INTERNATIONAL UNION OF PURE AND APPLIED CHEMISTRY

ANALYTICAL CHEMISTRY DIVISION
COMMISSION ON SOLUBILITY DATA

SOLUBILITY DATA SERIES

Volume 21

AMMONIA, AMINES, PHOSPHINE, ARSINE, STIBINE, SILANE, GERMANE AND STANNANE IN ORGANIC SOLVENTS

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Editor-in-Chief
A. S. KERTES

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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

This volume of *The Solubility Data Series* covers the solubility of ammonia, *N*-methylmethanamine and *N*,*N*-dimethylmethanamine in pure liquids not including water. Data on the solubility of some higher amines at pressures below the vapor pressure of the liquid amine are also included as are data on the solubility of deuterated methanamine and deuterated *N*-methylmethanamine. The volume also covers the available data on the solubility of phosphine, arsine, stibine, bismuthine, silane, germane and stannane in non-aqueous solvents. The editors believe that all solubility values published up to June 1983 have been included but would be grateful to learn of significant omissions.

In few cases can one be certain that the available data has an accuracy better than about ±3%. In many cases data may have an accuracy less than this. It is hoped that this and other similar volumes in *The Solubility Data Series* will draw attention to the systems for which there is lack of good data and will stimulate further experimental work in the field.

The editors wish to make a plea that authors publishing gas solubility data should always report the primary experimental observations of temperature, pressure, volume, etc. and should indicate the precise method used to calculate solubility values. Much of the value, for instance, of an Ostwald coefficient is lost if the pressure at which measurements were made is not reported. Henry's law constants have been defined and calculated in a variety of ways and the precise significance of a particular value is often lost if pressure measurements are not given.

A variety of techniques have been used to measure solubilities of the systems under consideration. The merits of experimental methods have been taken into account in the evaluation of data. Estimates have also been made as to whether particular values fit general patterns of solubility which appear to emerge when similar systems are compared. However, much more accurate experimental work is needed before such patterns are precisely defined.

The editors are grateful for advice and help given by fellow members of the I.U.P.A.C. Commission on Solubility Data. Colin Young wishes to acknowledge the help given by Professor H. L. Clever, Director of the Solubility Data and Information Project at Emory University. Peter Fogg is grateful to Dr W. Gerrard for stimulating and helpful discussions on the interpretation of published solubility data. He also wishes to acknowledge support for travel in connection with the preparation of this volume from The Royal Society of London, from I.U.P.A.C. and from The Polytechnic of North London.

Both editors wish to express their appreciation to Lesley Flanagan for typing the final manuscript.

Peter Fogg
London

Colin Young
Melbourne

November 1983

THE SOLUBILITY OF GASES IN LIQUIDS

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

INTRODUCTION

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

DEFINITION OF GAS SOLUBILITY

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

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

UNITS AND QUANTITIES

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

EVALUATION AND COMPILATION

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

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

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

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

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

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

PURITY OF MATERIALS

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

APPARATUS AND PROCEDURES

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

METHODS OF EXPRESSING GAS SOLUBILITIES

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

The Mole Fraction, $x(g)$

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

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

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

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

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

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

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

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

where $v^{\mathrm{o}}(1)$ 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 is assumed to be obeyed,

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

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

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

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

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

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 at the ratio of the volume of gas absorbed to the volume of the absorbing liquid, all measured at the same temperature:

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

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

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

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

The Absorption Coefficient, 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 atmosphere.

The Henry's Law Contant

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

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

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

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

or

$$C(g) = K_c C(l)$$

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

The Mole Ratio, N

The mole ratio, N, is defined by

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

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

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

TABLE 1. Interconversion of parameters used for reporting solubility.

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

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

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

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

where v_o is the molal volume of the gas in $\text{cm}^3\ \text{mol}^{-1}$ 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 $v_{t,\text{gas}}$ the molal volume of the gas ($\text{cm}^3\ \text{mol}^{-1}$) at the temperature of the measurement.

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APPENDIX I. Conversion Factors k and k^{-1}.

	k 1 (non-SI Unit) = k (SI Unit)		k^{-1} 1 (SI Unit) = k^{-1} (non-SI Unit)	
LENGTH			SI Unit, m	
Å (angstrom)	1 × 10^{-10}	(*)	1 × 10^{10}	(*)
cm (centimeter)	1 × 10^{-2}	(*)	1 × 10^{2}	(*)
in (inch)	254 × 10^{-4}	(*)	3 937 008 × 10^{-5}	
ft (foot)	3 048 × 10^{-4}	(*)	3 280 840 × 10^{-6}	
AREA			SI Unit, m^2	
cm^2	1 × 10^{-4}	(*)	1 × 10^{4}	(*)
in^2	64 516 × 10^{-8}	(*)	1 550 003 × 10^{-3}	
ft^2	9 290 304 × 10^{-8}	(*)	1 076 391 × 10^{-5}	
VOLUME			SI Unit, m^3	
cm^3	1 × 10^{6}	(*)	1 × 10^{6}	(*)
in^3	16 387 064 × 10^{-12}	(*)	6 102 374 × 10^{-2}	
ft^3	2 831 685 × 10^{-8}		3 531 467 × 10^{-5}	
l (litre)	1 × 10^{-3}	(*)	1 × 10^{3}	(*)
UKgal (UK gallon)	45 461 × 10^{-7}		21 997 × 10^{-2}	
USgal (US gallon)	37 854 × 10^{-7}		26 417 × 10^{-2}	
MASS			SI Unit, kg	
g (gram)	1 × 10^{-3}	(*)	1 × 10^{3}	(*)
t (tonne)	1 × 10^{3}	(*)	1 × 10^{-3}	(*)
lb (pound)	45 359 237 × 10^{-8}	(*)	2 204 623 × 10^{-6}	
DENSITY			SI Unit, kg m^{-3}	
g cm^{-3}	1 × 10^{3}	(*)	1 × 10^{-3}	(*)
g l^{-1}	1	(*)	1	(*)
lb in^{-3}	2 767 991 × 10^{-2}		3 612 728 × 10^{-11}	
lb ft^{-3}	1 601 847 × 10^{-5}		6 242 795 × 10^{-8}	
lb UKgal^{-1}	99 776 × 10^{-3}		100 224 × 10^{-7}	
lb USgal^{-1}	1 198 264 × 10^{-4}		8 345 406 × 10^{-9}	
PRESSURE	SI Unit, Pa (pascal, kg m^{-1} s^{-2})			
dyn cm^{-2}	1 × 10^{-1}	(*)	1 × 10	(*)
at (kgf cm^{-2})	980 665 × 10^{-1}	(*)	1 019 716 × 10^{-11}	
atm (atmosphere)	101 325	(*)	9 869 233 × 10^{-12}	
bar	1 × 10^{5}	(*)	1 × 10^{-5}	(*)
lbf in^{-2} (p.s.i.)	6 894 757 × 10^{-3}		1 450 377 × 10^{-10}	
lbf ft^{-2}	47 880 × 10^{-3}		20 886 × 10^{-6}	
inHg (inch of mercury)	3 386 388 × 10^{-3}		2 952 999 × 10^{-10}	
mmHg (millimeter of mercury, torr)	1 333 224 × 10^{-4}		7 500 617 × 10^{-9}	
ENERGY	SI Unit, J (joule, kg m^2 s^{-2})			
erg	1 × 10^{-7}	(*)	1 × 10^{7}	(*)
cal$_{\mathrm{IT}}$ (I.T. calorie)	41 868 × 10^{-4}	(*)	2 388 459 × 10^{-7}	
cal$_{\mathrm{th}}$ (thermochemical calorie)	4 184 × 10^{-3}	(*)	2 390 057 × 10^{-7}	
kW h (kilowatt hour)	36 × 10^{5}	(*)	2 777 778 × 10^{-13}	
l atm	101 325 × 10^{-3}	(*)	9 869 233 × 10^{-9}	
ft lbf	1 355 818 × 10^{-6}		7 375 622 × 10^{-7}	
hp h (horse power hour)	2 684 519		3 725 062 × 10^{-13}	
Btu (British thermal unit)	1 055 056 × 10^{-3}		9 478 172 × 10^{-10}	

An asterisk (*) denotes an exact relationship.

COMPONENTS:	EVALUATOR:
(1) Ammonia; NH_3; [7664-41-7] (2) Organic liquids	P. G. T. Fogg, School of Chemistry, Polytechnic of North London, Holloway, London, U.K. January 1984

CRITICAL EVALUATION:

The solubility of ammonia has been measured in a wide variety of solvents. Some systems have been investigated by more than one worker or group of workers enabling comparisons between sets of results to be made. Comparison of solubilities in chemically similar solvents indicates general trends in solubility and draws attention to values which do not conform to general patterns. In cases where solubilities at several pressures have been measured the variation with pressure may be compared with that found for other systems. Where variations of solubility with change of temperature have been measured it is possible to compare the so-called "heats of solution" and "entropies of solution" for different systems. In cases where only a single solubility value at one temperature and one pressure has been measured the extent to which comparisons with other systems may be made, is rather limited.

In some cases the solubilities of ammonia for given partial pressures have been reported. In other cases the solubilities correspond to given total pressures made up of partial pressures of solvent and partial pressures of ammonia. In order to compare different sets of measurements it has sometimes been necessary to convert solubility values for given total pressures to the corresponding mole fraction solubilities for a partial pressure of ammonia of 760 mmHg. In the absence of data from which activity coefficients can be calculated, approximate corrections have been made by the method used by Hildebrand (1). It has been assumed that the partial vapor pressure of the solvent is proportional to the mole fraction of the solvent (i.e., that the solvent obeys Raoult's law) and that the mole fraction solubility of ammonia is proportional to the partial pressure of ammonia over a short pressure range.

Hydrocarbons

In general, mole fraction solubilities are low compared with "Raoult's law" values and compared with mole fraction solubilities in alcohols measured under the same conditions. The solubilities are greater in aromatic hydrocarbons than in non-aromatic hydrocarbons.

Non-aromatic hydrocarbons

Hexane; C_6H_{14}; [110-54-3]

Bell (2) measured the solubility of ammonia in hexane at 293.2 K and a partial pressure of 760 mmHg and also reported unpublished measurements of the mole fraction solubilities in octane, dodecane and hexadecane which had been measured by Brønsted and Volqvartz. The mole fraction solubility in hexane at 298.2 K and a partial pressure of 1 atm has been reported by Patyi *et al.* (3). If both solubility values for hexane are correct it would indicate a large variation of mole fraction solubility with change of temperature. This is not entirely inconsistent with the solubility data for amines in this solvent but both values should be used with caution.

The Ostwald coefficient reported by Horsman-van den Dool and Warman (4) and measured at 292.4 K and an unspecified pressure can be compared with the solubility measurements discussed above if it is assumed that Ostwald coefficients are independent of pressure. The corresponding mole fraction solubility is about 7% less than the value at 298.2 K reported by Patyi *et al.* but Horsman-van den Dool and Warman used very simple apparatus.

(cont.)

COMPONENTS:	EVALUATOR:
(1) Ammonia; NH_3; [7664-41-7] (2) Organic liquids	P. G. T. Fogg, School of Chemistry, Polytechnic of North London, Holloway, London, U.K. January 1984

CRITICAL EVALUATION:

Octane; C_8H_{18}; [111-65-9]: 2,2,4-Trimethylpentane; C_8H_{18}; [540-84-1]: Dodecane; $C_{12}H_{26}$; [112-40-3]

There are no other solubility values for octane and dodecane for direct comparison with the values reported by Bell. However Bell's value for the mole fraction solubility in octane at 293.2 K and 1 atm is within about 2% of the value for the mole fraction solubility in 2,2,4-trimethylpentane at 292.4 K and 1 atm which may be estimated from the Ostwald coefficient measured at an unspecified pressure by Horsman-van den Dool and Warman.

Hexadecane; $C_{16}H_{34}$; [544-76-3]

Tremper and Prausnitz (5) measured the solubilities of ammonia in hexadecane at eight temperatures between 300 K and 475 K. Henry's law constants were reported. The pressures at which measurements were made were not stated. Mole fraction solubilities at 1 atm calculated from these Henry's law constants are in agreement with the general pattern of data for the hydrocarbons. In particular, extrapolation of the mole fraction solubility at 1 atm to 293.2 K gives a value within about 8% of the mole fraction solubility of hexadecane at 1 atm as reported by Bell. The Henry's law constants measured by Tremper and Prausnitz are reliable for calculation of mole fraction solubilities to pressures of about 1 atm.

The mole fraction solubilities in samples of kerosine and of diesel oil published by Messow and Pape (6) are in line with values for pure hydrocarbons of similar boiling point.

Cyclohexane; C_6H_{12}; [110-82-7]

The mole fraction solubility of ammonia in cyclohexane at 292.2 K and 1 atm from measurements by Kuznetsov *et al.* (7) is out of line with values for all other hydrocarbons and should therefore be disregarded.

Ostwald coefficients for this system at unspecified pressures have been reported by Horsman-van den Dool and Warman (4) and also by Hentz and Sherman (8). In both cases very simple apparatus was used. Corresponding values of mole fraction solubilities for a partial pressure of 1 atm may be estimated on the assumption that Ostwald coefficients are independent of pressure. The Horsman-van den Dool value corresponds to a mole fraction solubility of about 0.011 at 1 atm and 292.5 K. The Hentz and Sherman value corresponds to a mole fraction of about 0.009 at 1 atm and about 297 K. Both of these values fall below the value of 0.035 at 1 atm and 298.2 K given by Patyi *et al*(3). The apparatus and technique used by Patyi *et al.* are likely to be more reliable than those used by the other groups but further measurements on this system are needed in view of the disagreement between various solubility values.

Methylcyclohexane; C_7H_{14}; [108-87-2]

The Ostwald coefficient for solubility in methylcyclohexane at an unspecified pressure and 297.5 K has also been reported by Horsman-van den Dool and Warman. The value needs to be supported by other measurements on the system.

1,1'-Bicyclohexyl; $C_{12}H_{22}$; [92-51-3]

Mole fraction solubilities in 1,1'-bicyclohexyl at a partial pressure of 1 atm may be calculated from Henry's law constants measured by

(cont.)

COMPONENTS:	EVALUATOR:
(1) Ammonia; NH_3; [7664-41-7] (2) Organic liquids	P. G. T. Fogg, School of Chemistry, Polytechnic of North London, Holloway, London, U.K. January 1984

CRITICAL EVALUATION:

Tremper and Prausnitz (5) at unspecified pressures and eight temperatures in the range 300 K to 475 K. These mole fraction solubilities are low compared with values for other hydrocarbons but may be accepted as reliable values. Horsman-van den Dool and Warman (4) have reported Ostwald coefficients for this system. These were measured at 295.6 K and 301.2 K and unspecified pressures and correspond to mole fraction solubilities which are over 20% greater than those which may be calculated from the Henry's law constants reported by Tremper and Prausnitz. The measurements by Horsman-van den Dool and Warman are likely to be less reliable than those carried out by Tremper and Prausnitz.

cis-Decahydronaphthalene; $C_{10}H_{18}$; [493-01-6];
trans-Decahydronaphthalene; $C_{10}H_{18}$; [493-02-7]

Ostwald coefficients for solubilities of ammonia in *cis*- and *trans*-decalin were also measured by Horsman-van den Dool and Warman at 300.1 K and 301.3 K and unspecified pressures. The corresponding mole fraction solubilities may be estimated on the assumption that Ostwald coefficients are independent of pressure. These mole fraction solubilities are close to those estimated for 1,1'-bicyclohexyl from the Ostwald coefficients given by these authors for this compound and discussed above. Although no great reliance ought to be placed on these solubilities in the decalins until they are supported by other measurements on these systems, they are of the right order of magnitude.

Cyclohexene; C_6H_{10}; 110-83-8

The solubility of ammonia at 273.2 K and 293.2 K and various pressures in pure cyclohexene, in mixtures with benzene and in pure benzene have been measured by Noda *et al.* (9). The mole fraction solubilities in cyclohexene at 1 atm partial pressure, are lower than solubilities in alkanes or in benzene. The variation in solubility, as the proportion of cyclohexene is reduced, follows a consistent pattern. There is no reason to doubt the reliability of the measurements which can be accepted on a tentative basis.

Aromatic hydrocarbons

Benzene; C_6H_6; [71-43-2]

Mole fraction solubilities are higher in aromatic hydrocarbons than in non-aromatic hydrocarbons. Mole fraction solubilities in benzene were measured by Noda *et al.* (9) at 273.2 K and 293.2 K and pressures approaching the vapor pressures of liquid ammonia at the temperatures of measurement. When these solubilities are plotted against the partial pressure of ammonia it is found that points fall on smooth curves which can be extrapolated through $x_{NH_3} = 1$; p_{NH_3} = vapor pressure of liquid ammonia.

The mole fraction solubility at 293.2 K and a partial pressure of ammonia of 1 atm has been estimated from these measurements by the evaluator and found to be 0.038. This contrasts with the value of 0.0474 for this temperature and pressure given by Bell (2). The evaluator has also estimated the corresponding value at 298.2 K by extrapolation of values calculated from measurements by Noda *et al.* This estimated value of 0.033 also contrasts with the value of 0.0257 from work by Patyi *et al.* (3). Since the measurements by both Bell and Patyi *et al.* were made at one pressure only whereas the measurements reported by Noda *et al.* were made at a series of pressures and lead to a consistent set of solubility values, it is likely that the latter are

(cont.)

COMPONENTS:

(1) Ammonia; NH_3; [7664-41-7]

(2) Organic liquids

EVALUATOR:

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London, U.K.

January 1984

CRITICAL EVALUATION:

the most reliable. These should therefore be accepted as tentative values.

