's constant[1], h/ (mol cm^{-3})$_g$(mol cm^{-3})$_l^{-1}$	Ostwald Coefficient[2] L/cm^{3}cm^{-3}	Bunsen Coefficient[2] α/ cm^3(STP)cm^{-3}	Mole Fraction[2] /x_1	Method
328.15	0.090	11.1	9.25	0.165	A
328.15	0.088	11.4	9.46	0.168	B

[1] Original data listed as a modified Henry's constant, h.

[2] Calculated by compiler assuming Henry's law and ideal gas law apply.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Two different methods were used: method A, chromatographic, and method B, liquid saturation.

A. A chromatography column containing a known amount of solvent was installed in an oven. Helium was used as a carrier gas. Pulses of solute gas and argon were consecutively injected into the gas stream. The solubility was determined from the total retention times. The solubilities were determined at effectively very low partial pressures and hence linear extrapolation to atmospheric pressure is subject to error.

B. The increase in mass of the solvent exposed to moderate pressures of gas was measured. Details not given.

SOURCE AND PURITY OF MATERIALS:

1. Matheson Co. Purity not specified.

2. Consolidated Electrodynamics Corp. Purity not specified.

ESTIMATED ERROR:

A. $\delta h/h = 0.10$

B. $\delta h/h = 0.03$ (by compiler)

REFERENCES:

COMPONENTS:	EVALUATOR:
(1) Propane; C_3H_8; [74-98-6] Butane; C_4H_{10}; [106-97-8] (2) Polar solvents, at high pressure	Walter Hayduk Department of Chemical Engineering University of Ottawa November, 1984

CRITICAL EVALUATION:

The solubilities of both *propane* and *butane* were reported in 1,2-ethoxyethane (ethylene oxide) for pressures above 101.325 kPa by Hess and Tilton[1]. The data for the solubility of *propane* obey Henry's law for the relatively low pressures involved and appear consistent. No comparable data are available; these data are classified as tentative. In contrast, the data for the solubility of *butane* in the same solvent appear quite inconsistent, they do not obey Henry's law even approximately even although at the relatively low pressures involved, they would be expected to. It is not possible to assess whether or not the low pressure solubility corresponding to 101 kPa (and a total pressure of approximately 202 kPa) is accurate; hence these data for *butane* are classified as doubtful. See also the Critical Evaluation for the solubility of *ethane* in the same solvent by the same authors[2].

References

1. Hess, L.G.; Tilton, V.V. *Ind. Eng. Chem.* 1950, *42*, 1251-1258.

2. Hayduk, W., Ed. *IUPAC Solubility Data Series, Ethane, Pergamon Press, Oxford, England* 1982, *11*, 197.

COMPONENTS:

(1) Propane; C_3H_8; [74-98-6]

(2) 1,2-Epoxyethane (Ethylene oxide); C_2H_4O; [75-21-8]

ORIGINAL MEASUREMENTS:

Hess, L. G.; Tilton, V. V.

Ind. Eng. Chem.

1950, *42*, 1251-1258.

VARIABLES:

T/K: 303.2, 318.2

P/kPa: 208.1-446.0

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

t^a/C	T^b/K	Total pressure,[a] pounds per square inch gauge /psig	Mass per cent[a] in solution	Henry's constant[b] H/atm	Mole fraction[b] $/x_1$
30	303.2	30	4.7	21.7	0.047
30	303.2	40	7.9	21.5	0.079
30	303.2	50	11.1	21.5	0.111
45	318.2	50	3.7	31.4	0.037
45	318.2	60	5.9	31.2	0.059
45	318.2	70	8.1	31.2	0.081

[a] Original data.

[b] Calculated by compiler. Original data obeys Henry's law hence Henry's law constant is given. The mole fraction corresponding to gas partial pressure of 101.325 kPa is calculated to be 0.047. It is noted that solvent normal boiling point is 286.7 K.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

High pressure, steel flow apparatus consisting of two presaturators for the gas and an equilibrium vessel containing a stirrer operated by a solenoic. The gas is supersaturated in the first saturator at a temperature 10 K above the equilibration temperature. A steady flow of gas is made for at least 2 h after which liquid and vapor samples are withdrawn for analysis at 1-h intervals. Equilibrium indicated by constant consecutive compositions of both phases.

Details in ref. (1)

SOURCE AND PURITY OF MATERIALS:

Source and purities not available.

ESTIMATED ERROR:

$\delta T/K = 0.1$; $\delta x_1/x_1 = \delta H/H = 0.10$

(estimated by compiler).