Methylbenzene; C_7H_8; [108-88-3]; 1-Methylnaphthalene; $C_{11}H_{10}$; [1321-94-4]

The mole fraction solubility in methylbenzene at 1 atm partial pressure of ammonia has been given by Bell (2) as 0.0313 at 293.2 K and by Gerrard (10) as 0.078 at 273.2 K. These values are similar in magnitude to values reported for the solubility of ammonia in benzene at the same temperatures and therefore the two values may be accepted as tentative values. However it would be unwise to extrapolate these values to obtain solubilities outside the range 273 K to 293 K. Henry's law constants for solubility in 1-methylnaphthalene are reliable for calculation of mole fraction solubilities to a pressure of about 1 atm.

Alcohols

The mole fraction solubility in alcohols and other compounds containing one or more -OH groups is high in comparison with the solubility in other liquids at the same temperature and partial pressure of ammonia. This may be due to the effect of hydrogen bonding between hydroxyl groups and nitrogen atoms in ammonia molecules. There is a general tendency for the mole fraction solubility in straight chain aliphatic alcohols to decrease with increase in length of the hydrocarbon chain. The mole fraction solubility is increased markedly if two or more hydroxyl groups are present in a solvent molecule. Ammonia has also a high solubility in chloro-substituted ethanols. This is consistent with a decrease of electron density at the oxygen atom with the replacement of hydrogen atoms by chlorine atoms.

Methanol; CH_4O; [67-56-1]

Solubilities at eight temperatures from 273.2 K to 313.2 K were determined by Hatem (11) at a total pressure equal to barometric pressure (unspecified). A single value at 291.2 K determined by Kuznetsov *et al.* (7) corresponds to a partial pressure of 1 atm. The values given by de Bruyn (12) for seven temperatures from 273.2 K to 301.6 K also correspond to a total pressure equal to barometric pressure as does the measurement by Delépine (13) at 273.2 K. Mole fraction solubilities at a partial pressure of 1 atm at three temperatures, corrected for the vapor pressure of the solvent and interpolated where necessary, are shown in Table 1. The single measurement by Delépine can be disregarded.

Table 1. Mole fraction solubilities of ammonia in methanol at p_{NH_3} = 1 atm from the results of several workers. Values have been interpolated and corrected for the vapor pressure of the solvent where necessary.

T/K	273.2	288.2	291.2
Hatem	0.49	0.35	0.33
de Bruyn	0.47	0.36	0.34
Kuznetsov *et al.*			0.35
Delépine	0.44		

(cont.)

COMPONENTS:	EVALUATOR:
(1) Ammonia; NH_3; [7664-41-7] (2) Organic liquids	P. G. T. Fogg, School of Chemistry, Polytechnic of North London, Holloway, London, U.K. January 1984

CRITICAL EVALUATION:

Considering the early date at which it was done, there is reasonable agreement between the work by de Bruyn and the later work by Hatem but the latter is likely to be the more reliable with better temperature control and probably better estimations of equilibrium concentrations. Kuznetsov *et al.* (7) were able to control temperatures to only ± 0.5 K. Poor temperature control may explain why the solubility measured at 291.2 K by these workers differs from the solubility reported by Hatem. There may also be differences in the way in which correction for the vapor pressure of the solvent has been made. It is recommended that the values given by Hatem, corrected to allow for the vapor pressure of the solvent, should be accepted as tentative values of the solubility at a partial pressure of 1 atm. These "corrected" values fit the equation:

$$-RT \ln x_{NH_3} = -11570 + 48.68(T/K).$$

The use of this equation outside the range 273.2 K to 313.2 K is not recommended.

Ethanol; C_2H_6O; [64-17-5]

There is great discrepancy between the solubilities given by different workers. Barclay and Butler (14) carried out measurements at partial pressures of ammonia of about 10 mmHg. Extrapolation of these measurements to 760 mmHg is unlikely to give reliable estimation of solubility at this pressure and comparison with solubilities measured at 760 mmHg cannot be made. The solubility reported by Kuznetsov *et al.* (7) can be disregarded because the ethanol was only 92% pure. The purities of the ethanol used in the early work by Delépine (13) and in that by de Bruyn (12) were not stated but ethanol of high quality seems to have been used by Hatem (11). Values given by Hatem may therefore be more reliable than those reported by other workers even though the former do not conform to the general trend for monohydric straight-chain aliphatic alcohols. It should be noted, however, that ethanol shows a similar anomaly when the reported solubilities of diethylamine in various straight-chain alcohols are compared.

1-Propanol; C_3H_8O; [71-23-8]

Solubilities were measured by Hatem (11) at seven temperatures from 273.2 K to 308.2 K at a total pressure equal to barometric pressure. The interpolated value at 291.2 K, corrected for the vapor pressure of the solvent, differs by 8% from the single value obtained by Kuznetsov *et al.* (7) but the Hatem values can be tentatively accepted.

2-Propanol; C_3H_8O; [67-63-0]

Solubilities were also measured by Hatem (11) at seven temperatures from 273.2 K to 308.2 K at a total pressure equal to barometric pressure. The interpolated value at 291.2 K, corrected for the vapor pressure of the solvent, is close to the single value given by Kuznetsov *et al.* (7). The Hatem values can therefore be accepted as tentative values.

1-Butanol; $C_4H_{10}O$; [71-36-3]

Short *et al.* (15) measured solubilities in this solvent at three temperatures from 263.2 K to 333.2 K and a total pressure equal to 1 atm and corrected these measurements to give solubilities when the partial pressure of ammonia is 1 atm. The interpolated solubility at 273.2 K agrees with the value given by Maladkar (16) when the latter is corrected

(cont)

COMPONENTS:	EVALUATOR:
(1) Ammonia; NH_3; [7664-41-7] (2) Organic liquids	P. G. T. Fogg, School of Chemistry, Polytechnic of North London, Holloway, London, U.K. January 1984

CRITICAL EVALUATION:

for the vapor pressure of the solvent. The solubility at 291.2 K interpolated from the values given by Short *et al.* is within 8% of the value given by Kuznetsov *et al.* The values of Short *et al.* can be accepted as reliable.

2-Butanol; $C_4H_{10}O$; [78-92-2]

Maladkar (16) measured the solubility at 273.2 K and a total pressure of 1 atm. The value obtained is lower than the corresponding value for 1-butanol just as values for 2-propanol are lower than values for 1-propanol. There is no reason to question the value given by Malakdar and it should be accepted as a provisional value.

2-Methyl-1-propanol; $C_4H_{10}O$; [78-83-1]

The single solubility measurement at 291.2 K and a partial pressure of 1 atm given by Kuznetsov *et al.* (7) is close to the value which they quote for 1-propanol. It should be borne in mind that temperature control was no better than ± 0.5 K and such an uncertainty in the temperature leads to an uncertainty in the mole fraction solubility quoted for 291.2 K of about ± 0.01.

3-Methyl-1-butanol; $C_5H_{12}O$; [123-51-3]

The mole fraction solubility calculated from measurements by Kuznetsov *et al.* (7) at the single temperature of 2-8.2 K and 1 atm is close to the value of the mole fraction solubility for 1-butanol under the same conditions. The solubility as measured by Kuznetsov can be accepted on a tentative basis with an estimated error in the mole fraction solubility of ± 0.01 due to uncertainty in the temperature.

Octanol; $C_8H_{18}O$; [111-87-5]

The value determined by Gerrard and Maladkar (10) at 273.2 K and a total pressure of 1 atm fits into the general pattern of results for aliphatic alcohols and can be accepted as a tentative value.

Cyclohexanol; $C_6H_{12}O$; [108-93-0]

The mole fraction solubility from work by Cauquil (17) at 299.2 K and 755 mmHg is about half the value for a straight-chain monohydric alcohol. In view of this and of the primitive nature of the apparatus which was used, the measurement should be used with great caution.

2-Amino ethanol; C_2H_7NO; [141-43-5]

The mole fraction solubility at 290.2 K and a partial pressure of 1 atm calculated from data published by Kuznetsov *et al.* (7) is lower than the solubility in ethanol under these conditions. This lower solubility is consistent with an increase in the electron density at the oxygen atom and with competition between amino groups and ammonia leading to a reduced tendency for hydrogen bonding to take place between oxygen and ammonia. The value can be accepted as a tentative value.

1,2-Ethanediol (Ethylene glycol); $C_2H_6O_2$; [107-21-1]

The solubility in this solvent at 263.2 K, 298.2 K and 333.2 K and a partial pressure of 1 atm were measured by Short *et al.* (15). Mole fraction solubilities are about twice the values for monohydric alcohols under the same conditions, showing the importance of the hydroxyl groups

(cont.)

COMPONENTS:	EVALUATOR:
(1) Ammonia; NH_3; [7664-41-7] (2) Organic liquids	P. G. T. Fogg, School of Chemistry, Polytechnic of North London, Holloway, London, U.K. January 1984

CRITICAL EVALUATION:

in determining the solubility. The values for 298.2 K and 333.2 K lie close to the values of the mole fraction solubilities in diethylene glycol under the same conditions as calculated from data published by Timonin *et al.* (18). The measurements by Short *et al.* (15) therefore appear to be reliable and may be accepted as tentative values.

2,2'-Oxybisethanol (diethylene glycol); $C_4H_{10}O_3$; [111-46-6]

Measurements of solubilities in diethylene glycol were made by Timonin *et al.* (18) at four temperatures from 298.2 K to 343.2 K and pressures from 0.025 atm to 32.3 atm. As mentioned above, mole fraction solubilities for a pressure of 1 atm are close to values for ethylene glycol. The higher pressures reached are close to the vapor pressure of liquid ammonia. At temperatures above 298.2 K plots of x_{NH_3} against p_{NH_3} cross the reference line (line following Raoult's law). In terms of Raoult's law this means that there is a change from negative deviation to positive deviation as the pressure is increased. Such behavior has been reported for other systems and there seems to be no reason to doubt the measurements reported by Timonin *et al.* (18) which may be accepted as reliable values.

1,2,3-Propanetriol (glycerol); $C_3H_8O_3$; [56-81-5]

The mole fraction solubility at 291.2 K and a partial pressure of ammonia of 1 atm may be calculated from the mole ratio solubility given by Kuznetsov *et al.* (7). The value is close to that for ethylene glycol and for diethylene glycol under the same conditions with little apparent change in the solubility due to the presence of the extra hydroxyl group. However there is no reason to question the value which should be accepted on a tentative basis.

Chloroethanols

2-Chloroethanol; C_2H_5ClO; [59826-67-4]:
2,2-Dichloroethanol; $C_2H_4Cl_2O$; [598-38-9]:
2,2,2-Trichloroethanol; $C_2H_3Cl_3O$; [115-20-8]

Replacement of hydrogen atoms in the methyl group of ethanol by chlorine atoms is likely to reduce the electron density on the oxygen atom and hence increase the tendency towards hydrogen bonding between oxygen and dissolved ammonia. Measurements of solubilities at 273.2 K and a total pressure of 1 atm have been reported by Gerrard and Maladkar (10). Mole fraction solubilities are greater than the value for ethanol under the same conditions and are close to the value for ethylene glycol and for diethylene glycol. There is also an increase in the mole fraction solubility with increase in the number of chlorine atoms which one would expect. Values should be accepted on a tentative basis because they fit in with the general pattern of solubility data.

Other compounds containing oxygen

2-Propanone; C_3H_6O; [67-64-1]:
Cyclohexanone; $C_6H_{10}O$; [108-93-0]

Careful measurements of the solubility of ammonia in acetone at 1 atm and temperatures of 263.2 K and 298.2 K have been carried out by Short *et al.* (15). The interpolated value of the mole fraction solubility at 292.2 K is 0.096 compared with the value of 0.28 calculated from measurements by Kuznetsov *et al.* (7) at this temperature. The dis-

(cont.)

COMPONENTS:	EVALUATOR:
(1) Ammonia; NH_3; [7664-41-7] (2) Organic liquids	P. G. T. Fogg, School of Chemistry, Polytechnic of North London, Holloway, London, U.K. January 1984

CRITICAL EVALUATION:

crepancy could be due to chemical reaction between acetone and ammonia during Kuznetsov's measurement. The measurements by Short *et al.* are likely to be the more reliable. Kuznetsov *et al.* (7) have also given a value for the solubility of ammonia in cyclohexanone but this has not been compiled because the formation of a solid precipitate was mentioned.

1-Methyl-2-pyrrolidinone; C_5H_9NO; [872-50-4]

The solubilities of ammonia in 1-methyl-2-pyrrolidinone at numerous temperatures and pressures have been reported by Freidson *et al.* (19). The measurements are self-consistent and there is no reason to doubt the reliability of the work.

1,1'-Oxybisoctane; $C_{16}H_{34}O$; [629-82-3]

The mole fraction solubility of ammonia in 1,1'-oxybisoctane (dioctyl ether) reported by Gerrard and Maladkar (10) is close to that for the mole fraction solubility in hydrocarbons of similar carbon number. There is no reason to doubt the value which may be accepted on a tentative basis.

Acetic acid, octyl ester; $C_{10}H_{20}O$; [112-14-1]

The solubility of ammonia in octyl acetate has also been measured by Gerrard and Maladkar (10). This value may also be accepted as a tentative value because there is again no reason to doubt its reliability.

1,4-Dioxane; $C_4H_8O_2$; [123-91-1]

The Ostwald coefficient for ammonia in 1,4-dioxane was measured at an unspecified pressure and about 297 K by Hentz and Sherman (8) but no great reliance can be placed on the value until it is supported by other measurements on the same system.

Phosphorous acid, triphenyl ester; $C_{18}H_{15}O_3P$; [101-02-0]:
Phosphorous acid, triethyl ester; $C_6H_{15}O_3P$; [122-52-1]:
Phosphorous acid, dibutyl ester; $C_8H_{19}O_3P$;

The solubilities in esters of phosphorous acid were studied by Maladkar (16). The measurements appear to be reliable and should be accepted on a tentative basis. The appreciable difference between the apparent mole fraction solubility in the dibutyl ester of phosphorous acid and that in the triethyl ester can be explained as being due to the presence of a free hydroxy group in the former solvent which is absent in the latter.

Phosphoric acid, tributyl ester; $C_{12}H_{27}O_4P$; [126-73-8]

The solubility of ammonia in tributyl phosphate was measured by Hála and Tuck (20) at 1 atm and several temperatures. The mole fraction solubility calculated from these measurements for 1 atm and 273.2 K is close to the value from measurements on the dibutyl ester of phosphorous acid reported by Maladkar (16). Measurements by Hála and Tuck can be accepted as tentative values.

(cont.)

COMPONENTS:	EVALUATOR:
(1) Ammonia; NH_3; [7664-41-7] (2) Organic liquids	P. G. T. Fogg, School of Chemistry, Polytechnic of North London, Holloway, London, U.K. January, 1984

CRITICAL EVALUATION:

1,2,3-Propanetriol, triacetate (glyceryl triacetate); $C_9H_{14}O_6$; [102-76-1]

The mole fraction solubilities of ammonia in glyceryl triacetate, calculated from measurements by Furmer *et al.* (21) are similar in magnitude to values for solubilities in other esters. This work by Furmer *et al.* can also be accepted on a tentative basis.

Triethoxysilane; $C_6H_{16}O_3Si$; [998-30-1]

The mole fraction solubility of ammonia in triethoxysilane has been measured at various pressures and temperatures by Ditsent and Zolotareva (22). This is a consistent set of measurements which appear to be reliable and which should be accepted on a tentative basis.

Chloro-compounds

Tetrachloromethane; CCl_4; [56-23-5]:
1,2-Dichloroethane; $C_2H_4Cl_2$; [107-06-2]

Bell (2) has given the mole fraction solubility in tetrachloromethane at 293.2 K and 1 atm partial pressure of ammonia as 0.0281. This value is close to values for aliphatic hydrocarbons. The value given by Bell for 1,2-dichloroethane under the same conditions is 0.0797. This increase can be explained as being due to a tendency for hydrogen bonding to occur between the hydrogen atoms of the solvent and the nitrogen atoms of the ammonia. There is no reason to question either the value given for tetrachloromethane or for 1,2-dichloroethane which may be accepted as tentative values.

Trichloromethane; $CHCl_3$; [67-66-3]

The solubility in trichloromethane was measured by Bell (2) at 293.2 K. The mole fraction solubility at a partial pressure of ammonia of 1 atm was reported to be 0.193. Seward (23) measured the solubility in this solvent at 298.2 K and at a pressure range from 14 mmHg to 453 mmHg. Extrapolation of Seward's results to 1 atm indicates a mole fraction solubility of 0.141 at 298.2 K and a partial pressure of ammonia of 1 atm. Hydrogen bonding between solvent and solute would be expected to lead to a high solubility of ammonia in trichloromethane but the apparent large change in solubility with a change of temperature from 293.2 K to 298.2 K must be viewed with caution and little reliance can be placed upon extrapolations to other temperatures.

1-Chlorooctane; $C_8H_{17}Cl$; [111-85-3]

The mole fraction solubility in 1-chlorooctane at 273.2 K and 1 atm has been measured by Gerrard and Maladkar (10). The value is greater than that for alkanes of similar chain length but less than that for trichloromethane. There is no reason to doubt the value which may be accepted as tentative.

Chlorobenzene; C_6H_5Cl; [108-90-7]

The solubility in chlorobenzene at 1 atm partial pressure of ammonia has been measured at 263.2 K, 298.2 K and 333.2 K by Short *et al.* (15). The interpolated value of the mole fraction solubility at 293.2 K is about 5% higher than the value reported by Bell (2) for this temperature.

(cont.)

COMPONENTS:	EVALUATOR:
(1) Ammonia; NH_3; [7664-41-7] (2) Organic liquids	P. G. T. Fogg, School of Chemistry, Polytechnic of North London, Holloway, London, U.K. January 1984

CRITICAL EVALUATION:

The values reported by Short *et al.* are likely to be reliable. Comparison of these measurements with values for benzene reported by Noda *et al.* (9) shows that the introduction of a chlorine atom into the benzene nucleus may cause an increase in the mole fraction solubility. This would be consistent with the polarity of chlorobenzene.

Bromobenzene; C_6H_5Br; [108-86-1]

The mole fraction solubility of ammonia in bromobenzene was measured at 293.2 K by Bell (2) and the value for a partial pressure of 1 atm was reported. In this case the value is slightly less than the mole fraction solubility in benzene from Noda's measurements but the reliability of this single value for bromobenzene cannot be judged.

Chloromethylbenzene; C_7H_7Cl; [100-44-7]

Bell also reported the mole fraction solubility in chloromethylbenzene at 293.2 K and 1 atm partial pressure. The value appears to be greater than the corresponding values for benzene and for methylbenzene as would be expected from its polarity and there is no reason to question the value which may be accepted on a tentative basis.

Compounds containing nitrogen

Hydrazine; N_2H_4; [302-01-2]:
Methylhydrazine; $N_2H_3CH_3$; [60-34-4]:
1,1-Dimethylhydrazine; $N_2H_2C_2H_6$; [57-14-7]

Mole fraction solubilities in hydrazine, methylhydrazine and 1,1-dimethylhydrazine were measured at three temperatures and several partial pressures of ammonia by Chang *et al.* (24). At each temperature, values of mole fraction solubilities, when plotted against the partial pressure of ammonia, fall on smooth curves through the origin and through $x_{NH_3} = 1$; p_{NH_3} = vapor pressure of liquid ammonia at the temperature of measurement. For each compound interpolated values of x_{NH_3} for p_{NH_3}=1 atm fit closely to equations of the form:

$$-RT \ln x_{NH_3} = a + b(T/K).$$

There is no reason to doubt the reliability of these measurements.

Benzenamine; C_6H_7N; [62-53-3]

The mole fraction solubility in benzenamine (aniline) at a total pressure equal to barometric pressure and at six temperatures from 298.2 K to 423.2 K may be calculated from solubilities given by Stoica *et al.* (25). Extrapolation of these mole fraction solubilities to 291.2 K gives a value of 0.148 which may be compared with the value at this temperature given by Kuznetsov *et al.* (7) of 0.13. The vapor pressure of aniline made an appreciable contribution to the total pressure at the higher temperatures at which Stoica's measurements were carried out.

If corrections are made for the vapor pressure of aniline then the mole fraction solubilities at a partial pressure of 1 atm from measurements by Stoica *et al.* may be accepted as tentative values. These values fit the equation:

(cont.)

COMPONENTS:	EVALUATOR:
(1) Ammonia; NH_3; [7664-41-7] (2) Organic liquids	P. G. T. Fogg, School of Chemistry, Polytechnic of North London, Holloway, London, U.K. January 1984

CRITICAL EVALUATION:

$$-RT \ln x_{NH_3} = -25180 + 101.1(T/K)$$

(Standard deviation of $-RT \ln x_{NH_3} = 643\ J\ mol^{-1}$)

This equation should be used with caution outside the range 298.2 K to 423.2 K.

N,N-Diethylethanamine (triethylamine); $C_6H_{15}N$; [121-44-8]

The mole fraction solubility in triethylamine at 294.2 K and a partial pressure of ammonia of 1 atm may be calculated from measurements by Kuznetsov (7) to be 0.08. This is about half the value for the solubility in aniline at the same temperature. There is, however, no reason to doubt this value for triethylamine but there are no measurements on closely similar systems with which to make comparisons.

Quinoline; C_9H_7N; [91-22-5]

Kuznetsov *et al.* (7) have also made a single measurement of the solubility in quinoline at 291.2 K and 1 atm. The mole fraction solubility has been calculated to be 0.06, less than the value for triethylamine but slightly greater than the apparent value of 0.04 for benzene under the same conditions. The value for quinoline must be accepted as a tentative value because no proper evaluation can be carried out.

Hexanedinitrile; $C_6H_8N_2$; [111-69-3]

The solubility of ammonia in hexanedinitrile (adiponitrile) at several temperatures and pressures from about 70 mmHg to about 16 atm has been measured by Freidson *et al.* (26). These measurements correspond to a consistent set of values of mole fraction solubilities and seem to be reliable. However they should be accepted on a tentative basis because measurements on closely related systems are not available for comparison.

Compounds containing silicon

Tetramethylsilane; $C_4H_{12}Si$; [75-76-3]

The Ostwald coefficient for dissolution of ammonia in tetramethylsilane was measured by Horsman-van den Dool and Warman (4) at 292.9 K and an unspecified pressure. The value is within the range found for dissolution in hydrocarbons but little reliance can be placed on this single value until other measurements on this or similar systems are available for comparison.

References

1. Taylor, N. W.; Hildebrand, J. H.
   J. Amer. Chem. Soc. 1923, *45*, 682.

2. Bell, R. P. *J. Chem. Soc.* 1931, 1371.

(cont.)

COMPONENTS:	EVALUATOR:
(1) Ammonia; NH_3; [7664-41-7] (2) Organic liquids	P. G. T. Fogg, School of Chemistry, Polytechnic of North London, Holloway, London, U.K. January 1984

CRITICAL EVALUATION:

3. Patyi, L.; Furmer, I. E.; Makranczy, J.; Sadilenko, A. S.; Stepanova, Z. G.; Berengarten, M. G. *Zh. Prikl. Khim.* 1978, *51*, 1296.

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

5. Tremper, K. K.; Prausnitz, J. M. *J. Chem. Engng. Data* 1976, *21*, 295.

6. Messow, U.; Pape, D. *Pol. J. Chem.* 1980, *54*, 2001.

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8. Hentz, R. R.; Sherman, W. V. *J. Phys. Chem.* 1968, *72*, 2635.

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10. Gerrard, W.; Maladkar, V. K. *Chem. Ind.* 1970, 925.

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12. de Bruyn, L. *Rec. Trav. Chim. Pays-Bas* 1892, *11*, 337.

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16. Maladkar, V. K. Thesis, Univ. of London, 1970.

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18. Timonin, V. E.; Timofeeva, E. G.; Marchenkova, T. G. 1980, Deposited Doc. VINITI 2874-80.

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22. Ditsent, V. E.; Zolotareva, M. N. *Zh. Fiz. Khim.* 1973, *47*, 1045 (details in VINITI 5307-73).

23. Seward, R. P. *J. Amer. Chem. Soc.* 1932, *54*, 4598.

24. Chang, E. T.; Gocken, N. A.; Poston, T. M. *J. Chem. Engng. Data* 1971, *16*, 404.

25. Stoica, T.; Bota, T. D.; Teusdea, G. M.; Sarbu, L.; Herscovici, J. *Rev. Chim. (Bucharest)* 1981, *32*, 1018.

26. Freidson, G. S.; Furmer, I. E.; Amelin, A. G. 1974, Deposited Doc. VINITI 1543-74.

COMPONENTS:

1. Ammonia; H_3N; [7664-41-7]
2. Hydrocarbons

ORIGINAL MEASUREMENTS:

Bell, R. P.

J. Chem. Soc.

1931, 1371-82.

VARIABLES:

PREPARED BY:

P. G. T. Fogg

EXPERIMENTAL VALUES:

Solvent	Partition coeff. $mol_{NH_3}\ dm^{-3}(soln)/mol_{NH_3}\ dm^{-3}(gas)$	Mole fraction x_{NH_3} (1 atm)
Hexane; C_6H_{14}; [110-54-3]	4.16	0.0223
*Octane; C_8H_{18}; [111-65-9]	2.56	0.0170
*Dodecane; $C_{12}H_{26}$; [112-40-3]	2.13	0.0197
*Hexadecane; $C_{16}H_{34}$; [544-76-3]	1.84	0.0219
Benzene; C_6H_6; [71-43-2]	9.95	0.0474
Methylbenzene; C_7H_8; [108-88-3]	7.23	0.0313

Temperature = 293.2 K   1 atm = 1.015×10^5 Pascal

* Unpublished measurements by Brönsted and Volqvartz reported by Bell.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE

Ammonia at barometric pressure was passed through the solvent in a graduated glass vessel for about 3 hours. The temperature was controlled to ±0.01 K by a thermostat bath. Dissolved ammonia in a measured volume of solution was removed by a current of air over a period of 8-10 hours, trapped in U-tubes containing hydrochloric acid and estimated by titration. Solubilities were corrected to 1 atm by making corrections for the vapor pressure of the solvent, barometric pressure and hydrostatic pressure of liquid in the absorption vessel. Mole fraction solubilities were calculated by the author on the assumption that densities of solutions obey the ideal mixture law.

SOURCE AND PURITY OF MATERIALS

Solvents "zur Analyse" grade from Merck or Kahlbaum; dried over $CaCl_2$ and distilled.

C_6H_{14}: b.p. 67.1 - 67.6°C

C_6H_6 : b.p. 79.60 - 79.65°C

C_7H_8 : b.p. 110.0 - 111.0°C.

The author stated that measurements were reproducible to within 1%.

COMPONENTS:	ORIGINAL MEASUREMENTS:
1. Ammonia; NH_3; [7664-41-7] 2. Hexane; C_6H_{14}; [110-54-3]	Patyi, L.; Furmer, I. E.; Makranczy, J.; Sadilenko, A. S.; Stepanova, Z. G.; Berengarten, M. G. *Zh. Prikl. Khim.* 1978, *51*, 1296-1300.
VARIABLES:	PREPARED BY:
	C. L. Young

EXPERIMENTAL VALUES:

T/K	α^a	Mole fraction of ammonia at a partial pressure of 101.325 kPa x_{NH_3}
298.15	2.48	0.01457

[a] Volume of gas (calculated for 101.325 kPa and 273.15 K) dissolved by one volume of solvent when the partial pressure of gas was 101.325 kPa.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The authors stated that they used a static method previously described by Bodor *et al.* (ref. 1). However, Bodor *et al.* described apparatus for use below 0 °C but referred to another paper (ref 2.) in which an apparatus for use above 0 °C was described. Bodor *et al.* stated that, in each case, the volume of gas absorbed by a given quantity of liquid at a particular pressure was measured by a gas burette. Bodor *et al.* gave details of a method of calculating gas solubilities, applicable to either apparatus, with allowance for the vapor pressure of the solvent.

SOURCE AND PURITY OF MATERIALS:

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

ESTIMATED ERROR:

$\delta T/K = \pm 0.1$; $\delta\alpha = \pm 4\%$ or less.

REFERENCES:

1. Bodor, E.; Bor, G. J.; Mohai, B.; Sipos, G. *Veszpremi. Vegyip. Egy. Kozl.* 1957, *1*, 55.
2. Schay, G.; Szekely, G.; Racz, Gy.; Traply, G. *Periodica Polytechnica Ser. Chem. Eng. (Budapest)* 1958, *2*, 1.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Ammonia; NH_3; [7664-41-7] (2) Hexane; C_6H_{14}; [110-54-3] 2,2,4-Trimethylpentane or iso-octane; C_8H_{18}; [540-84-1]	Horsman-van den Dool, L. E. W.; Warman, J. W. Interuniversity Reactor Institute (IRI)-Report 134-81-01
VARIABLES:	**PREPARED BY:**
$T/K = 292.4$ p_1/kPa not given	H. L. Clever

EXPERIMENTAL VALUES:

Temperature $t/^{\circ}C$	Temperature T/K	Ostwald Coefficient $L/cm^3\ cm^{-3}$	Number of Runs
Hexane			
19.2	292.4	2.51	2
2,2,4-Trimethylpentane			
19.2	292.4	2.45	2

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

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

The chromatograph is a Hewlett-Packard model 5750 equiped with a thermal conductivity cell detector. The carrier gas is helium. A 90 cm column packed with Porapak Q coated with 10 percent polyethyleneimine is used for the separation.

SOURCE AND PURITY OF MATERIALS:

(1) Ammonia. Baker Chemical Co. Anhydrous, 99.99 percent. Used as received.

(2) Hexane and 2,2,4-Trimethylpentane. Both Merck, Uvasol Spektroskopie grade. Impurities which give the same retention time as the gas are removed before the experiment by adsorption or distillation.

ESTIMATED ERROR:

$\delta L/L = \pm 0.05$

REFERENCES:

COMPONENTS: 1. Ammonia; NH ; [7664-41-7] 2. Various organic liquids.	ORIGINAL MEASUREMENTS: Gerrard, W. *"Solubility of Gases and Liquids"*, Plenum Press, New York, 1976, pp.164-165.
VARIABLES: Temperature, pressure	PREPARED BY: P. G. T. Fogg

EXPERIMENTAL VALUES:

The general pattern of variation of mole fraction of NH_3 with variation of pressure of NH_3 from 0-1 atm at 273.2 K has been presented in graphical form for the following liquids:

Decane; $C_{10}H_{22}$; [124-18-5]

1,3,5-Trimethylbenzene; C_9H_{12}; [108-67-8]

N,N-Diethylbenzenamine; $C_{10}H_{15}N$; [91-66-7]

1,1'-Oxybisoctane; $C_{16}H_{34}O$; [629-82-3]*

1-Octanamine; $C_8H_{19}N$; [111-86-4]

Trichloromethane; $CHCl_3$; [67-66-3]

Benzenamine; C_6H_7N; [62-53-3]

Octanol; $C_8H_{18}O$; [29063-28-3]**

Benzenemethanol; C_7H_8O; [100-51-6]

2,2,2-Trichloroethanol; $C_2H_3Cl_3O$ [115-20-8]

Benzeneethanamine; $C_8H_{11}N$; [64-04-0]

N,N-Dimethylformamide; C_3H_7NO; [68-12-2]

The mole fraction of NH_3 at 1 atm and 293.2 K has been given in graphical form for the following liquids:

Octane; C_8H_{18}; [111-65-9]

Dodecane; $C_{12}H_{26}$; [112-40-3]

Hexadecane; $C_{16}H_{34}$; [544-76-3]

* formula incorrectly printed as $(n\text{-}C_{18}H_{17})_2O$;

** formula incorrectly printed as $n\text{-}C_6H_7OH$.

Correct formulae are given in the manuscript copy of the book held at the Polytechnic of North London.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Adsorption at barometric pressure was measured by bubbling ammonia through a weighed quantity (about 2 g) of solvent in a glass vessel held in a thermostat until saturation was achieved. The concentration of ammonia was calculated from the increase in weight of the vessel after an allowance had been made for the weight of ammonia in the gas phase above the saturated solution.

Solubilities at lower pressures were calculated from weight changes when solutions which had been previously saturated at barometric pressure were allowed to come to equilibrium under a lower pressure of ammonia.

Details of the apparatus are given in ref. (1).

SOURCE AND PURITY OF MATERIALS:

Not given.

ESTIMATED ERROR:

REFERENCES:

1. Gerrard, W. *"Solubility of Gases and Liquids"* Plenum Press, New York, 1976, pp.3-5.

COMPONENTS:	ORIGINAL MEASUREMENTS:
1. Ammonia; NH_3; [7664-41-7] 2. Hexadecane; $C_{16}H_{34}$; [544-76-3]	Tremper, K.K.; Prausnitz, J.M. *J. Chem. Engng. Data* 1976, *21*, 295-9
VARIABLES:	**PREPARED BY:**
Temperature	C.L. Young

EXPERIMENTAL VALUES:

T/K	Henry's Constant /atm	Mole fraction[b] of ammonia at 1 atm partial pressure, x_{NH_3}
300	45.8	0.0218
325	59.0	0.0169
350	73.4	0.0136
375	87.6	0.0114
400	100.0	0.0100
425	112.0	0.00893
450	122.0	0.00820
475	129.0	0.00775

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:

$\delta T/K = \pm 0.1$; $\delta x_{NH_3} = \pm 1\%$

REFERENCES:

1. Dymond, J.; Hildebrand, J.H. *Ind.Chem.Eng.Fundam.* 1967, *6*, 130.
2. Cukor, P.M.; Prausnitz, J.M. *Ind.Chem.Eng.Fundam.* 1971, *10*, 638.

COMPONENTS:	ORIGINAL MEASUREMENTS:
1. Ammonia; NH_3; [7664-41-7] 2. Kerosine	Messow, U.; Pape, D. *Pol. J. Chem.* 1980, *54*, 2001-2009.
VARIABLES: Temperature	PREPARED BY: P. G. T. Fogg

EXPERIMENTAL VALUES:

T/K	Mole fraction (1 atm), x_{NH_3}
303.2	0.02513
333.2	0.01698
363.2	0.01227

Total pressure = 1 atm = 1.013×10^5 Pa.

The authors stated that the kerosine had the following properties:

Average molecular weight/g mol^{-1} = 209

Average b.p./K = 462

Molar volume at 25 °C/cm^3 mol^{-1} = 257.75

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:	SOURCE AND PURITY OF MATERIALS:
The authors claimed to have made measurements in the pressure range from 1 atm to 10 atm but no further experimental results or details were given.	No details given.
	ESTIMATED ERROR:
	REFERENCES:

COMPONENTS:

1. Ammonia; NH_3; [7664-41-7]

2. Diesel fuel

ORIGINAL MEASUREMENTS:

Messow, U.; Pape, D.

Pol. J. Chem.

1980, *54*, 2001-2009.

VARIABLES:

Temperature

PREPARED BY:

P. G. T. Fogg

EXPERIMENTAL VALUES:

T/K	Mole fraction (1 atm), x_{NH_3}
303.2	0.02127
333.2	0.01577
363.2	0.01195

Total pressure = 1 atm = 1.013×10^5 Pa.

The authors stated that the diesel fuel had the following properties:

Average molecular weight/g mol^{-1} = 234

Average b.p./K = 553

Molar volume at 25 °C/cm^3 mol^{-1} = 300.12

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The authors claimed to have made measurements in the pressure range from 1 atm to 10 atm but no further experimental results or details were given.