REFERENCES:

1. Wan, S.-W.; Dodge, B. F. *Ind. Eng. Chem.* 1940, *32*, 95.

COMPONENTS:

(1) Butane; C_4H_{10}; [106-97-8]

(2) 1,2-Epoxyethane (Ethylene oxide); C_2H_4O; [75-21-8]

ORIGINAL MEASUREMENTS:

Hess, L. G.; Tilton, V. V.
Ind. Eng. Chem.
1950, *42*, 1251-1258.

VARIABLES:

T/K: 303.2
P/kPa: 308.1-583.8

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

t^a/C	T^b/K	Total pressure,[a] pounds per square inch /psig	Mass percent[a] in solution	Mole fraction[b] /x_1
30	303.2	30	26.2	0.212
30	303.2	40	31.7	0.260
30	303.2	50	33.0	0.272

[a] Original data.

[b] Calculated by compiler.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

High pressure, steel flow apparatus consisting of two presaturators for the gas and an equilibrium vessel containing a stirrer operated by a solenoid. The gas is supersaturated in the first saturator at a temperature 10 K above the equilibration temperature. A steady flow of gas is made for at least 2 h after which liquid and vapor samples are withdrawn for analysis at 1-h intervals. Equilibrium indicated by constant consecutive compositions of both phases.

Details in ref. (1).

SOURCE AND PURITY OF MATERIALS:

Source and purities not available.

ESTIMATED ERROR:

$\delta T/K = 0.1$; $\delta x_1/x_1 = \delta H/H = 0.10$ (estimated by compiler).

REFERENCES:

1. Wan, S.-W.; Dodge, B. F. *Ind. Eng. Chem.* 1940, *32*, 95.

COMPONENTS:	EVALUATOR:
(1) Propane; C_3H_8; [74-98-6] Butane; C_4H_{10}; [106-97-8] 2-Methylpropane; C_4H_{10}; [75-28-5] (2) Common solvents or aqueous solutions or suspensions of biological substances	Walter Hayduk Department of Chemical Engineering University of Ottawa Ottawa, Canada K1N 9B4 November, 1984

CRITICAL EVALUATION:

The solubilities of *propane*, *butane* and *2-methylpropane* in common solvents or aqueous solutions or suspensions of biological substances are all of qualitative value only. In no case is the composition of the solvent unequivocally specified so that the measurement can be reproduced elsewhere. Nonetheless, the data may be of value to those requiring such information. These data remain unclassified.

The early solubility of *propane* in turpentine as reported by Lebeau[1] is expected to be too low as are some of the other data reported by this author. Nor can the composition of turpentine be explicitly defined because its composition is dependent on its source and process for its production. The solubilities of *propane* and *butane* are available in kerosene A-3, and in gasoline solvents[2]; these data are of low accuracy (10 - 15%) and are also for solvents that are essentially mixed solvents containing many components. The solubilities of all three gases are available in aqueous suspensions of one or more egg phospholipid components[3]. General comments that may be made are that the order of solubilities of the three gases is the same as that observed in most organic solvents rather than that in water and that the solubilities are many times those in water alone. Finally, data are available for solubilities of *butane* in aqueous solutions (5 mass %) of human hemoglobin and bovine serum albumin[4]. These latter data were read from a graph and are of low accuracy.

References

1. Lebeau, P. *Compt. Rend.* 1905, *140*, 1454-6 and 1572.
2. Miller, K.W.; Hammond, L.; Porter, E.G. *Chem. Phys. Lipids* 1977, *20*, 229-241.
3. Hannaert, H.; Haccuria, M.; Mathieu, M.P. *Ind. Chim. Belg.* 1967, *32*, 156-164.
4. Wishnia, A. *Proc. Natl. Acad. Sci Biochem.* 1962, *43*, 2200-2204.

COMPONENTS:

(1) Propane; C_3H_8; [74-98-6]

(2) Water, Benzene, Ethanol, Diethylether, Chloroform, Turpentine

ORIGINAL MEASUREMENTS:

Lebeau, P.

Compt. Rend. 1905, *140*, 1454-6 and 1572.

Bull. Soc. Chim. [*3*] 1905, *33*, 1137-9.

VARIABLES:

T/K = 290.8 - 294.8
p/kPa = 100.4 - 100.9

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

Temperature t/°C	Temperature T/K	Pressure[a] p/mmHg	Solubility Volume propane/100 Volumes Solvent
Water; H_2O; [7732-18-5]			
17.8	291.0	753	6.5
Benzene; C_6H_6; [71-43-2]			
21.5	294.7	757	1452
Ethanol; C_2H_6O; [64-17-5]			
16.6	290.8	754	790
1,1'-Oxybisethane or diethylether; $C_4H_{10}O$; [60-29-7]			
16.6	290.8	757	926
Chloroform or trichloromethane; $CHCl_3$; [67-66-3]			
21.6	294.8	757	1299
Oil of turpentine			
17.7	290.9	757	1587

[a] Not clear whether this is total pressure or propane partial pressure. It is probably total pressure.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Details not given.