SOURCE AND PURITY OF MATERIALS:

No details given.

ESTIMATED ERROR:

REFERENCES:

COMPONENTS:

(1) Ammonia; NH_3; [7664-41-7]

(2) Cyclohexane; C_6H_{12}; [110-82-7]

1,4-Dioxane; $C_4H_8O_2$; [123-91-1]

ORIGINAL MEASUREMENTS:

Hentz, R. R.; Sherman, W. V.

J. Phys. Chem. 1968, *72*, 2635-41.

VARIABLES:

$T/K = \sim 297$

p_1/kPa not given

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

Temperature		Ostwald Coefficient
$t/^{\circ}C$	T/K	$L/cm^3\ cm^{-3}$
Cyclohexane		
~ 24	~ 297	2.0
1,4-Dioxane		
~ 24	~ 297	17.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The apparatus consisted of a solvent bulb, a gas and mixing bulb of known volume, and a manometer.

A 100 cm^3 sample of solvent was placed in the solvent bulb. It was degassed by repeated pumping and shaking. The solvent was brought to the temperature of the measurement and its vapor pressure measured.

Gas was added to the gas and mixing bulb, and its pressure measured. The gas was condensed. The degassed solvent was transferred to the bulb. The bulb contents were brought back to the temperature of the measurement and shaken vigorously to establish equilibrium. The pressure was measured and the Ostwald coefficient calculated from the decrease in pressure suitably corrected for the solvent vapor pressure.

SOURCE AND PURITY OF MATERIALS:

(1) Ammonia. Matheson Co., Inc. Purified by three trap to trap distillations. Degassed by pumping at -196 $^{\circ}C$.

(2) Cyclohexane. Fisher. Spectroanalyzed grade. Passed through silica gel, stored over sodium. 1,4-Dioxane. Matheson, Coleman & Bell. Spectroscopic reagent. Passed over alumina, refuxed over Na under N_2, distilled.

ESTIMATED ERROR:

$\delta L/L = \pm 0.10$ (authors)

REFERENCES:

COMPONENTS:

1. Ammonia; NH_3; [7664-41-7]

2. Cyclohexane; C_6H_{12}; [110-82-7]

ORIGINAL MEASUREMENTS:

Kuznetsov, A. I.; Panchenkov, G. M.; Gogoleva, T. V.

Zh. Fiz. Khim. 1968, *42*, 982-3.
(*Russ. J. Phys. Chem.* 1968, *42*, 510-511).

VARIABLES:

PREPARED BY:

P. G. T. Fogg

EXPERIMENTAL VALUES:

T/K	p_{NH_3}/mmHg	$mol_{NH_3}/mol_{solvent}$	Mole fraction* x_{NH_3}
292.2	760	0.29	0.22

The authors stated that the total pressure was varied from about 100 mmHg to about 800 mmHg although only solubilities at p_{NH_3} = 760 mmHg were reported.

The authors also stated that Henry's law in the form:

$$mol_{NH_3}/mol_{solvent} = p_{NH_3} \times \text{constant}$$

was "satisfactorily" obeyed.

760 mmHg = 1 atm = 1.013×10^5 Pa.

* Calculated by the compiler.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Conventional gas handling apparatus attached to a vacuum line was used. A measured volume of solvent was admitted to the absorption vessel which was fitted with a magnetic stirrer. Portions of ammonia at a measured volume and pressure were then admitted to the absorption vessel and equilibrium pressures in this vessel were measured by a mercury manometer. Allowance was made for the vapor pressure of the solvent but the method of making this allowance was not stated.

SOURCE AND PURITY OF MATERIALS:

1. Obtained from a commercial cylinder.

2. "Pure" grade.

ESTIMATED ERROR:

$\delta T/K = \pm 0.5$; $\delta p/mmHg = \pm 0.5$

(estimated by the authors).

REFERENCES:

COMPONENTS:

1. Ammonia; NH_3; [7664-41-7]
2. Cyclohexane; C_6H_{12}; [110-82-7]

ORIGINAL MEASUREMENTS:

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

Zh. Prikl. Khim. 1978, *51*, 1296-1300.

VARIABLES:

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	α^a	Mole fraction of ammonia at a partial pressure of 101.325 kPa x_{NH_3}
298.15	7.52	0.03501

[a] Volume of gas (calculated for 101.325 kPa and 273.15 K) dissolved by one volume of solvent when the partial pressure of gas was 101.325 kPa.

AUXILIARY INFORMATION

METHOD APPARATUS/PROCEDURE:

The authors stated that they used a static method previously described by Bodor *et al.* (ref. 1). However, Bodor *et al.* described apparatus for use below 0 °C but referred to another paper (ref. 2) in which an apparatus for use above 0 °C was described. Bodor *et al.* stated that, in each case, the volume of gas absorbed by a given quantity of liquid at a particular pressure was measured by a gas burette. Bodor *et al.* gave details of a method of calculating gas solubilities, applicable to either apparatus, with allowance for the vapor pressure of the solvent.

SOURCE AND PURITY OF MATERIALS:

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

ESTIMATED ERROR:

$\delta T/K = \pm 0.1$; $\delta\alpha = \pm 4\%$ or less.

REFERENCES:

1. Bodor, E.; Bor, G. J.; Mohai, B.; Sipos, G. *Veszpremi. Vegyip. Egy. Kozl.* 1957, *1*, 55.
2. Schay, G.; Szekely, G.; Racz, Gy.; Traply, G. *Periodica Polytechnica Ser. Chem. Eng. (Budapest)* 1958, *2*, 1.

COMPONENTS:

(1) Ammonia; NH_3; [7664-41-7]

(2) Cyclohexane; C_6H_{12}; [110-82-7]

Methylcyclohexane; C_7H_{14}; [108-87-2]

ORIGINAL MEASUREMENTS:

Horsman-van den Dool, L. E. W.; Warman, J. W.

Interuniversity Reactor Institute (IRI)-Report 134-81-01

VARIABLES:

T/K = 292.5, 297.5

p_1/kPa not given

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

Temperature		Ostwald Coefficient	Number of Runs
$t/^{\circ}C$	T/K	$L/cm^3\ cm^{-3}$	
Cyclohexane			
19.3	292.5	2.36	3
Methylcyclohexane			
24.3	297.5	2.48	2

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

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

The chromatograph is a Hewlett-Packard model 5750 equiped with a thermal conductivity cell detector. The carrier gas is helium. A 90 cm column packed with Porapak Q coated with 10 % polyethyleneimine is used for the separation.

SOURCE AND PURITY OF MATERIALS:

(1) Ammonia. Baker Chemical Co. Anhydrous, 99.99 percent. Used as received.

(2) Cyclohexane. Merck Uvasol Spektroskopie grade. Methylcyclohexane. Fluka. UV-Spektrskopie grade. Impurities which gave the same retention time as the gas are removed before the experiment by adsorption or distillation.

ESTIMATED ERROR:

$\delta L/L = \pm\ 0.05$

REFERENCES:

COMPONENTS:

1. Ammonia; NH_3; [7664-41-7]
2. 1,1'-Bicyclohexyl; $C_{12}H_{22}$; [92-51-3]

ORIGINAL MEASUREMENTS:

Tremper, K.K.; Prausnitz, J.M.

J. Chem. Engng. Data 1976, *21*, 295-9

VARIABLES:

Temperature

PREPARED BY:

C.L. Young

EXPERIMENTAL VALUES:

T/K	Henry's Constant[a] /atm	Mole fraction[b] of ammonia at 1 atm partial pressure, x_{NH_3}
300	101.0	0.00990
325	168.0	0.00595
350	213.0	0.00469
375	243.0	0.00412
400	265.0	0.00377
425	285.0	0.00351
450	299.0	0.00334
475	304.0	0.00329

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:

$\delta T/K = \pm 0.1$; $\delta x_{NH_3} = \pm 1\%$

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) Ammonia; NH_3; [7664-41-7]

(2) 1,1'-Bicyclohexyl; $C_{12}H_{22}$; [92-51-3]

ORIGINAL MEASUREMENTS:

Horsman-van den Dool, L. E. W.; Warman, J. W.

Interuniversity Reactor Institute (IRI)-Report 134-81-01

VARIABLES:

T/K = 295.6, 301.2
p_1/kPa not given

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

Temperature		Ostwald Coefficient	Number of Runs
t/°C	T/K	L/cm³ cm⁻³	
22.4	295.6	1.77	2
28.0	301.2	1.70	1

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

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

The chromatograph is a Hewlett-Packard model 5750 equiped with a thermal conductivity cell detector. The carrier gas is helium. A 90 cm column packed with Porapak Q coated with 10 % polyethyleneimine is used for the separation.

SOURCE AND PURITY OF MATERIALS:

(1) Ammonia. Baker Chemical Co. Anhydrous, 99.99 percent. Used as received.

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

ESTIMATED ERROR:

$\delta L/L = \pm 0.05$

REFERENCES:

COMPONENTS:

(1) Ammonia; NH_3; [7664-41-7]

(2) *cis*-Decahydronaphthalene or *cis*-decalin; $C_{10}H_{18}$; [493-01-6]

trans-Decahydronaphthalene or *trans*-decalin; $C_{10}H_{18}$; [493-02-7]

ORIGINAL MEASUREMENTS:

Horsman-van den Dool, L. E. W.; Warman, J. W.

Interuniversity Reactor Institute (IRI)-Report 134-81-01

VARIABLES:

$T/K = 300.1, 301.3$
p_1/kPa not given

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

Temperature $t/^\circ C$	Temperature T/K	Ostwald Coefficient $L/cm^3\ cm^{-3}$	Number of Runs
cis-Decalin			
26.9	300.1	1.78	2
trans-Decalin			
28.1	301.3	1.94	1

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

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

The chromatograph is a Hewlett-Packard model 5750 equiped with a thermal conductivity cell detector. The carrier gas is helium. A 90 cm column packed with Porapak Q coated with 10 % polyethyleneimine is used for the separation.

SOURCE AND PURITY OF MATERIALS:

(1) Ammonia. Baker Chemical Co. Anhydrous, 99.99 percent. Used as received.

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

ESTIMATED ERROR:

$\delta L/L = \pm\ 0.05$

REFERENCES:

COMPONENTS:

1. Ammonia; NH_3; [7664-41-7]

2. Cyclohexene; C_6H_{10}; [110-83-8]

ORIGINAL MEASUREMENTS:

Noda, K.; Morisue, T.; Ishida, K.

J. Chem. Eng. Japan. 1975, *8*, 104-8.

VARIABLES:

Temperature, pressure

PREPARED BY:

C.L. Young

EXPERIMENTAL VALUES:

T/K	P/atm	P/kPa	Mole fraction of ammonia in liquid, x_{NH_3}	in vapor, y_{NH_3}
273.15	1.12	113	0.025	0.922
	1.83	185	0.043	0.953
	2.09	212	0.054	0.961
	2.49	252	0.069	0.973
	3.52	357	0.122	0.985
	3.80	385	0.149	0.984
	4.00	405	0.161	0.988
	4.22	428	0.262*	0.986
	4.21	427	0.808*	0.989
	4.22	428	0.978*	0.988
293.15	1.40	142	0.019	-
	2.45	248	0.035	0.944
	4.62	468	0.092	0.975
	5.80	588	0.130	0.978
	6.46	655	0.161	0.983
	7.25	735	0.206	0.978
	7.81	791	0.255	0.982
	8.34	845	0.384*	0.987
	8.33	844	0.557*	0.984
	8.33	844	0.948*	0.988
	8.35	846	0.966	0.985
	8.38	849	0.978	0.993
	8.41	852	0.983	0.993

* three phase region

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Pyrex glass cell fitted with gaseous sample port and Bourdon pressure gauge. Composition of liquid phase estimated from known volume of system and amounts added. Gas sample analysed by GC. Details in source.

SOURCE AND PURITY OF MATERIALS:

1. Commercial product, fractionated at least four times under pressure.

2. Commercial sample, distilled middle fraction used.

ESTIMATED ERROR:

$\delta T/K = \pm 0.02$; $\delta P/kPa = \pm 1$;
δx_{NH_3}, $\delta y_{NH_3} = \pm 0.003$
(estimated by compiler)

REFERENCES:

COMPONENTS: 1. Ammonia; NH_3; [7664-41-7] 2. Aromatic compounds	ORIGINAL MEASUREMENTS: Bell, R.P. *J. Chem. Soc.* 1931, 1371-1382.
VARIABLES:	PREPARED BY: C.L. Young

EXPERIMENTAL VALUES:

Solvent	T/K	Partition coefficient, s^+	Mole fraction of ammonia in liquid, x_{NH_3}
Benzene, C_6H_6; [71-43-2]	293.15	9.95	0.0474
Methylbenzene; (Toluene); C_7H_8; [108-88-3]		7.23	0.0313
Bromobenzene; C_6H_5Br; [108-86-1]		8.08	0.0340
Chlorobenzene; C_6H_5Cl; [108-90-7]		11.35	0.0423
Chloromethylbenzene; (Benzyl chloride); C_7H_7Cl; [100-44-7].		12.20	0.0556

$^+$ defined as $s = 22.4 \times \frac{293}{273} \times c$ where c is the "solubility in equivalents/litre".

§ for a partial pressure of 101.325 kPa.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Volumetric apparatus consisting of bulb (~50cm^3capacity) extended at the top as a graduated tube and joined at bottom to a capillary u-tube. Liquid saturated with gas at atmospheric pressure. Gas withdrawn in a current of air, absorbed in hydrochloric acid. Excess hydrochloric acid titrated with sodium hydroxide.

SOURCE AND PURITY OF MATERIALS:

1. Obtained from cylinder, no other details given.
2. Merck or Kahlbaum samples dried over calcium chloride and fractionally distilled.

ESTIMATED ERROR:

$\delta T/K = \pm 0.1$; $\delta x_{NH_3} = \pm 1\%$.

(estimated by compiler)

REFERENCES:

COMPONENTS:

1. Ammonia; NH_3; [7664-41-7]
2. Benzene; C_6H_6; [71-43-2]

ORIGINAL MEASUREMENTS:

Noda, K.; Morisue, T.; Ishida, K.

J. Chem. Eng. Japan. 1975, *8*, 104-8

VARIABLES:

Temperature, pressure

PREPARED BY:

C.L. Young

EXPERIMENTAL VALUES:

T/K	P/atm	P/kPa	Mole fraction of ammonia in liquid, x_{NH_3}	 in vapor, y_{NH_3}
273.15	1.48	150	0.079*	0.974
	1.73	175	0.112	0.970
	1.84	186	0.122	0.961
	2.14	217	0.152	-
	2.71	275	0.229	0.974
	3.08	312	0.296	0.982
	3.41	346	0.390	0.987
	3.60	365	0.472	0.984
	3.79	384	0.606	0.988
	3.86	391	0.689	0.991
	3.93	398	0.793	-
	4.03	408	0.901	0.991
	4.12	417	0.957	0.993
293.15	1.35	137	0.046	0.903
	2.78	282	0.109	0.964
	3.81	386	0.164	0.979
	5.34	541	0.290	0.981
	6.21	629	0.396	0.992
	6.82	691	0.510	0.991
	7.18	728	0.598	0.989
	7.60	770	0.769	0.993
	7.65	775	0.794	0.991
	7.67	777	0.799	0.987
	7.90	800	0.883	0.993
	8.34	845	0.978	0.995

*three phase region

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Pyrex glass cell fitted with gaseous sample port and Bourdon pressure gauge. Composition of liquid phase estimated from known volume of system and amounts added. Gas sample analysed by GC. Details in source.

SOURCE AND PURITY OF MATERIALS:

1. Commercial product, fractionated at least four times under pressure.
2. Guaranteed reagent sample.

ESTIMATED ERROR:

$\delta T/K = \pm 0.02$; $\delta P/kPa = \pm 1$;
δx_{NH_3}, $\delta y_{NH_3} = \pm 0.003$.
(estimated by compiler).

REFERENCES:

COMPONENTS:

1. Ammonia; NH_3; [7664-41-7]
2. Benzene; C_6H_6; [71-43-2]

ORIGINAL MEASUREMENTS:

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

Zh. Prikl. Khim. 1978, *51*, 1296-1300.

VARIABLES:

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	α^a	Mole fraction of ammonia at a partial pressure of 101.325 kPa x_{NH_3}
298.15	6.52	0.02573

[a] Volume of gas (calculated for 101.325 kPa and 273.15 K) dissolved by one volume of solvent when the partial pressure of gas was 101.325 kPa.

AUXILIARY INFORMATION

METHOD APPARATUS/PROCEDURE:

The authors stated that they used a static method previously described by Bodor *et al.* (ref. 1). However, Bodor *et al.* described apparatus for use below 0 °C but referred to another paper (ref. 2) in which an apparatus for use above 0 °C was described. Bodor *et al.* stated that, in each case, the volume of gas absorbed by a given quantity of liquid at a particular pressure was measured by a gas burette. Bodor *et al.* gave details of a method of calculating gas solubilities, applicable to either apparatus, with allowance for the vapor pressure of the solvent.

SOURCE AND PURITY OF MATERIALS:

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

ESTIMATED ERROR:

$\delta T/K = \pm 0.1$; $\delta\alpha = \pm 4\%$ or less.

REFERENCES:

1. Bodor, E.; Bor, G. J.; Mohai, B.; Sipos, G. *Veszpremi. Vegyip. Egy. Kozl.* 1957, *1*, 55.
2. Schay, G.; Szekely, G.; Racz, Gy.; Traply, G. *Periodica Polytechnica Ser. Chem. Eng. (Budapest)* 1958, *2*, 1.