The data are reported in both papers.

SOURCE AND PURITY OF MATERIALS:

(1) Propane. Prepared by author from carefully purified propyl iodide by reaction with sodium in liquid ammonia.
Melting point/°C = -195
Boiling point/°C = -44.5
Critical temperature/°C = 102.

(2) Solvents. No information.

ESTIMATED ERROR:

REFERENCES:

COMPONENTS:

(1) Propane; C_3H_8; [74-98-6]

(2) Kerosene A-3
Gasoline

ORIGINAL MEASUREMENTS:

Hannaert, H.; Haccuria, M.;
Mathieu, M. P.

Ind. Chim. Belge 1967, *32*,
156 - 164.

VARIABLES:

T/K = 243.15 - 293.15

PREPARED BY: E. L. Boozer
H. L. Clever

EXPERIMENTAL VALUES:

Temperature Interval of Measurements T/K	Propane Mol % Range 10^2x_1/mol %	$K\pi\nu$/atm[1] at 293.15 K	Enthalpy of Dissolution ΔH/kcal mol^{-1}	Constant A
Kerosene A-3				
243.15-293.15	5 - 15	7.0	4.14	3.93
Gasoline				
243.15-293.15	2 - 15	7.15	4.08	3.90

[1] $\log (K\pi\nu/\text{atm}) = A - (\Delta H/\text{cal mol}^{-1})/(2.3R(T/K))$

The author's definitions are:

$$K = y_1/x_1 = \frac{\text{mole fraction gas in gas phase}}{\text{mole fraction gas in liquid phase}},$$

π/atm = total pressure,

ν = coefficient of fugacity.

The function, $K\pi\nu$/atm, is equivalent to a Henry's constant in the form $H_{1,2}$/atm = (f_1/atm)/x_1 where f_1 is the fugacity.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The authors describe three methods:

1.A. [Saturat. n° 1]. A measure of the static pressure of saturation in an apparatus which gave a precision of 10 - 15 %.

1.B. [Saturat. n° 2]. A measure of the static pressure of saturation in an apparatus which gave a precision of 2 - 5 %.

2. [Chromato]. A Gas liquid chromatographic method estimated to have a precision of 2 - 5 %.

3. [Anal. directe]. Direct analysis of the gaseous and liquid phases.

Method 1.A. was used for these systems.

SOURCE AND PURITY OF MATERIALS:

(1) Propane. Matheson Co. Inc. Chemical pure. Fractionated, purity > 99.9 per cent.

(2) Kerosene and gasoline
distillation density

	range °C	gcm^{-} ,20°C	mol wt
A-3	207-255	0.784	192
gasoline	99-168	0.7521	122

ESTIMATED ERROR:

REFERENCES:

COMPONENTS:

(1) Butane; C_4H_{10}; [106-97-8]

(2) Kerosene A-3
Gasoline

ORIGINAL MEASUREMENTS:

Hannaert, H.; Haccuria, M.;
Mathieu, M. P.

Ind. Chim. Belge 1967, *32*, 156-164.

VARIABLES:

T/K = 243.15 - 293.15

PREPARED BY:

E. L. Boozer
H. L. Clever

EXPERIMENTAL VALUES:

Temperature Interval of Measurements T/K	Butane Mol % Range 10^2x_1/mol %	$K\pi\nu$/atm[1] at 293.15 K	Enthalpy of Dissolution ΔH/kcal mol^{-1}	Constant A
Kerosene A-3				
243.15-293.15	10 - 40	2.03	5.575	4.47
Gasoline				
243.15-293.15	10 - 50	1.4	5.44	4.32

[1] $\log (K\pi\nu/\text{atm}) = A - (\Delta H/\text{cal mol}^{-1})/(2.3R(T/\text{K}))$

The author's definitions are:

$$K = y_1/x_1 = \frac{\text{mole fraction gas in gas phase}}{\text{mole fraction gas in liquid phase}},$$

π/atm = total pressure,

ν = coefficient of fugacity.

The function, $K\pi\nu$/atm, is equivalent to a Henry's constant in the form $H_{1,2}$/atm = $(f_1/\text{atm})/x_1$ where f_1 is the fugacity.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The authors describe three methods:

1.A. [Saturat. n°1]. A measure of the static pressure of saturation in an apparatus which gave a precision of 10 - 15 %.

1.B. [Saturat. n°2]. A measure of the static pressure of saturation in an apparatus which gave a precision of 2 - 5 %.

2. [Chromato]. A Gas liquid chromatographic method estimated to have a precision of 2 - 5 %.

3. [Anal. directe]. Direct analysis of the gaseous and liquid phases.