COMPONENTS:

1. Ammonia; NH_3; [7664-41-7]
2. Benzene; C_6H_6; [71-43-2]
3. Cyclohexene; C_6H_{10}; [110-83-8]

ORIGINAL MEASUREMENTS:

Noda, K.; Morisue, T.; Ishida, K.

J. Chem. Eng. Japan. 1975, *8*, 104-8.

VARIABLES:

Pressure, composition

PREPARED BY:

C.L. Young

EXPERIMENTAL VALUES:

T/K	p/atm	p/kPa	Mole fraction of benzene §		Mole fraction of ammonia	
			in liquid $x_{C_6H_6}$	in gas, $y_{C_6H_6}$	in liquid, x_{NH_3}	in gas, y_{NH_3}
293.15	2.51	254	0.083	0.110	0.048	0.978
	5.53	560		0.086	0.137	0.985
	6.33	641		0.089	0.178	0.989
	7.61	771		0.081	0.278	0.990
	8.26	837		0.072	0.522*	0.990
	8.29	840		0.064	0.752*	0.991
	8.32	843		0.049	0.900*	0.992
	2.48	251	0.212	0.205	0.050	0.972
	3.07	311		0.198	0.067	0.972
	5.91	599		0.215	0.178	0.989
	6.43	652		0.202	0.209	0.987
	7.68	778		0.195	0.336	0.991
	8.16	827		0.155	0.491	0.992
	8.19	830		0.147	0.658*	0.990
	8.22	833		0.132	0.801*	0.993
	8.27	838		0.105	0.915*	0.991
	8.30	841		0.065	0.956	0.992
	1.97	200	0.532	0.492	0.051	0.947
	3.43	348		0.484	0.100	0.979
	4.37	443		0.488	0.147	0.980
	5.95	603		0.465	0.244	0.987
	6.99	708		0.458	0.365	0.991
	7.71	781		0.412	0.572	0.991
	7.94	805		0.376	0.750	0.992

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Pyrex glass cell fitted with gaseous sample port and Bourdon pressure gauge. Composition of liquid phase estimated from known volume of system and amounts added. Gas sample analysed by GC. Details in source.

SOURCE AND PURITY OF MATERIALS:

1. Commercial product, fractionated at least four times under pressure.
2. Guaranteed reagent sample
3. Commercial sample, distilled middle fraction used.

ESTIMATED ERROR:

$\delta T/K = \pm 0.02$; $\delta P/kPa = \pm 1$;
δx_{NH_3}, $\delta y_{NH_3} = \pm 0.003$.
(estimated by compiler)

REFERENCES:

COMPONENTS:

1. Ammonia; NH_3; [7664-41-7]
2. Benzene; C_6H_6; [71-43-2]
3. Cyclohexene; C_6H_{10}; [110-83-8]

ORIGINAL MEASUREMENTS:

Noda, K.; Morisue, T.; Ishida, K.

J. Chem. Eng. Japan. 1975, *8*, 104-8

EXPERIMENTAL VALUES:

T/K	p/atm	p/kPa	Mole fraction of § benzene in liquid $x_{C_6H_6}$	Mole fraction of § benzene in gas $x_{C_6H_6}$	Mole fraction of ammonia in liquid y_{NH_3}	Mole fraction of ammonia in gas, y_{NH_3}
293.15	8.03	814	0.532	0.321	0.848	0.992
	8.27	838		0.238	0.954	0.993
	1.50	152	0.739	0.698	0.040	0.960
	2.92	296		0.695	0.097	0.961
	3.55	360		0.707	0.130	0.960
	4.74	480		0.665	0.205	0.984
	6.05	613		0.647	0.320	0.989
	6.79	688		0.640	0.426	0.990
	7.05	714		0.635	0.472	0.984
	7.12	721		0.646	0.491	0.991
	7.32	742		0.612	0.552	0.993
	7.74	784		0.553	0.740	0.992
	8.00	811		0.487	0.881	0.992
	8.05	816		0.445	0.898	0.993

§ Mole fraction on ammonia free basis.

* total composition in two liquid phase region.

COMPONENTS: 1. Ammonia; NH_3; [7664-41-7] 2. Methylbenzene; C_7H_8; [108-88-3]	ORIGINAL MEASUREMENTS: Gerrard, W.; Maladkar, V.K. *Chem. Ind.* 1970, 925-926. Maladkar, V.K. Thesis, Univ. of London, 1970.
VARIABLES:	PREPARED BY: P.G.T. Fogg.

EXPERIMENTAL VALUES:

T/K	Moles $_{NH_3}$/moles $_{C_7H_8}$ (1 atm)	Mole fraction* x_{NH_3} (1 atm)
273.2	0.085	0.078

* Calculated by compiler.

1 atm = 1.013×10^5 Pascal

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Ammonia at barometric pressure was bubbled through a weighed quantity (about 2 g) of solvent in a glass vessel held in a thermostat until saturation was achieved. The concentration of ammonia was calculated from the increase in weight of the vessel after an allowance had been made for the weight of ammonia in the gas phase above the saturated solution. Details of the apparatus are given in ref. (1).

SOURCE AND PURITY OF MATERIALS:

1. Obtained from a cylinder; dried by KOH pellets and a cold trap.

ESTIMATED ERROR:

REFERENCES:

1. Gerrard, W. *"Solubility of Gases and Liquids"*, Plenum Press, New York, 1976, p.3.

COMPONENTS:

1. Ammonia; NH_3; [7664-41-7]
2. 1-Methylnaphthalene; $C_{11}H_{10}$; [1321-94-4]

ORIGINAL MEASUREMENTS:

Tremper, K.K.; Prausnitz, J.M.

J. Chem. Engng. Data 1976, *21*, 295-9

VARIABLES:

Temperature

PREPARED BY:

C.L. Young

EXPERIMENTAL VALUES:

T/K	Henry's Constant[a] /atm	Mole fraction[b] of ammonia at 1 atm partial pressure x_{NH_3}
300	30.5	0.0328
325	49.6	0.0202
350	68.1	0.0147
375	86.1	0.0116
400	104.0	0.00962
425	121.0	0.00826
450	139.0	0.00719
475	154.0	0.00649

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:

$\delta T/K = \pm 0.1$; $\delta x_{NH_3} = \pm 1\%$.

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. Ammonia; NH_3; [7664-41-7]

2. Methanol; CH_4O; [67-56-1]

ORIGINAL MEASUREMENTS:

Delépine,

J. Pharm. Chim.

1892, *25*, 496-7.

VARIABLES:

PREPARED BY:

P. G. T. Fogg

EXPERIMENTAL VALUES:

T/K	g_{NH_3}/dm^3 solution	Density of solution /g cm^{-3}	Ostwald coefficient, L	Mole fraction* x_{NH_3} (1 atm)
273.2	218.0	0.770	425.0	0.426

Pressure = 760 mmHg = 1 atm = 1.013 × 10^5 Pa.

* Calculated by compiler.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

No information given.

SOURCE AND PURITY OF MATERIALS:

No information given.

ESTIMATED ERROR:

REFERENCES:

COMPONENTS:

1. Ammonia; NH_3; [7664-41-7]

2. Methanol; CH_4O; [67-56-1]

ORIGINAL MEASUREMENTS:

de Bruyn, L.

Rec. Trav. Chim. Pays-Bas

1892, *11*, 112-191.

VARIABLES:

Temperature

PREPARED BY:

P. G. T. Fogg

EXPERIMENTAL VALUES:

T/K	g_{NH_3}/ 100 $g_{solution}$	Mol_{CH_4O}/ mol_{NH_3}	Mole fraction* x_{NH_3} (1 atm)
273.2	29.3	1.28	0.439
279.2	26	1.51	0.398
284.9	23.5	1.73	0.366
287.9	21.8	1.91	0.344
290.2	20.8	2.02	0.331
295.2	18.3	2.37	0.297
301.6	14.8	3.05	0.247

Pressure = 1 atm = 1.013×10^5 Pa.

* Calculated by compiler.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Dry ammonia at barometric pressure was introduced into small glass bulbs (2-3 cm^3) of known weight which were about half full of solvent and held in a thermostat bath. The bulbs were subsequently sealed, reweighed and broken under dilute acid. The ammonia was then estimated by titration.

SOURCE AND PURITY OF MATERIALS:

No information given.

ESTIMATED ERROR:

REFERENCES:

COMPONENTS:

1. Ammonia; NH_3; [7664-41-7]
2. Methanol; CH_4O; [67-56-1]

ORIGINAL MEASUREMENTS:

Hatem, S.

Bull. Soc. Chim. Fr.

1949, *16*, 337-340.

VARIABLES:

PREPARED BY:

P. G. T. Fogg

EXPERIMENTAL VALUES:

T/K	mol_{NH_3} dm^{-3} (soln.)	Mole fraction*, x_{NH_3}
273.2	13.65	0.449
283.2	10.85	0.375
288.2	9.66	0.341
293.2	8.42	0.304
298.2	7.30	0.270
303.2	6.19	0.234
308.2	5.34	0.206
313.2	4.60	0.180

The total pressure was equal to barometric pressure (unspecified).

* The densities of other solutions of ammonia in methanol of various concentrations at temperatures from 273.2 K to 303.2 K were given by the authoress. The compiler has estimated the densities of solutions listed above by extrapolation and has then calculated mole fraction solubilities from molar concentrations given in the paper.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Ammonia from a cylinder was bubbled, for about one hour in each case, through portions of methanol in a graduated glass absorption vessel held in a thermostat controlled to ±0.1 K. The final volumes of solution were recorded.

Dissolved ammonia was estimated by dilution with water and titration with sulfuric acid. Densities of solutions were measured with a pyknometer.

SOURCE AND PURITY OF MATERIALS:

1. Obtained from a cylinder; passed over CaO.
2. Free from traces of H_2O and $(CH_3)_2CO$; b.p. 65 °C; density (15 °C) 0.794 g cm^{-3}; n_D (temp. not stated) 1.330.

ESTIMATED ERROR:

REFERENCES:

COMPONENTS: 1. Ammonia; NH_3; [7664-41-7] 2. Aliphatic monohydric alcohols	ORIGINAL MEASUREMENTS: Kuznetsov, A. I.; Panchenkov, G. M.; Gogoleva, T. V. *Zh. Fiz. Khim.* 1968, *42*, 982-3 (*Russ. J. Phys. Chem.* 1968, *42*, 510-11).
VARIABLES:	PREPARED BY: P. G. T. Fogg

EXPERIMENTAL VALUES:

Solvent	T/K	p_{NH_3}/mmHg	Mole ratio $mol_{NH_3}/mol_{solv.}$	Mole fraction* x_{NH_3}
Methanol; CH_4O; [67-56-1]	291.2	760	0.54	0.35
Ethanol; C_2H_6O; [64-17-5]	291.2	760	0.49	0.33
1-Propanol; C_3H_8O; [71-23-8]	291.2	760	0.34	0.25
2-Propanol; C_3H_8O; [67-63-0]	291.2	760	0.34	0.25

The authors stated that the total pressure was varied from about 100 mmHg to about 800 mmHg but only solubilities at p_{NH_3} = 760 mmHg were reported.

The authors also stated that Henry's law in the form:

$$mol_{NH_3}/mol_{solvent} = p_{NH_3} \times \text{constant}$$

was "satisfactorily" obeyed except by methanol close to atmospheric pressure.

*Calculated by the compiler. 760 mmHg = 1 atm = 1.013×10^5 Pa.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Conventional gas handling apparatus attached to a vacuum line was used. A measured volume of solvent was admitted to the absorption vessel which was fitted with a magnetic stirrer. Portions of ammonia at a measured volume and pressure were admitted to the absorption vessel and equilibrium pressures in this vessel were measured by a mercury manometer. Allowance was made for the vapor pressure of the solvent but the method of making this allowance was not stated.

SOURCE AND PURITY OF MATERIALS:

1. Obtained from a commercial cylinder.
2. Methanol: "analytical reagent" grade; ethanol: 92% pure; propanol: "chemically pure" grade.

ESTIMATED ERROR:

$\delta T/K = \pm 0.5$; $\delta p/\text{mmHg} = \pm 0.5$ (estimated by authors).

REFERENCES:

COMPONENTS: 1. Ammonia; NH_3; [7664-41-7] 2. Ethanol; C_2H_6O; [64-17-5]	ORIGINAL MEASUREMENTS: Delépine, *J. Pharm. Chim.* 1892, *25*, 496-7.
VARIABLES: Temperature	PREPARED BY: P. G. T. Fogg

EXPERIMENTAL VALUES:

T/K	g_{NH_3}/dm^3 solution	Density of solution /g cm^{-3}	Ostwald coefficient, L	Mole fraction* x_{NH_3} (1 atm)
273.2	130.5	0.782	209.5	0.351
283.2	108.5	0.787	164.3	0.302
293.2	75.0	0.791	106.6	0.221
303.2	51.5	0.798	97.0	0.157

Pressure = 760 mmHg = 1 atm = 1.013×10^5 Pa.

* Calculated by compiler.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE: No information given.	SOURCE AND PURITY OF MATERIALS: No information given.
	ESTIMATED ERROR:
	REFERENCES:

COMPONENTS:

1. Ammonia; NH_3; [7664-41-7]
2. Ethanol; C_2H_6O; [64-17-5]

ORIGINAL MEASUREMENTS:

de Bruyn, L.

Rec. Trav. Chim. Pays-Bas

1892, *11*, 112-191.

VARIABLES:

Temperature

PREPARED BY:

P. G. T. Fogg

EXPERIMENTAL VALUES:

T/K	g_{NH_3}/ 100 $g_{solution}$	$Mol_{C_2H_6O}$/ mol_{NH_3}	Mole fraction* x_{NH_3} (1 atm)
273.2	19.7	1.51	0.398
279.2	17.1	1.79	0.358
284.9	14.1	2.25	0.308
287.9	13.2	2.43	0.292
290.2	12.6	2.56	0.281
295.2	10.9	3.02	0.249
301.6	9.2	3.73	0.211

Pressure = barometric (approx. 760 mmHg).

760 mmHg = 1 atm = 1.013×10^5 Pa.

* Calculated by compiler.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Dry ammonia at barometric pressure was introduced into small glass bulbs (2-3 cm^3) of known weight which were about half full of solvent and held in a thermostat bath. The bulbs were subsequently sealed, reweighed and broken under dilute acid.
The ammonia was then estimated by titration.

SOURCE AND PURITY OF MATERIALS:

No information given.

ESTIMATED ERROR:

REFERENCES:

COMPONENTS: 1. Ammonia; NH_3; [7664-41-7] 2. Ethanol; C_2H_6O; [64-17-5]	ORIGINAL MEASUREMENTS: Barclay, I.M.; Butler, J.A.V. *Trans. Faraday Soc.* 1938, *34*, 1445-54.
VARIABLES: Pressure, temperature	PREPARED BY: P.G.T. Fogg.

EXPERIMENTAL VALUES:

T/K	Mole fraction in solution, x_{NH_3}	Wt % NH in condensate	p_{NH_3}/mmHg *
298.2	4.053×10^{-3}	4.482	7.47
298.2	3.983×10^{-3}	4.40	7.33
308.2	3.94×10^{-3}	3.59	10.42
308.2	3.896×10^{-3}	3.59	10.42

* Units of pressure were not given in the original paper but calculations by the compiler have shown that the authors measured pressures in mmHg.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Dry N_2 was passed through a row of six bulbs containing solution of known concentration. The ethanol vapor which emerged was trapped in a tube cooled by solid CO_2. Ammonia was absorbed in a second tube containing solvent and estimated by titration. The mole ratio of ammonia to ethanol in the total condensate was equal to the ratio in the vapor phase. It was assumed that the partial pressure of ethanol over the solution could be calculated from the concentration by use of Raoult's law because the solution was dilute. The partial pressure of ammonia over the solution was taken to be equal to the product of the mole ratio of ammonia to ethanol in the vapor phase and the partial pressure of ethanol in the vapor phase.

SOURCE AND PURITY OF MATERIALS:

2. Purified and dried; b.p. 78.47°C (760 mmHg).

ESTIMATED ERROR:

REFERENCES:

COMPONENTS:

1. Ammonia; NH_3; [7664-41-7]
2. Ethanol; C_2H_6O; [64-17-5]

ORIGINAL MEASUREMENTS:

Hatem, S.

Bull. Soc. Chim. Fr.

1949, *16*, 337-340.

VARIABLES:

Temperature

PREPARED BY:

P. G. T. Fogg

EXPERIMENTAL VALUES:

T/K	mol_{NH_3} dm^{-3} (soln.)	Mole fraction*, x_{NH_3}
273.2	8.65	0.308
283.2	6.62	0.246
288.2	5.69	0.215
293.2	5.02	0.192
298.2	4.32	0.167
303.2	3.79	0.148
308.2	3.30	0.130

The total pressure was equal to barometric pressure (unspecified).

* The densities of other solutions of ammonia in ethanol of various concentrations at temperatures from 273.2 K to 308.2 K were given by the authoress. The compiler has estimated the densities of solutions listed above by extrapolation and has then calculated mole fraction solubilities from molar concentrations given in the paper.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Ammonia from a cylinder was bubbled, for about an hour in each case, through portions of ethanol in a graduated absorption vessel held in a thermostat controlled to ±0.1 K. The final volumes of solution were recorded. Dissolved ammonia was estimated by dilution with water and titration with sulfuric acid. Densities of solutions were measured with a pyknometer.

SOURCE AND PURITY OF MATERIALS:

1. Obtained from a cylinder; passed over CaO.
2. Absolute alcohol: distilled from CaO; b.p. 78.35 °C; n_D^{20} 1.3614; density (20 °C) 0.7901 g cm^{-3}.

ESTIMATED ERROR:

REFERENCES:

COMPONENTS:

1. Ammonia; NH_3; [7664-41-7]
2. 1-Propanol; C_3H_8O; [71-23-8]

ORIGINAL MEASUREMENTS:

Hatem, S.