Method 1.A. was used for this system.

SOURCE AND PURITY OF MATERIALS:

(1) Butane. Matheson Co., Inc. Fractionated, purity > 99.5 per cent.

(2) Kerosene and gasoline.

	Distillation Range, t/°C	Density ρ^{20}/g cm^{-3}	mol wt
A-3	207-255	0.784	192
Gasoline	94-168	0.7521	122

ESTIMATED ERROR:

REFERENCES:

COMPONENTS:

(1) Propane; C_3H_8; [74-98-6]

(2) Phospholipids

ORIGINAL MEASUREMENTS:

Miller, K. W.; Hammond, L.;
Porter, E. G.
Chem. Phys. Lipids
1977, *20*, 229-241.

VARIABLES:

T/K: 298.4
P/kPa: 101.3

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K = 298.4 t/°C = 25.2

96 mole per cent egg phosphatidylcholine
+ 4 mole per cent egg phosphatidic acid sonicated vesticles

Bunsen coefficient 3.6 ± 0.21
(3 measurements)

68.2 mole per cent egg phosphatidylcholine
+ 2.8 mole per cent egg phosphatidic acid sonicated vesticles
+ 29 mole per cent cholesterol

Bunsen coefficient 1.12

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Samples of lipids were prepared as a translucent aqueous suspension containing 5-10 mg/ml of phospholipids. Samples saturated with gas at ambient pressure and then analysed by stripping out gas. Gas so obtained was analysed by gas chromatography using helium as a carrier gas and a Poropak Q column. Details in source. Bunsen coefficient calculated from experimental data on lipid solution and of pure water.

SOURCE AND PURITY OF MATERIALS:

1. Matheson Gas Products sample; purity 99 mole per cent.
2. Grade 1 samples from Lipid Products, Nutford, England.

ESTIMATED ERROR:

$\delta T/\mathrm{K} = \pm 0.05$; $\delta p/\mathrm{kPa} = \pm 0.5\%$;
$\delta\alpha/\alpha = \pm 8\%$ (estimated by compiler).

REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Butane; C_4H_{10}; [106-97-8] (2) Phospholipids	Miller, K. W.; Hammond, L.; Porter, E. G. *Chem. Phys. Lipids* 1977, *20*, 229-241.
VARIABLES: *T*/K: 273.2-303.2 *P*/kPa: 101.3	PREPARED BY: C. L. Young

EXPERIMENTAL VALUES:

T/K = 298.4 t/°C = 25.2

96 mole per cent egg phosphatidylcholine
+ 4 mole per cent egg phosphatidic acid sonicated vesticles

Bunsen coefficient 17

68.2 mole per cent egg phosphatidylcholine
+ 2.8 mole per cent egg phosphatidic acid sonicated vesticles
+ 29 mole per cent cholesterol

Bunsen coefficient 14

T/K		Bunsen Coefficient
298.2	80 mole per cent egg phosphatidylcholine + 20 mole per cent egg phosphatidic acid sonicated vesticles	16
	Phosphatidylserine	17
	Dioleoylphosphatidylcholine	17
	Dimyristoylphosphatidylcholine	15
	Erythrocyte ghosts	4
303.2	Egg lecithin	13
273.2	Egg lecithin	56
298.2	Egg lecithin containing 33% cholesterol	16
273.2	Egg lecithin containing 33% cholesterol	70

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Samples of lipids were prepared as a translucent aqueous suspension containing 5-10 mg/ml of phospholipids. Samples saturated with gas at ambient pressure and then analysed by stripping out gas. Gas so obtained was analysed by gas chromatography using helium as a carrier gas and a Poropak Q column. Details in source. Bunsen coefficient calculated from experimental data on lipid solution and of pure water.

SOURCE AND PURITY OF MATERIALS:

1. Matheson Gas Products sample; purity 99 mole per cent.
2. Grade 1 samples from Lipid Products, Nutford, England.

ESTIMATED ERROR:

$\delta T/K = \pm 0.05$; $\delta p/kPa = \pm 0.5\%$;
$\delta\alpha/\alpha = \pm 8\%$ (estimated by compiler).

REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) 2-Methylpropane (*iso*butane); C_4H_{10}; [75-28-5] (2) Phospholipids	Miller, K. W.; Hammond, L.; Porter, E. G. *Chem. Phys. Lipids* 1977, *20*, 229-241.
VARIABLES: *T*/K: 298.4 *P*/kPa: 101.3	PREPARED BY: C. L. Young

EXPERIMENTAL VALUES:

T/K = 298.4   t/°C = 25.2

96 mole per cent egg phosphatidylcholine
+ 4 mole per cent egg phosphatidic acid sonicated vesticles

Bunsen coefficient 9.5

68.2 mole per cent egg phosphatidylcholine
+ 2.8 mole per cent egg phosphatidic acid sonicated vesticles
+ 29 mole per cent cholesterol

Bunsen coefficient 7.4

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Samples of lipids were prepared as a translucent aqueous suspension containing 5-10 mg/ml of phospholipids. Samples saturated with gas at ambient pressure and then analysed by stripping out gas. Gas so obtained was analysed by gas chromatography using helium as a carrier gas and a Poropak Q column. Details in source. Bunsen coefficient calculated from experimental data on lipid solution and of pure water.