Bull. Soc. Chim. Fr.

1949, *16*, 337-340.

VARIABLES:

PREPARED BY:

P. G. T. Fogg

EXPERIMENTAL VALUES:

T/K	mol_{NH_3} dm^{-3} (soln.)	Mole fraction*, x_{NH_3}
273.2	7.07	0.388
283.2	5.3	0.314
288.2	4.65	0.284
293.2	4.15	0.259
298.2	3.62	0.232
303.2	3.25	0.213
308.2	2.39	0.163

The total pressure was equal to barometric pressure (unspecified).

* The densities of other solutions of ammonia in 1-propanol of various concentrations at temperatures from 273.2 K to 308.2 K were given by the authoress. The compiler has estimated the densities of solutions listed above by extrapolation and has then calculated mole fraction solubilities from molar concentrations given in the paper.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Ammonia from a cylinder was bubbled, for about an hour in each case, through portions of propanol in a graduated absorption vessel held in a thermostat controlled to ±0.1 K. The final volumes of solution were recorded. Dissolved ammonia was estimated by dilution with water and tiration with sulfuric acid. Densities of solutions were measured with a pyknometer.

SOURCE AND PURITY OF MATERIALS:

1. Obtained from a cylinder; passed over CaO.
2. Distilled twice; b.p. 94.4 °C; density (20 °C) 0.8038 g cm^{-3}.

ESTIMATED ERROR:

REFERENCES:

COMPONENTS:

1. Ammonia; NH_3; [7664-41-7]

2. 2-Propanol; C_3H_8O; [67-63-0]

ORIGINAL MEASUREMENTS:

Hatem, S.

Bull. Soc. Chim. Fr.

1949, *16*, 337-340.

VARIABLES:

Temperature

PREPARED BY:

P. G. T. Fogg

EXPERIMENTAL VALUES:

T/K	mol_{NH_3} dm^{-3} (soln.)	Mole fraction* x_{NH_3}
273.2	6	0.349
283.2	4.55	0.283
288.2	4.05	0.258
293.2	3.48	0.228
298.2	2.98	0.200
303.2	2.52	0.173
308.2	2.25	0.157

The total pressure was equal to barometric pressure (unspecified).

* The densities of other solutions of ammonia in 2-propanol of various concentrations at temperatures from 273.2 K to 308.2 K were given by the authoress. The compiler has estimated the densities of solutions listed above by extrapolation and has then calculated mole fraction solubilities from molar concentrations given in the paper.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Ammonia from a cylinder was bubbled, for about an hour in each case, through portions of 2-propanol in a graduated absorption vessel held in a thermostat controlled to ±0.1 K. The final volumes of solution were recorded. Dissolved ammonia was estimated by dilution with water and titration with sulfuric acid. Densities of solutions were measured with a pyknometer.

SOURCE AND PURITY OF MATERIALS:

1. From a cylinder; passed over CaO.
2. b.p. 82.7 °C; n_D^{17} 1.380; density (17 °C) 0.790 g cm^{-3}

ESTIMATED ERROR:

REFERENCES:

COMPONENTS:

1. Ammonia; NH_3; [7664-41-7]
2. Aliphatic monohydric alcohols

ORIGINAL MEASUREMENTS:

Kuznetsov, A. I.; Panchenkov, G. M.; Gogoleva, T. V.

Zh. Fiz. Khim. 1968, *42*, 982-3 (*Russ. J. Phys. Chem.* 1968, *42*, 510-11).

VARIABLES:

PREPARED BY:

P. G. T. Fogg

EXPERIMENTAL VALUES:

Solvent	T/K	p_{NH_3}/mmHg	Mole ratio $mol_{NH_3}/mol_{solv.}$	Mole fraction* x_{NH_3}
1-Butanol; $C_4H_{10}O$; [71-36-3]	291.2	760	0.36	0.26
2-Methyl-1-propanol; $C_4H_{10}O$; [78-83-1]	291.2	760	0.38	0.28
3-Methyl-1-butanol (isopentyl alcohol); $C_5H_{12}O$; [123-51-3]	288.2	760	0.38	0.28

The authors stated that the total pressure was varied from about 100 mmHg to about 800 mmHg but only solubilities at p_{NH_3} = 760 mmHg were reported.

The authors also stated that Henry's law in the form:

$$mol_{NH_3}/mol_{solvent} = p_{NH_3} \times \text{constant}$$

was "satisfactorily" obeyed.

*Calculated by the compiler. 760 mmHg = 1 atm = 1.013×10^5 Pa.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Conventional gas handling apparatus attached to a vacuum line was used. A measured volume of solvent was admitted to the absorption vessel which was fitted with a magnetic stirrer. Portions of ammonia at a measured volume and pressure were admitted to the absorption vessel and equilibrium pressures in this vessel were measured by a mercury manometer. Allowance was made for the vapor pressure of the solvent but the method of making this allowance was not stated.

SOURCE AND PURITY OF MATERIALS:

1. Obtained from a commercial cylinder.
2. Butanol: "chemically pure" grade; 2-methyl-1-propanol: "analytical reagent" grade; 3-methyl-1-butanol: "pure grade".

ESTIMATED ERROR:

δT/K = ±0.5; δp/mmHg = ±0.5 (estimated by authors).

REFERENCES:

COMPONENTS:

1. Ammonia; NH_3; [7664-41-7]
2. Butanols, $C_4H_{10}O$;

ORIGINAL MEASUREMENTS:

Maladkar, V.K. Thesis, Univ. of London, 1970

(See also Gerrard, W.; Maladkar, V.K. *Chem. Ind.* 1970, 925-926).

VARIABLES:

PREPARED BY:

P.G.T. Fogg.

EXPERIMENTAL VALUES:

Compound	T/K	$\text{Moles}_{NH_3}/\text{moles}_{\text{solvent}}$ (1 atm)	Mole fraction * x_{NH_3} (1 atm)
1-butanol; [71-36-3]	273.2	0.5813	0.368
2-butanol [78-92-2]	273.2	0.4510	0.311
2-methyl-2-propanol; [75-65-0]	273.2	0.3590	0.264
2-methyl-1-propanol; [78-83-1]	273.2	0.6000	0.375

* Calculated by compiler

1 atm = 1.013×10^5 Pa

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Ammonia at barometric pressure was bubbled through a weighed quantity (about 1 g) of solvent in a glass vessel held in a thermostat until saturation was achieved. The concentration of ammonia was calculated from the increase in weight of the vessel after an allowance had been made for the weight of ammonia in the gas phase above the saturated solution. Details of the apparatus are given in ref. (1).

SOURCE AND PURITY OF MATERIALS:

1. Obtained from a cylinder; dried by KOH pellets and a cold trap.
2. 1-&2- butanols: distilled from CaO digested over BaO;distilled from Na.

   2-methyl-2-propanol: distilled from CaO; crystallised; fractionally distilled.

   2-methyl-1-propanol: dried over BaO; distilled.

ESTIMATED ERROR:

REFERENCES:

1. Gerrard, W.; *"Solubility of Gases and Liquids"*, Plenum Press, New York, 1976, p.3.

COMPONENTS:

(1) Ammonia; NH_3; [7664-41-7]

(2) 1-Butanol; $C_4H_{10}O$; [71-36-3]

ORIGINAL MEASUREMENTS:

Short, I.; Sahgal, A.; Hayduk, W.

J. Chem. Eng. Data 1983,

VARIABLES:

T/K: 263.15-333.15

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
263.15	213.1	221.2	0.472 (0.4721)[3]
298.15	73.0	66.9	0.217 (0.2170)
333.15	32.0	26.2	0.1007(0.1007)

[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:

$$\Delta G°/\text{J mol}^{-1} = -RT \ln x_1 = 1022.0\ T \ln T - 6177.75\ T + 143147$$

$$\ln x_1 = 75.287 - 1744.5/T - 12.455 \ln T$$

T/K	$10^{-4}\Delta G°$/J mol^{-1}	x_1	T/K	$10^{-4}\Delta G°$/J mol^{-1}	x_1
263.15	1.621	0.4721	303.15	4.075	0.1943
273.15	2.179	0.3782	313.15	4.776	0.1559
283.15	2.776	0.3028	323.15	5.510	0.1252
293.15	3.408	0.2425	333.15	6.275	0.1007
298.15	3.737	0.2170			

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. Specified minimum purity 99.99 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.* 1957, *61*, 1078.

COMPONENTS:	ORIGINAL MEASUREMENTS:
1. Ammonia; NH_3; [7664-41-7] 2. Octanol; $C_8H_{18}O$; [111-87-5]	Gerrard, W.; Maladkar, V.K. *Chem. Ind.* 1970, 925-926. Maladkar, V.K. Thesis, Univ. of London, 1970.
VARIABLES:	PREPARED BY:
Temperature, pressure	P.G.T. Fogg.

EXPERIMENTAL VALUES:

T/K	Moles $_{NH_3}$/moles $_{C_8H_{18}O}$ (1 atm)	Mole fraction* x_{NH_3} (1 atm)
273.2	0.56	0.359

The variation of moles $_{NH_3}$/moles $_{C_8H_{18}O}$ (p_{NH_3} = 1 atm) with temperature from 263 K to 293 K was given in graphical form. The variation of moles $_{NH_3}$/moles $_{C_8H_{18}O}$ (T = 273.2 K) with pressure from 0 to 1 atm was also given in the form of a graph.

* Calculated by compiler.

1 atm = 1.013×10^5 Pascal.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Absorption at barometric pressure was measured by bubbling ammonia through a weighed quantity (about 2 g) of octanol in a glass vessel held in a thermostat until saturation was achieved. The concentration of ammonia was calculated from the increase in weight of the vessel after an allowance had been made for the weight of ammonia in the gas phase above the saturated solution.

Solubilities at low pressures were calculated from weight changes when solutions which had been previously saturated at barometric pressure were allowed to come to equilibrium under a lower pressure of ammonia. Details of the apparatus are given in ref. (1).

SOURCE AND PURITY OF MATERIALS:

1. Obtained from a cylinder; dried by KOH pellets and a cold trap.
2. Dried over $CaCl_2$; distilled under reduced pressure.

ESTIMATED ERROR:

REFERENCES:

1. Gerrard, W. *"Solubility of Gases and Liquids,"* Plenum Press, New York, 1976, p.3.

COMPONENTS:

1. Ammonia; NH_3; [7664-41-7]
2. Cyclohexanol; $C_6H_{12}O$; [108-93-0]

ORIGINAL MEASUREMENTS:

Cauquil, G.

J. Chim. Phys. Phys. Chim. Biol. 1927, *24*, 53-55.

VARIABLES:

PREPARED BY:

P. G. T. Fogg

EXPERIMENTAL VALUES:

T/K	p_{H_3N}/mmHg	Ostwald coefficient L	Mole fraction* x_{NH_3} (1 atm)
299.2	755	28.166	0.108

$$760 \text{ mmHg} = 1 \text{ atm} = 1.013 \times 10^5 \text{ Pa.}$$

* Value of x_{NH_3} (1 atm) has been calculated by the compiler using densities of cyclohexanol at 293.2 K and 303.2 K given in refs. (1) and (2), respectively, and values of van der Waals constants for ammonia given in ref. (1).

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

A measured volume of cyclohexanol was put into contact with a measured volume of ammonia in a graduated tube over mercury. The final volume of gas and the temperature and pressure were measured when equilibrium had been reached. The author considered that no allowance for the vapor pressure of cyclohexanol at the temperature of measurement was necessary.

SOURCE AND PURITY OF MATERIALS:

2. Dissolved air removed by boiling; b.p. 334.1 K (766 mmHg).

ESTIMATED ERROR:

REFERENCES:

1. *Handbook of Chemistry and Physics*, (61st edition) C.R.C. Press, Cleveland, Ohio, 1980.
2. Timmermans, J. *Physico-Chemical Constants of Pure Organic Compounds*, Vol. II, Elsevier, London, 1965.

COMPONENTS:

(1) Ammonia; NH_3; [7664-41-7]

(2) 1,2-Ethanediol (ethylene glycol); $C_2H_6O_2$; [107-21-1]

ORIGINAL MEASUREMENTS:

Short, I.; Sahgal, A.; Hayduk, W.

J. Chem. Eng. Data 1983,

VARIABLES:

T/K: 263.15-333.15

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
263.15	727	754.6	0.652 (0.652)[3]
298.15	296.2	271.4	0.406 (0.406)
333.15	120.3	98.6	0.202 (0.202)

[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:

$$\Delta G°/\mathrm{J\ mol^{-1}} = -RT \ln x_1 = 2150.45\ T \ln T - 13905.13\ T + 514826$$

$$\ln x_1 = 169.459 - 6274.08/T - 26.2071 \ln T$$

T/K	$10^{-4}\Delta G°/\mathrm{J\ mol^{-1}}$	x_1	T/K	$10^{-4}\Delta G°/\mathrm{J\ mol^{-1}}$	x_1
263.15	0.924	0.6520	303.15	2.463	0.3715
273.15	1.193	0.5872	313.15	3.032	0.3073
283.15	1.541	0.5151	323.15	3.669	0.2507
293.15	1.966	0.4417	333.15	4.373	0.2020
298.15	2.205	0.4060			

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. Specified minimum purity 99.99 per cent.
2. Canlab. Baker Analyzed grade of minimum purity 99.8 per cent.

ESTIMATED ERROR:

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

$\delta x_1/x_1 = 0.01$

REFERENCES:

1. Clever, H.L.; Battino, R.; Saylor, J.H.; Gross, P.M. *J. Phys. Chem.* 1957, *61*, 1078.

COMPONENTS:

1. Ammonia; NH_3; [7664-41-7]
2. 2,2'-Oxybisethanol (diethylene glycol); $C_4H_{10}O_3$; [111-46-6]

ORIGINAL MEASUREMENTS:

Timonin, V. E.; Timofeeva, E. G.; Marchenkova, T. G.; Marchenkov, V. F. 1980, VINITI deposited document 2874-80.

VARIABLES:

Temperature, pressure

PREPARED BY:

P. G. T. Fogg

EXPERIMENTAL VALUES:

T/K	p_{NH_3}/atm	Bunsen coeff. α	Mole fraction# x_{NH_3}	T/K	p_{NH_3}/atm	Bunsen coeff. α	Mole fraction# x_{NH_3}
298.2	0.025	5.1	0.021	313.2	0.14	18.9	0.075
	0.067	13.8	0.055		0.29	33.5	0.125
	0.113	27.0	0.103		0.43	45.4	0.162
	0.18	37.1	0.136		0.54	54.8	0.190
	0.35	67.3	0.222		0.63	61.1	0.207
	0.53	93.8	0.285		0.71	69.4	0.229
	0.61	104	0.306		0.83	78.1	0.250
	0.74	119	0.336		0.90	83.6	0.263
	0.86	137	0.368		2.76	256	0.522
	3.00	390	0.623		3.64	323	0.580
	5.80	730	0.756		4.00	329	0.584
	5.96	814	0.776		5.92	498	0.680
	7.28	1127	0.827		6.84	540	0.697
	7.44	1156	0.831		8.72	727	0.756
	8.08	1542	0.867		9.40	742	0.760
	8.52	1871	0.888		9.60	916	0.796
	8.56	1956	0.893		9.88	932	0.799
					11.8	1291	0.846
					13.3	1755	0.882
					15.0	2525	0.915

\# Calculated by the compiler using densities of solvent given in ref. 1.

1 atm = 1.013×10^5 Pa.

(cont.)

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Apparatus described previously was used (ref. 2). A quantity of gas, measured by changes in pressure of a known volume, was allowed into contact with solvent in a thermostatted absorption vessel. The liquid was magnetically stirred and the final pressure of gas in contact with solvent was measured.

SOURCE AND PURITY OF MATERIALS:

1. Dried with silica gel; nitrogen removed by repeated condensation.
2. Analytically pure; cooled in liquid nitrogen and degassed under vacuum.

ESTIMATED ERROR:

REFERENCES:

1. Timmermans, J. *Physico-Chemical Constants of Pure Organic Compounds*, Vol. II, Elsevier, Amsterdam, 1965.
2. Braude, G. E.; Leites, I. L.; Dedova, I. V. *Khim. Prom.* 1961, 232.

COMPONENTS:

1. Ammonia; NH_3; [7664-41-7]
2. 2,2'-Oxybisethanol (diethylene glycol); $C_4H_{10}O_3$; [111-46-6]

ORIGINAL MEASUREMENTS:

Timonin, V. E.; Timofeeva, E. G.; Marchenkova, T. G.; Marchenkov, V. F. 1980, VINITI deposited document 2874-80.

EXPERIMENTAL VALUES:

T/K	p_{NH_3}/atm	Bunsen coeff. α	Mole fraction# x_{NH_3}	T/K	p_{NH_3}/atm	Bunsen coeff. α	Mole fraction# x_{NH_3}
328.2	0.25	16.8	0.0673	343.2	0.28	13.1	0.054
	0.44	28.4	0.109		0.49	22.4	0.088
	0.59	37.7	0.139		0.66	28.4	0.109
	0.70	44.2	0.159		0.75	33.5	0.126
	0.77	50.0	0.177		0.83	36.6	0.136
	0.84	62.8	0.212		0.87	38.7	0.143
	0.90	57.6	0.198		0.91	40.0	0.147
	5.00	251	0.519		7.40	256	0.525
	5.04	264	0.531		14.4	404	0.635
	8.44	458	0.663		15.1	541	0.700
	8.72	460	0.664		24.1	1232	0.842
	9.56	522	0.691		25.8	1428	0.860
	10.1	575	0.712		28.2	2044	0.898
	10.2	589	0.717		29.6	2269	0.907
	17.1	1212	0.839		32.3	2950	0.927
	19.8	2032	0.897				
	21.7	2844	0.924				

Calculated by the compiler using densities of solvent given in ref. 1.