SOURCE AND PURITY OF MATERIALS:

1. Matheson Gas Products sample; purity 99 mole per cent.
2. Grade 1 samples from Lipid Products, Nutford, England.

ESTIMATED ERROR:

$\delta T/K = \pm 0.05$; $\delta p/kPa = \pm 0.5\%$; $\delta\alpha/\alpha = \pm 8\%$ (estimated by compiler).

REFERENCES:

COMPONENTS:

(1) Butane; C_4H_{10}; [106-97-8]

(2) Bovine serum albumin (BSA), Human hemoglobin (Hb)

(3) Water; H_2O; [7732-18-5]

ORIGINAL MEASUREMENTS:

Wishnia, A.

Proc. Natl. Acad. Sci., Biochem. 1962, *43*, 2200-2204.

VARIABLES:

T/K: 283.15-308.15

c_2/mass %: 5

P/kPa: 101.325

PREPARED BY:

W. Hayduk

EXPERIMENTAL VALUES:

t/°C	T/K	Solubility in water s_0/mMol(kg)$^{-1}$	Solubility in Aqueous protein s/mMol(kg)$^{-1}$	Butane solubilization Ratio/s s_0^{-1}
		Aqueous bovine serum albumin (BSA), 5 mass %:		
10	283.15	2.5	8.0	3.20
15	288.15	2.1	6.6	3.14
20	293.15	1.7	5.7	3.35
25	298.15	1.4	4.8	3.43
30	303.15	1.2	4.0	3.33
35	308.15	1.1	3.4	3.09
		Aqueous human hemoglobin (Hb), 5 mass %:		
10	283.15		5.0	2.00
15	288.15		4.1	1.95
20	293.15		3.4	2.00
25	298.15		2.9	2.07
30	303.15		2.6	2.17
35	308.15		2.2	2.00

Values of solubilities read from graph of s versus t by compiler; butane solubilization ratio calculated. No numerical data given. Additional graphical data for propane gas and aqueous sodium lauryl sulfate could not be read with sufficient accuracy to warrant reproduction.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The solubility was determined at pressures from 0.15 to 0.70 atm and extrapolated to a gas partial pressure of 1 atm using Henry's law.

An all-glass apparatus was used which consisted of a calibrated liquid contactor, 10 cm^3 in volume and a 5-10 cm^3 gas storage tube. The solution was deaerated in the contactor under vacuum. The pressure was measured with a manometer. The initial and final gas pressures and volumes, together with the compressibilities were used to compute the molal solubilities. The quantity of solvent charged was determined by weight.

SOURCE AND PURITY OF MATERIALS:

1. Phillips Petroleum, research grade. Purity not specified.

2a. Crystalline BSA from Pentex (Lot BX3) deionized on Dowex-1 and Dowex-50 ion exchangers.

2b. Human hemoglobin; no further details given.

3. Deaerated.

ESTIMATED ERROR:

δT/K = 0.01 (author)

$\delta s/s$ = 0.08 (compiler)

REFERENCES:

COMPONENTS:	EVALUATOR:
(1) Propane; C_3H_8; [74-98-6] Butane; C_4H_{10}; [106-97-8] (2) Hydrocarbon solvents at high pressure	Walter Hayduk Department of Chemical Engineering University of Ottawa Ottawa, Canada K1N 9B4 November, 1984

CRITICAL EVALUATION:

The high pressure solubilities of *propane* are available in several crude oils[1], in kerosene[2] of average molecular weight 167 and in spray oil[2] of average molecular weight 287, as well as of both *propane*[3] and *butane*[4] in hydrocarbon oil of average molecular weight 337.5. Except for the solubilities in the crude oils, mole fraction solubilities were calculated to test the consistency of the data using plots of mole fraction versus *propane* partial pressure on logarithmic scales. As previously observed, (see Critical Evaluation for alkane solvents at high pressure) it is possible to ascertain whether Henry's law is obeyed on such a plot and whether the vapor pressure of the pure solute gas can be obtained by extrapolation to a gas composition corresponding to pure gas. Mole fraction solubilities were calculated based on the data supplied and such plots were constructed for the four different gas-solvent systems excluding the crude oils. In the calculations it was assumed that the solvents, of relatively high molecular weight, were essentially non-volatile. The data for *propane* in kerosene, hydrocarbon oil and spray oil were all found to be highly consistent. The data for *butane* solubility, however, indicated that Henry's law was not obeyed even at low gas pressures for the hydrocarbon oil solvent. It appears possible that there is some error in the data for *butane* solubilities especially at low pressures although this cannot be confirmed.