1 atm = 1.013 × 10^5 Pa.

COMPONENTS:

1. Ammonia; NH_3; [7664-41-7]
2. 1,2,3-Propanetriol (glycerol); $C_3H_8O_3$; [56-81-5]

   2-Propanone (acetone); C_3H_6O; [67-64-1]

ORIGINAL MEASUREMENTS:

Kuznetsov, A. I.; Panchenkov, G.M.; Gogoleva, T. V.

Zh. Fiz. Khim. 1968, *42*, 982-3.

(*Russ. J. Phys. Chem.* 1968, *42*, 510-11)

VARIABLES:

PREPARED BY:

P. G. T. Fogg

EXPERIMENTAL VALUES:

Solvent	T/K	p_{NH_3}/mmHg	$mol_{NH_3}/mol_{solvent}$	Mole fraction* x_{NH_3}
1,2,3-Propanetriol	291.2	760	1.03	0.51
2-Propanone	292.2	760	0.38	0.28

The authors stated that the total pressure was varied from about 100 mmHg to about 800 mmHg although only solubilities at p_{NH_3} = 760 mmHg were reported.

The authors also stated that Henry's law in the form:

$$mol_{NH_3}/mol_{solvent} = p_{NH_3} \times \text{constant}$$

was "satisfactorily" obeyed except by glycerol close to atmospheric pressure.

$$760 \text{ mmHg} = 1 \text{ atm} = 1.013 \times 10^5 \text{ Pa.}$$

* Calculated by the compiler.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Conventional gas handling apparatus attached to a vacuum line was used. A measured volume of solvent was admitted to the absorption vessel which was fitted with a magnetic stirrer. Portions of ammonia at a measured volume and pressure were then admitted to the absorption vessel and equilibrium pressures in this vessel were measured by a mercury manometer. Allowance was made for the vapor pressure of the solvent but the method of making this allowance was not stated.

SOURCE AND PURITY OF MATERIALS:

1. Obtained from a commercial cylinder.
2. Acetone was of "analytical reagent" grade; 1,2,3-Propanetriol was of "pure" grade.

ESTIMATED ERROR:

δT/K = ±0.5; δp/mmHg = ±0.5 (estimated by the authors).

REFERENCES:

COMPONENTS:

1. Ammonia, NH_3; [7664-41-7]
2. Chloroethanols

ORIGINAL MEASUREMENTS:

Gerrard, W.; Maladkar, V.K.

Chem. Ind. 1970, 925-926.

VARIABLES:

PREPARED BY:

P.G.T. Fogg.

EXPERIMENTAL VALUES:

Compound	Moles$_{NH_3}$/moles$_{solvent}$ (1 atm)	Mole fraction * x_{NH_3} (1 atm)
2-Chloroethanol C_2H_5ClO; [59826-67-4]	1.03	0.507
2,2-Dichloroethanol $C_2H_4Cl_2O$; [598-38-9]	1.31	0.567
2,2,2-Trichloroethanol $C_2H_3Cl_3O$; [115-20-8]	1.33	0.571

All measurements were made at T = 273.2 K

In the case of 2,2,2-trichloroethanol the variation of moles$_{NH_3}$/moles$_{C_2H_3Cl_3O}$ (T = 273.2 K) with pressure from 0 - 1 atm was given in the form of a graph.

* Calculated by compiler.

1 atm = 1.013×10^5 Pa

AUXILIARY INFORMATION

METHOD APPARATUS/PROCEDURE:

Ammonia at barometric pressure was bubbled through a weighed quantity (about 2 g) of solvent in a glass vessel held in a thermostat until saturation was achieved. The concentration of ammonia was calculated from the increase in weight of the vessel after an allowance had been made for the weight of ammonia in the gas phase above the saturated solution. Details of the apparatus are given in ref. (1).

SOURCE AND PURITY OF MATERIALS:

1. Obtained from a cylinder; dried by KOH pellets and a cold trap.

ESTIMATED ERROR:

REFERENCES:

1. Gerrard, W. *"Solubility of Gases and Liquids"*, Plenum Press, New York, 1976, p.3.

COMPONENTS:

(1) Ammonia; NH_3; [7664-41-7]

(2) 2-Propanone (acetone); C_3H_6O; [67-64-1]

ORIGINAL MEASUREMENTS:

Short, I.; Sahgal, A.; Hayduk, W.

J. Chem. Eng. Data 1983,

VARIABLES:

T/K: 263.15, 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
263.15	70.9	73.6	0.1906
298.15	30.1	27.6	0.0842

[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:

$$\Delta G°/\text{J mol}^{-1} = -RT \ln x_1 = 707.08\ T - 150277$$

$$\ln x_1 = 1831.40/T - 8.61710$$

T/K	$10^{-4}\Delta G°/\text{J mol}^{-1}$	x_1
263.15	3.579	0.1906
273.15	4.286	0.1477
283.15	4.993	0.1166
293.15	5.701	0.0935
298.15	6.054	0.0842

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. Specified minimum purity 99.99 per cent.
2. Canlab. Specified minimum purity 99.5 per cent.

ESTIMATED ERROR:

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

$\delta x_1/x_1 = 0.01$

REFERENCES:

1. Clever, H.L.; Battino, R.; Saylor, J.H.; Gross, P.M. *J. Phys. Chem.* 1957, *61*, 1078.

COMPONENTS:

1. Ammonia; NH_3; [7664-41-7]
2. 1-Methyl-2-pyrrolidinone;
   C_5H_9NO; [872-50-4]

ORIGINAL MEASUREMENTS:

Freidson, G. S.; Furmer, I. E.;
Amelin, A. G.
1974, VINITI deposited document
1697-74.

VARIABLES:

Temperature, pressure

PREPARED BY:

P. G. T. Fogg

EXPERIMENTAL VALUES:

T/K	p_{NH_3}/ mmHg*	Volume of gas, corrected to 273.2 K and 760 mmHg, dissolved by one volume of solvent.*	Mole fraction# x_{NH_3}
263.2	77	8.2	0.033
	163	15.7	0.061
	270	27.8	0.103
	280	29.0	0.107
	392	41.5	0.146
	482	54.0	0.182
	597	69.6	0.223
	681	82.0	0.253
	734	94.0	0.280
273.2	110	7.3	0.030
	182	11.9	0.047
	298	21.2	0.081
	321	22.9	0.087
	408	30.5	0.113
	419	31.2	0.115
	505	38.4	0.138

* Values taken, by the compiler, from a graph showing experimental points which was given by the authors.

\# Calculated by the compiler using densities of solvent at 20 °C and 25 °C given in refs. 1 and 2.

(cont.)

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Apparatus described previously was used (refs. 3, 4 and 5). A quantity of gas, measured by changes in pressure of a known volume, was allowed into contact with solvent in a thermostatted absorption vessel. The liquid was magnetically stirred and the final pressure of gas in contact with solvent was measured. The authors gave the results in graphical form with volume of gas (corrected to 273.2 K and 1 atm) absorbed by one volume of solvent plotted as a function of gas pressure. One graph corresponded to pressures below 1 atm and a second graph to higher pressures.

SOURCE AND PURITY OF MATERIALS:

1. Dried and purified by potassium hydroxide.
2. Distilled under vacuum; chromatographic analysis indicated it to be 99.8% pure.

REFERENCES:

1. *Dictionary of Organic Compounds*, Chapman and Hall, New York, 1982.
2. *Handbook of Chemistry and Physics* (63rd edition), C.R.C. Press, Cleveland, Ohio, 1982.
3. Braude, G. E.; Leites, I. L.; Dedova, I. V. *Khim. Prom.* 1961, 232.
4. Braude, G. E.; Shakhova, S. F. *Khim. Prom.* 1961, 177.
5. Shenderei, E. R.; Zel'venskii, Ya. D.; Ivanovskii, F. P. *Khim. Prom.* 1960, 370.

COMPONENTS:

1. Ammonia; NH_3; [7664-41-7]
2. 1-Methyl-2-pyrrolidinone; C_5H_9NO; [872-50-4]

ORIGINAL MEASUREMENTS:

Freidson, G. S.; Furmer, I. E.; Amelin, A. G.

1974, VINITI deposited document 1697-74.

EXPERIMENTAL VALUES:

T/K	p_{NH_3}/ mmHg*	Volume of gas, corrected to 273.2 K and 760 mmHg, dissolved by one volume of solvent.*	Mole fraction# x_{NH_3}
273.2	527	40.5	0.145
	590	45.7	0.160
	708	57.1	0.193
283.2	77	3.8	0.016
	108	5.8	0.024
	170	8.3	0.034
	243	11.6	0.047
	342	17.0	0.067
	364	18.1	0.071
	429	22.2	0.086
	475	24.4	0.094
	567	30.2	0.113
	631	33.9	0.126
	655	35.8	0.132
	713	39.3	0.143
298.2	89	3.3	0.014
	198	6.4	0.027
	220	6.8	0.029
	301	9.0	0.037
	350	10.7	0.044
	508	15.7	0.064
	576	18.3	0.073
	603	18.7	0.075
	697	21.6	0.085
	736	23.7	0.093
313.2	113	2.6	0.011
	183	3.8	0.017
	278	5.9	0.025
	294	5.9	0.025
	385	7.8	0.033
	416	8.2	0.035
	512	10.4	0.044
	586	11.9	0.050
	685	13.8	0.057
	701	14.2	0.059
	758	15.9	0.066
328.2	175	2.6	0.012
	285	4.3	0.019
	331	4.6	0.020
	399	5.7	0.025
	479	6.7	0.029
	570	8.0	0.035
	671	9.2	0.040
	740	10.2	0.044
348.2	167	1.2	0.006
	273	2.2	0.010
	324	2.7	0.012
	388	3.3	0.015
	410	3.7	0.017
	504	4.5	0.020
	586	5.3	0.024
	595	5.3	0.024
	666	5.9	0.027
	681	6.2	0.028
	748	6.1	0.028

* Values taken, by the compiler, from a graph showing experimental points which was given by the authors.

\# Calculated by the compiler.

(cont.)

COMPONENTS:

1. Ammonia; NH_3; [7664-41-7]
2. 1-Methyl-2-pyrrolidinone; C_5H_9NO; [872-50-4]

ORIGINAL MEASUREMENTS:

Freidson, G. S.; Furmer, I. E.; Amelin, A. G.

1974, VINITI deposited document 1697-74.

EXPERIMENTAL VALUES:

T/K	p_{NH_3}/atm*	Volume of gas, corrected to 273.2 K and 760 mmHg, dissolved by one volume of solvent.*	Mole fraction# x_{NH_3}
283.2	1.10	53	0.18
	1.92	93	0.28
	2.96	150	0.39
	3.85	280	0.54
	4.23	295	0.56
	4.29	319	0.57
	4.62	532	0.69
	4.88	572	0.71
	5.31	806	0.77
	5.87	1173	0.83
298.2	1.08	29	0.11
	2.29	58	0.20
	3.27	104	0.31
	5.08	198	0.46
	6.33	305	0.57
	6.73	378	0.62
	7.60	497	0.68
	8.08	636	0.73
	9.37	1277	0.85
313.2	3.17	61	0.21
	5.19	116	0.34
	6.88	176	0.44
	7.77	228	0.50
	9.50	340	0.60
	10.27	439	0.66
	10.50	467	0.67
	11.58	621	0.73
	12.60	827	0.79
	13.75	1350	0.86
328.2	3.75	39	0.15
	5.29	68	0.23
	6.25	98	0.31
	7.31	113	0.34
	8.46	145	0.40
	8.77	150	0.40
	9.52	190	0.46
	10.58	208	0.48
	11.62	266	0.55
	14.69	476	0.68
	16.15	699	0.76
	17.56	849	0.79
	19.13	1388	0.86

* Values taken, by the compiler, from a graph showing experimental points which was given by the authors.

\# Calculated by the compiler.

$$760 \text{ mmHg} = 1 \text{ atm} = 1.013 \times 10^5 \text{ Pa.}$$

COMPONENTS:

1. Ammonia; NH_3; [7664-41-7]
2. 1,1'-Oxybisoctane; $C_{16}H_{34}O$; [629-82-3]

ORIGINAL MEASUREMENTS:

Gerrard, W.; Maladkar, V.K. *Chem. Ind.* 1970, 925-926.

Maladkar, V.K. Thesis, Univ. of London, 1970

VARIABLES:

PREPARED BY:

P.G.T. Fogg

EXPERIMENTAL VALUES:

T/K	$\text{Moles}_{NH_3}/\text{moles}_{C_{16}H_{34}O}$ (1 atm)	Mole fraction* x_{NH_3} (1 atm)
273.2	0.10	0.09

* Calculated by compiler

1 atm = 1.013 x 10^5 Pascal

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Ammonia at barometric pressure was bubbled through a weighed quantity (about 2 g) of solvent in a glass vessel held in a thermostat until saturation was achieved. The concentration of ammonia was calculated from the increase in weight of the vessel after an allowance had been made for the weight of ammonia in the gas phase above the saturated solution. Details of the apparatus are given in ref. (1).

SOURCE AND PURITY OF MATERIALS:

1. Obtained from a cylinder; dried by KOH pellets and a cold trap.
2. Dried over $CaCl_2$; distilled under reduced pressure.

ESTIMATED ERROR:

REFERENCES:

1. Gerrard, W. *"Solubility of Gases and Liquids"*, Plenum Press, New York, 1976, p.3.

COMPONENTS:

1. Ammonia; NH_3; [7664-41-7]
2. Acetic acid, octyl ester; $C_{10}H_{20}O_2$; [112-14-1]

ORIGINAL MEASUREMENTS:

Gerrard, W.; Maladkar, V.K.
Chem. Ind. 1970, 925-926.

Maladkar V.K. Thesis, Univ. of London, 1970.

VARIABLES:

PREPARED BY:

P.G.T. Fogg.

EXPERIMENTAL VALUES:

T/K	Moles$_{NH_3}$/moles$_{C_{10}H_{20}O_2}$ (1 atm)	Mole fraction* x_{NH_3} (1 atm)
273.2	0.285	0.222

* Calculated by compiler

1 atm = 1.013×10^5 Pascal

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Ammonia at barometric pressure was bubbled through a weighed quantity (about 2 g) of solvent in a glass vessel held in a thermostat until saturation was achieved. The concentration of ammonia was calculated from the increase in weight of the vessel after an allowance had been made for the weight of ammonia in the gas phase above the saturated solution. Details of the apparatus are given in ref. (1).

SOURCE AND PURITY OF MATERIALS:

1. Obtained from a cylinder; dried by KOH pellets and a cold trap.
2. Dried over $CaCl_2$; distilled under reduced pressure.

ESTIMATED ERROR:

REFERENCES:

1. Gerrard, W. *"Solubility of Gases and Liquids"*, Plenum Press, New York, 1976, p.3.

COMPONENTS:

1. Ammonia; NH_3; [7664-41-7]
2. Phosphorous acid, triethyl ester; $C_6H_{15}O_3P$; [122-52-1]

ORIGINAL MEASUREMENTS:

Maladkar, V.K. Thesis, Univ. of London, 1970.

(See also Gerrard, W.; Maladkar, V. K. *Chem.Ind.* 1970, 925-926).

VARIABLES:

Pressure

PREPARED BY:

P.G.T. Fogg.

EXPERIMENTAL VALUES:

T/K	p_{NH_3}/mmHg	$Moles_{NH_3}/moles_{C_6H_{15}O_3P}$	Mole fraction * x_{NH_3}
273.2	35	0.013	0.013
273.2	225	0.076	0.071
273.2	375	0.111	0.100
273.2	490	0.127	0.113
273.2	790	0.153	0.133

Experimental values were given as points on a large scale graph.

* Calculated by compiler.

760 mmHg = 1 atm = 1.013×10^5 Pa.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Ammonia at barometric pressure was bubbled through a weighed quantity of solvent (about 2 g) in a glass vessel at a few degrees below 273.2 K. The glass vessel was then held in a thermostat at 273.2 K and the new pressure of ammonia measured. The concentration of ammonia was calculated from the increase in weight of the vessel after an allowance had been made for the displacement of air by ammonia in the gas phase above the saturated solution.

Solubilities at low pressures were calculated from weight changes when solutions which had been previously saturated at higher pressures were allowed to come to equilibrium under a lower pressure of ammonia.

Details of the apparatus are given in ref. (1).

SOURCE AND PURITY OF MATERIALS:

1. Obtained from a cylinder; dried by KOH pellets and a cold trap.
2. Distilled under reduced pressure.

ESTIMATED ERROR:

REFERENCES:

1. Gerrard, W. *"Solubility of Gases and Liquids"*, Plenum Press, New York, 1976, p.3.

COMPONENTS:

1. Ammonia; NH_3; [7664-41-7]
2. Phosphorous acid, dibutyl ester; $C_8H_{19}O_3P$

ORIGINAL MEASUREMENTS:

Maladkar, V.K. Thesis,
Univ. of London, 1970
(See also Gerrard,W.;Maladkar,V.K.
Chem.Ind. 1970,925-926)

VARIABLES:

PREPARED BY:

P.G.T. Fogg.

EXPERIMENTAL VALUES:

T/K	p_{NH_3}/mmHg	Moles $_{NH_3}$/moles$_{C_8H_{19}O_3P}$	Mole fraction * x_{NH_3}
273.2	100	0.064	0.060
273.2	200	0.106	0.096
273.2	300	0.142	0.124
273.2	500	0.202	0.168
273.2	700	0.248	0.199
273.2	750	0.260	0.206

Experimental results were presented on a large scale graph showing variation of mole ratio with pressure as a smooth curve. Numerical values given above have been taken from this curve at arbitrary pressure intervals by the compiler.