These data are all classified as tentative.

References

1. Safronova, T.P.; Zhuze, T.P. *Khim. i Tekhnol. Topliva i Masel* 1958, *3* (2), 41-46.

2. Hill, E.S.; Lacey, W.N. *Ind. Eng. Chem.* 1934, *26*, 1327-1331.

3. Sage, B.H.; Lacey, W.N.; Schaafsma, J.G. *Ind. Eng. Chem.* 1934, *26*, 874-877.

4. Sage, B.H.; Lacey, W.N. *Ind. Eng. Chem.* 1936, *28*, 106-111.

COMPONENTS:

(1) Propane; C_3H_8; [74-98-6]

(2) Petroleum, crude oils

ORIGINAL MEASUREMENTS:

Safronova, T. P.; Zhuze, T. P.

Khim. i Tekhnol. Topliva i Masel 1958, *3* (2), 41-46.

Chem. Abstr. 1958, *52*, 8518d.

VARIABLES:

T/K = 373
p_1/kPa up to 20.3

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

Temperature		Pressure	Bunsen Coefficient
$t/^{\circ}C$	T/K	p_1/atm	$\alpha/cm^3(STP)cm^{-3}atm^{-1}$
1. Nebit-Dag (Akchagylian layer) crude oil, Specific gravity, d_4^{20} = 0.8713, kinematic viscosity = 8.70 centistokes.			
100	373	10	1.618
		25	2.190
		50	3.252
		100	2.197
		150	2.005
		200	1.856
2. Romashkino oilfield crude oil, Specific gravity, d_4^{20} = 0.8530, kinematic viscosity = 6.54 centistokes.			
100	373	10	1.911
		21	2.02
		50	2.83
		75	3.09
		100	2.210
3. Surakhany oil field crude oil, Specific gravity, d_4^{20} = 0.8494, kinematic viscosity = 5.19 centistokes			
100	373	25	1.751
		50	3.649
		100	3.063
		150	2.676

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

A detailed diagram of the high pressure apparatus is given in the paper.

The propane solubility data are given in figures of solubility/cm^3 (STP) cm^{-3} *vs.* p_1/ atm. Data on a fourth crude oil propane system are given graphically only. The oil is 4. Tuimazy oil field crude oil, specific gravity d_4^{20} = 0.8510, kinematic viscosity = 4.46 centistokes. Solubilities are shown to a maximum pressure of 25 atm.

SOURCE AND PURITY OF MATERIALS:

(1) Propane.

(2) Petroleum crude oils. Four crude oils. Description given above and to the left. Additional information on the composition given in the paper.

ESTIMATED ERROR:

The compiler estimates the data have an uncertainty of 3 to 5 percent.

REFERENCES:

COMPONENTS:

1. Propane; C_3H_8; [74-98-6]

2. Spray oil

ORIGINAL MEASUREMENTS:

Hill, E. S.; Lacey, W. N.
Ind. Eng. Chem.
1934, *26*, 1327-1331.

VARIABLES:

T/K: 303.2 - 333.2
P/MPa: 0.216 - 1.395

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K (t/°F)	P/psi	P/MPa	S^a	C^b	Mole fraction in liquid, $x_{C_3H_8}$
303.15	31.3	0.216	20.80	19.28	0.2271
(86)	61.9	0.427	48.08	40.62	0.4045
	104.7	0.722	136.41	92.01	0.6601
318.15	26.5	0.183	12.04	11.30	0.1451
(113)	26.4	0.182	11.86	11.13	0.1434
	95.9	0.661	58.70	47.18	0.4532
	131.9	0.909	107.54	75.72	0.6029
333.15	32.6	0.225	10.80	10.04	0.1322
(140)	33.5	0.231	10.50	9.75	0.1292
	115.6	0.797	51.85	42.23	0.4227
	202.4	1.395	114.50	91.00	0.6711

[a] Volume of gas per unit volume of oil both measured at 60 °F and 30 in Hg pressure.

[b] Volume of gas measured at 60 °F and 30 in Hg pressure dissolved by unit volume of saturated oil at experimental temperature and pressure.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Measurements were carried out in a brass absorption cell designed for diffusion measurements and described in ref. 1.

SOURCE AND PURITY OF MATERIALS:

1. Obtained by distillation of commercial propane. Product purity about 99.2 mole per cent; major impurity 2-methylpropane.

2. Average molecular weight 287.

ESTIMATED ERROR:

REFERENCES:

1. Pomeroy, R. D.; Lacey, W. N.; Scudder, N. F.; Stapp, F. P.
Ind. Eng. Chem.
1933, *25*, 1014.

COMPONENTS:

(1) Propane; C_3H_8; [74-98-6]

(2) Kerosene

ORIGINAL MEASUREMENTS:

Hill, E. S.; Lacey, W. N.
Ind. Eng. Chem.
1934, *26*, 1327-1331.

VARIABLES:

T/K: 303.2-333.2

P/MPa: 0.180-1.385

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K (t/°F)	P/psi	P/MPa	S^a	C^b	Mole fraction in liquid, $x_{C_3H_8}$
303.2	30.5	0.210	27.49	24.98	0.1967
(86)	31.4	0.216	29.25	26.51	0.2068
	45.2	0.312	47.49	40.66	0.2973
	61.0	0.421	72.32	57.27	0.3919
	31.4	0.216	29.40	26.63	0.2076
	61.7	0.425	74.94	59.14	0.4004
	104.5	0.721	222.24	123.43	0.6645
	31.4	0.216	29.78	26.99	0.2098
318.2	26.1	0.180	17.25	15.94	0.1335
(113)	76.2	0.525	63.89	50.85	0.3632
	149.3	1.029	243.56	123.25	0.6850
333.2	30.8	0.212	14.36	13.17	0.1072
(140)	60.8	0.419	31.95	27.63	0.2223
	121.3	0.836	84.65	62.98	0.4309
	121.3	0.836	82.64	61.55	0.4251
	200.9	1.385	225.86	114.27	0.6690

[a] Volume of gas per unit volume of oil both measured at 60 °F and 30 in Hg pressure.

[b] Volume of gas measured at 60 °F and 30 in Hg pressure dissolved by unit volume of saturated oil at experimental temperature and pressure.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Measurements were carried out in a brass absorption cell designed for diffusion measurements and described in ref. 1.

SOURCE AND PURITY OF MATERIALS:

1. Obtained by distillation of commercial propane. Product purity about 99.2 mole per cent; major impurity 2-methylpropane.

2. Average molecular weight 167.

ESTIMATED ERROR:

REFERENCES:

1. Pomeroy, R. D.; Lacey, W. N.; Scudder, N. F.; Stapp, F. P. *Ind. Eng. Chem.* 1933, *25*, 1014.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Propane; C_3H_8; [74-98-6] (2) Hydrocarbon Oil	Sage, B.H.; Lacey, W. N.; Schaafsma, J. G. *Ind. Eng. Chem.* 1934, *26*, 874-877.
VARIABLES: *T*/K: 294.3-366.5 *P*/MPa: 0.230-1.863	PREPARED BY: C. L. Young

EXPERIMENTAL VALUES:

T/°F	T/K	*P*/psia	*P*/MPa	Solubility, *S*#	V
70.0	294.3	33.4	0.230	0.4002	0.01956
		45.3	0.312	0.6135	0.02030
		55.8	0.384	0.8441	0.02106
		64.9	0.447	1.066	0.02180
		72.8	0.502	1.308	0.02258
		79.7	0.549	1.541	0.02343
		85.2	0.587	1.766	0.02419
		90.1	0.621	2.007	0.02502
		94.4	0.651	2.241	0.02586
100.0	310.9	29.7	0.205	0.2223	0.01916
		53.5	0.369	0.4652	0.02000
		72.4	0.499	0.7022	0.02092
		87.2	0.601	0.9340	0.02169
		100.4	0.692	1.175	0.02254
		111.6	0.769	1.419	0.02351
		121.2	0.835	1.668	0.02429
		129.5	0.893	1.906	0.02512
		136.4	0.940	2.144	0.02604
140.0	333.2	40.1	0.277	0.2043	0.01962
		75.6	0.521	0.4464	0.02040
		105.3	0.725	0.6918	0.02133
		130.7	0.892	0.9391	0.02225
		152.6	1.052	1.198	0.02320

(cont.)

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Static pressure-volume-temperature cell as described in ref. (1). Propane was added to cell containing oil in increasing amounts. Amount of propane dissolved calculated from increase in pressure.

SOURCE AND PURITY OF MATERIALS:

1. Philgas sample, C.P. grade.
2. Refined oil with molecular weight of 337.5.

ESTIMATED ERROR:

$\delta T/K = \pm 0.1$; $\delta P/\text{psia} = \pm 1$; $\delta S/S = \pm 0.001$.

REFERENCES:

1. Sage, B. H.; Lacey, W. H.
   Ind. Eng. Chem.
   1934, *26*, 103.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Propane; C_3H_8; [74-98-6] (2) Hydrocarbon Oil	Sage, B. H.; Lacey, W. N.; Schaafsma, J. G. *Ind. Eng. Chem.* 1934, *26*, 874-877.

EXPERIMENTAL VALUES: (concluded)

T/°F	T/K	*P*/psia	*P*/MPa	Solubility, $S^{\#}$	V
140.0	333.2	172.0	1.186	1.461	0.02415
		189.4	1.305	1.733	0.02510
160.0	344.3	56.4	0.388	0.2502	0.01981
		101.0	0.696	0.5131	0.02077
		138.1	0.951	0.7789	0.02176
		168.2	1.159	1.039	0.02274
		194.7	1.342	1.312	0.02379
		217.8	1.501	1.592	0.02489
		237.8	1.638	1.871	0.02571
200	366.5	51.8	0.357	0.1557	0.01978
		97.0	0.669	0.3225	0.02042
		137.6	0.948	0.4914	0.02106
		174.6	1.203	0.6645	0.02172
		208.5	1.437	0.8388	0.02239
		240.6	1.658	1.025	0.02314
		270.5	1.863	1.214	0.02391

$S^{\#}$ Volume of propane in units of ft^3 measured at 288.7 K and a pressure of 1 atmosphere dissolved by one pound of oil.

V density of liquid in units of ft^3 lb^{-1}.

COMPONENTS:

(1) Butane; C_4H_{10}; [106-97-8]

(2) Hydrocarbon oil

ORIGINAL MEASUREMENTS:

Sage, B. H.; Lacey, W. N.

Ind. Eng. Chem.

1936, *28*, 106-111.

VARIABLES:

T/K: 294-378

P/MPa: 0.069-1.55

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/°F	T/K	P/psia	P/MPa	Solubility, S/wt-%
70	294	10	0.069	4.6
		20	0.14	13.5
		30	0.21	49.9
100	311	10	0.069	2.5
		20	0.14	6.8
		30	0.21	14.0
		40	0.28	25.2
		50	0.34	60.0
130	328	10	0.069	1.7
		20	0.14	4.2
		30	0.21	8.0
		40	0.28	12.8
		50	0.34	18.7
		75	0.52	58.5
160	344	10	0.069	1.1
		20	0.14	2.7
		30	0.21	4.9
		40	0.28	7.6
		50	0.34	10.8
		75	0.52	21.1
		100	0.69	39.0
190	361	10	0.069	0.7
		20	0.14	1.7
		30	0.21	3.2
		40	0.28	4.9

(cont.)

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Contents of variable volume cell brought to equilibrium at desired temperature and pressure and volume determined. Volume varied by admission or removal of mercury. Bubble point determined from change in slope of pressure-volume curve.

SOURCE AND PURITY OF MATERIALS:

1. Philgas Company sample, 99.21 per cent butane, 0.18 per cent 2-methylpropane, 0.61 per cent 2-methylbutane.
2. Nonwaxy asphalt crude oil with molecular weight of between 335 and 340 (by freezing point depression).

ESTIMATED ERROR:

$\delta T/K = \pm 0.13$; $\delta P/\text{psia} = \pm 1$;
$\delta S/S = \pm 0.001$

REFERENCES:

1. Sage, B. H.; Backus, H. S.; Lacey, W. N. *Ind. Eng. Chem.* 1935, *27*, 686.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Butane; C_4H_{10}; [106-97-8] (2) Hydrocarbon oil	Sage, B. H.; Lacey, W. N. *Ind. Eng. Chem.* 1936, *28*, 106-111.

EXPERIMENTAL VALUES: (concluded)

T/°F	T/K	*P*/psia	*P*/MPa	Solubility, *S*/wt-%
190	361	50	0.34	7.0
		75	0.52	12.9
		100	0.69	20.4
		125	0.86	30.4
		150	1.03	47.1
		175	1.21	88.4
220	378	10	0.069	0.6
		20	0.14	1.2
		30	0.21	2.1
		40	0.28	3.2
		50	0.34	4.3
		75	0.52	7.9
		100	0.69	12.4
		125	0.86	17.5
		150	1.03	23.2
		175	1.21	31.1
		200	1.38	43.3
		225	1.55	65.1

SYSTEM INDEX

Page numbers preceeded by E refer to evaluation texts whereas those not preceeded by E refer to compiled tables. Compounds are listed as in Chemical Abstracts. For example, toluene is listed as benzene, methyl- and N-methylaniline as benzenamine, N-methyl-.

REGISTRY NUMBER INDEX

Page numbers preceeded by E refer to evaluation texts whereas those not preceeded by E refer to compiled tables.

AUTHOR INDEX

Page numbers preceeded with E refer to evaluation texts, whereas those not preceeded with E refer to compiled tables.