* Calculated by the compiler.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Ammonia at barometric pressure was bubbled through a weighed quantity of solvent (about 2 g) in a glass vessel at a few degrees below 273.2K. The glass vessel was then held in a thermostat at 273.2 K and the new pressure of ammonia measured. The concentration of ammonia was calculated from the increase in weight of the vessel after an allowance had been made for the displacement of air by ammonia in the gas phase above the saturated solution.

Solubilities at lower pressures were calculated from weight changes when solutions which had been previously saturated at higher pressures were allowed to come to equilibrium under a lower pressure of ammonia.

Details of the apparatus are given in ref (1).

SOURCE AND PURITY OF MATERIALS:

1. Obtained from a cylinder; dried by KOH pellets and a cold trap.
2. Prepared from butanol and phosphorous trichloride; distilled under reduced pressure; purity checked by infra-red spectroxopy.

ESTIMATED ERROR:

REFERENCES:

1. Gerrard, W. *"Solubility of Gases and Liquids"*, Plenum Press, New York, 1976. p.3.

COMPONENTS:

1. Ammonia; NH_3; [7664-41-7]
2. Phosphorous acid, triphenyl ester, $C_{18}H_{15}O_3P$; [101-02-0]

ORIGINAL MEASUREMENTS:

Maladkar, V.K. Thesis, Univ. of London, 1970

(See also Gerrard, W.; Maladkar, V.K. *Chem. Ind.* 1970, 925-926).

VARIABLES:

Pressure

PREPARED BY:

P.G.T. Fogg.

EXPERIMENTAL VALUES:

T/K	p_{NH_3}/mmHg	Moles_{NH_3}/moles $C_{18}H_{15}O_3P$	Mole fraction * x_{NH_3}
293.2	60	0.0275	0.0268
293.2	125	0.0875	0.0805
293.2	295	0.1625	0.1398
293.2	425	0.2300	0.1870
293.2	485	0.2700	0.2126
293.2	750	0.3250	0.2453

Experimental values were given as points on a large scale graph.

* Calculated by compiler.

760 mmHg = 1 atm = 1.013×10^5 Pa

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Ammonia at barometric pressure was bubbled through a weighed quantity of solvent (about 2 g) in a glass vessel at a few degrees below 293.2K. and the new pressure of ammonia measured. The concentration of ammonia was calculated from the increase in weight of the vessel after an allowance had been made for displacement of air by ammonia in the gas phase above the saturated solution. Solubilities at lower pressures were calculated from weight changes when solutions which had been previously saturated at higher pressures were allowed to come to equilibrium under a lower pressure of ammonia.

Details of the apparatus are given in ref. (1).

SOURCE AND PURITY OF MATERIALS:

1. Obtained from a cylinder; dried by KOH pellets and a cold trap.
2. Distilled under reduced pressure.

ESTIMATED ERROR:

REFERENCES:

1. Gerrard, W. *"Solubility of Gases and Liquids,"* Plenum Press, New York, 1976, p.3.

COMPONENTS:

1. Ammonia; NH_3; [7664-41-7]
2. Phosphoric acid, tributyl ester (tributyl phosphate); $C_{12}H_{27}O_4P$; [126-73-8]

ORIGINAL MEASUREMENTS:

Hála, J.; Tuck, D. G.

J. Chem. Soc. (A)

1970, 3242-3246.

VARIABLES:

Temperature

PREPARED BY:

P. G. T. Fogg

EXPERIMENTAL VALUES:

T/K	$mol_{NH_3}/mol_{Bu_3PO_4}$ (1 atm)			Mole fraction* x_{NH_3} (1 atm)
	Expt. values		Mean	
243.2	1.26	1.19	1.22	0.55
253.2	0.62	0.60	0.61	0.38
263.2	0.34	0.35	0.35	0.26
273.2	0.21	0.20	0.20	0.17
283.2	0.16	0.15	0.15	0.13
293.2	0.11	0.10	0.10	0.09

1 atm = 1.013 × 10^5 Pa.

* Calculated by compiler.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Ammonia at a pressure of 1 atm was passed *via* a sinter disc inlet through the solvent in a thermostatted bubbling apparatus attached *via* taps to an evacuated sample collector. Equilibrium saturation was reached in about 1 hour but a period of 8 hours was normally allowed. Taps were then opened to let some of the saturated solution run into the sample collector which was then detached and weighed to give the weight of the sample. Contents were then distilled into standard aqueous hydrochloric acid which was subsequently back-titrated against alkali to give the weight of ammonia present.

SOURCE AND PURITY OF MATERIALS:

1. Obtained from Matheson Co., Ontario; dried by passing through CaO and then KOH.
2. Obtained from Fisher Scientific Co.; refluxed with aqueous NaOH, treated with anhydrous $MgSO_4$, dried at 50 °C *in vacuo* in a stream of dry N_2.

ESTIMATED ERROR:

REFERENCES:

COMPONENTS:

1. Ammonia; NH_3; [7664-41-7]
2. 1,2,3-Propanetriol triacetate (glyceryl triacetate, triacetin); $C_9H_{14}O_6$; [102-76-1]

ORIGINAL MEASUREMENTS:

Furmer, I. E.; Amelin, A. G.; Freidson, G. S.

Tr. Mosk. Khim. Teknol. Inst. 1974, *79*, 96-98.

VARIABLES:

Temperature, pressure

PREPARED BY:

P. G. T. Fogg

EXPERIMENTAL VALUES:

T/K	Henry's Constant* /mmHg	Mole fraction (1 atm)# $x_{C_9H_{14}O_6}$
298.2	4600	0.165
313.2	6760	0.112
328.2	9700	0.078

* Henry's constant = p_{NH_3}/x_{NH_3} where x_{NH_3} is the mole fraction of NH_3 in the liquid phase.

\# Calculated by the compiler on the assumption that the Henry's law constant is valid for 1 atm.

The absorption of ammonia was measured at pressures to 1 atm at temperatures from 10 °C to 75 °C and to 20 atm at temperatures from 25 °C to 55 °C. Results were given in the form of small scale graphs and in the form of Henry's constants. One graph shows that, at each temperature, the volume of gas (corrected to 1 atm and 273.2 K) absorbed by one volume of liquid varied linearly with pressure for pressures to about 1 atm. A second graph shows that the variation was non-linear at higher pressures. Henry's law constants, H, based upon measurements at or below 1 atm, were given for three temperatures. Values were said to fit the equation:

$$H/\text{mmHg} = 7.03 - (1000/T).$$

The compiler considers that this is erroneous and that authors intended to write

$$\log_{10}(H/\text{mmHg}) = 7.03 - (1000/T).$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Apparatus described previously was used (refs. 1, 2 and 3). A quantity of gas, measured by changes in pressure of a known volume, was allowed into contact with solvent in a thermostatted absorption vessel. The liquid was magnetically stirred and the final pressure of gas in contact with solvent was measured.

SOURCE AND PURITY OF MATERIALS:

No information given.

ESTIMATED ERROR:

REFERENCES:

1. Braude, G.E.; Leites, I.L.; Dedova, I.V. *Khim. Prom.* 1961, 232.
2. Braude, G.E.; Shakhova, S.F. *Khim. Prom.* 1961, 177.
3. Shenderei, E.R.; Zel'venskii, Ya.D.; Ivanovskii, F.P. *Khim. Prom.* 1960, 370.

COMPONENTS:

1. Ammonia; NH_3; [7664-41-7]
2. Triethoxysilane; $C_6H_{16}O_3Si$; [998-30-1]

ORIGINAL MEASUREMENTS:

Ditsent, V.E.; Zolotareva, M.N.
Zh. Fiz. Khim. 1973, *47*, 1045;
Russ. J. Phys. Chem. 1973, *47*, 595.
(Brief details given in the above paper. Complete article deposited at VINITI. No. 5307-73, dep. from 3 Jan. 1973.)

VARIABLES:

Pressure, temperature

PREPARED BY:

P. G. T. Fogg

EXPERIMENTAL VALUES:

T/K	p_{NH_3}/mmHg	Mole fraction x_{NH_3}	T/K	p_{NH_3}/mmHg	Mole fraction x_{NH_3}
273.2	100	0.0149	303.2	100	0.0073
	200	0.0295		200	0.0143
	300	0.0445		300	0.0213
	400	0.0595		400	0.0285
	500	0.0742		500	0.0356
	600	0.0890		600	0.0426
	700	0.1065		700	0.0499
283.2	100	0.0113	313.2	100	0.0058
	200	0.0223		200	0.0115
	300	0.0335		300	0.0173
	400	0.0445		400	0.0227
	500	0.0555		500	0.0283
	600	0.0665		600	0.0338
	700	0.0778		700	0.0394
293.2	100	0.0087	323.2	100	0.0051
	200	0.0179		200	0.0101
	300	0.0268		300	0.0155
	400	0.0360		400	0.0206
	500	0.0449		500	0.0258
	600	0.0535		600	0.0310
	700	0.0627		700	0.0362

760 mmHg = 1 atm = 1.013×10^5 Pa.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The method and apparatus are described in refs. (1) and (2).

A known weight of ammonia was dissolved in a known weight of solvent and the resulting total pressure was measured by a manometer. Temperatures were controlled to ±0.1 °C.

SOURCE AND PURITY OF MATERIALS:

1. To specification GOST 6221-70; dried over solid KOH; purified by vacuum distillation.
2. Prepared from $SiHCl_3$ and C_2H_5OH; chromatography indicated a purity of 99.8%.

ESTIMATED ERROR:

δT/K = ±0.1

(estimated by the authors)

REFERENCES:

1. Tsiklis, D. S.; Svetlova, G. M. *Zh. Fiz. Khim.* 1958, *32*, 1476.
2. Tsiklis, D. S.; Kofman, A. N.; Shenderei, L. I. *Zh. Fiz. Khim.* 1959, *33*, 2012.

COMPONENTS: 1. Ammonia; NH_3; [7664-41-7] 2. Aliphatic chloro-compounds.	ORIGINAL MEASUREMENTS: Bell, R.P. *J. Chem. Soc.* 1931, 1371-1382.
VARIABLES:	PREPARED BY: C.L. Young.

EXPERIMENTAL VALUES:

Solvent	T/K	Partition coefficient, s^+	Mole fraction § of ammonia in liquid, x_{NH_3}
Tetrachloromethane; (Carbon tetrachloride); CCl_4; [56-23-5]	293.15	7.17	0.0281
1,2-Dichloroethane; (Ethylene chloride); $C_2H_4Cl_2$; [107-06-2]		26.6	0.0797
Trichloromethane; (Chloroform); $CHCl_3$; [67-66-3]		69.8	0.193

s^+ defined as $s = 22.4 \times \frac{293}{273} \times c$ where c is the "solubility in equivalents/litre".

§ for a partial pressure of 101.325 kPa.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE: Volumetric apparatus consisting of bulb (~50cm^3 capacity) extended at the top as a graduated tube and joined at bottom to a capillary u-tube. Liquid saturated with gas at atmospheric pressure. Gas withdrawn in a current of air, absorbed in hydrochloric acid. Excess hydrochloric acid titrated with sodium hydroxide.	SOURCE AND PURITY OF MATERIALS: 1. Obtained from cylinder, no other details given. 2. Merck and Kahlbaum samples dried over calcium chloride and fractionally distilled.
	ESTIMATED ERROR: $\delta T/K = \pm 0.1$; $\delta x_{NH_3} = \pm 1\%$. (estimated by compiler)
	REFERENCES:

COMPONENTS:

1. Ammonia; NH_3; [7664-41-7]
2. Trichloromethane,(Chloroform); $CHCl_3$; [67-66-3]

ORIGINAL MEASUREMENTS:

Seward, R.P.

J. Am. Chem. Soc. 1932, *54*, 4598-605.

VARIABLES:

Pressure

PREPARED BY:

P.G.T. Fogg.

EXPERIMENTAL VALUES:

Concentration in liquid phase mol_{NH_3}/dm^3 soln.	Concentration in vapor phase mol_{NH_3}/dm^3	p_{NH_3}/mmHg	Mole fraction in * liquid phase x_{NH_3}
1.105	0.0244	453.5	0.0841
0.851	0.0175	325.4	0.0656
0.661	0.0132	245.4	0.0515
0.423	0.00814	151.3	0.0334
0.392	0.00749	139.2	0.0310
0.246	0.00474	88.1	0.0196
0.1157	0.002215	41.2	0.00928
0.0888	0.001716	31.9	0.00713
0.0393	0.000756	14.0	0.00316

Temperature = 298.2 K 760 mmHg = 1 atm = 1.013×10^5 Pa

The density of the chloroform was given as 1.480 ± 0.002 g cm^{-3}
The density of a solution containing 1.315 mol_{NH_3} dm^3 was given as 1.450 g cm^{-3}

* The compiler has calculated densities of other solutions by assuming a linear relationship between molar concentration and density and has then calculated mole fraction concentrations.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The apparatus consisted of a lower bulb of capacity 50 cm^3 connected via a stopcock to an upper bulb of capacity of about 1 dm^3. Each bulb was fitted with another stopcock to allow filling and emptying. About 25 cm^3 of ammonia in chloroform was introduced into the lower bulb for each determination. The apparatus was placed in a thermostat and, in addition, inverted several times to allow liquid to pass back and forth from bulb to bulb. All liquid was then allowed to drain into the lower bulb and the connecting stopcock closed. The ammonia in the liquid phase in the smaller bulb and that in the gas phase in the larger bulb was estimated by titration. The pressure of ammonia was calculated from the concentration in the gas phase by assuming that the ideal gas law and Dalton's law were obeyed. Densities were measured with a pyknometer.

SOURCE AND PURITY OF MATERIALS:

2. U.S.P. standard; traces of ethanol removed by conc. H_2SO_4 or anhydrous $ZnCl_2$; washed and dried over K_2CO_3; 0.1 wt % ethanol then added to inhibit oxidation.

ESTIMATED ERROR:

REFERENCES:

COMPONENTS:

1. Ammonia; NH_3; [7664-41-7]
2. 1-Chlorooctane; $C_8H_{16}Cl$; [111-85-3]

ORIGINAL MEASUREMENTS:

Gerrard, W.; Maladkar, V.K. *Chem. Ind.* 1970, 925-926.

Maladkar, V.K. Thesis, Univ. of London, 1970

VARIABLES:

PREPARED BY:

P.G.T. Fogg

EXPERIMENTAL VALUES:

T/K	Moles $_{NH_3}$/moles $_{C_8H_{27}Cl}$ (1 atm)	Mole fraction* x_{NH_3} (1 atm.)
273.2	0.246	0.197

* Calculated by compiler.

1 atm = 1.013×10^5 Pascal

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Ammonia at barometric pressure was bubbled through a weighed quantity (about 2 g) of solvent in a glass vessel held in a thermostat until saturation was achieved. The concentration of ammonia was calculated from the increase in weight of the vessel after an allowance had been made for the weight of ammonia in the gas phase above the saturated solution. Details of the apparatus are given in ref. (1).

SOURCE AND PURITY OF MATERIALS:

1. Obtained from a cylinder; dried by KOH pellets and a cold trap.
2. Dried over $CaCl_2$; distilled under reduced pressure.

ESTIMATED ERROR:

REFERENCES:

1. Gerrard, W. *"Solubility of Gases and Liquids"*, Plenum Press, New York, 1976 p.3.

COMPONENTS:

(1) Ammonia; NH_3; [7664-41-7]

(2) Chlorobenzene; C_6H_5Cl; [108-90-7]

ORIGINAL MEASUREMENTS:

Short, I.; Sahgal, A.; Hayduk, W.

J. Chem. Eng. Data 1983,

VARIABLES:

T/K: 263.15-333.15

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] 10^4x_1
263.15	21.9	22.73	924 (924.0)[3]
298.15	10.10	9.25	409 (409.0)
333.15	5.24	4.30	200 (200.0)

[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:

$$\Delta G°/\text{J mol}^{-1} = -RT \ln x_1 = 475.60\ T \ln T - 2391.2\ T - 167.80$$

$$\ln x_1 = 204.49/T - 5.79607 \ln T + 29.1412$$

T/K	$10^{-4}\Delta G°/\text{J mol}^{-1}$	10^4x_1	T/K	$10^{-4}\Delta G°/\text{J mol}^{-1}$	$10\ x_1$
263.15	5.143	924.0	303.15	8.220	367.2
273.15	5.886	723.5	313.15	9.029	297.8
283.15	6.648	572.1	323.15	9.855	243.2
293.15	7.425	456.4	333.15	10.69	200.0
298.15	7.820	409.0			

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. Specified minimum purity 99.99 per cent.
2. Canlab. Baker Analyzed 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.* 1957, *61*, 1078.

COMPONENTS:	ORIGINAL MEASUREMENTS:
1. Ammonia; NH_3; [7664-41-7] 2. Hydrazine; N_2H_4; [302-01-2]	Chang, E.T.; Gocken, N.A. Poston, T.M.; *J. Chem. Engng. Data.* 1971, *16*, 404-8
VARIABLES: Temperature, pressure	PREPARED BY: C.L. Young

EXPERIMENTAL VALUES:

T/K	p^+/atm	p^+/kPa	Mole fraction of ammonia in liquid, x_{NH_3}
278.12	0.3857	39.08	0.0556
	0.6818	69.08	0.1003
	1.0351	104.88	0.1481
	1.9597	198.57	0.3058
298.16	0.2812	28.49	0.0218
	0.5695	54.66	0.0444
	0.8516	86.29	0.0661
	1.2207	123.69	0.0975
	1.9332	195.88	0.1553
313.22	0.3305	33.49	0.0171
	0.6661	67.49	0.0334
	1.0049	101.82	0.0501
	1.3176	133.51	0.0689
	2.1154	214.34	0.1125

+ partial pressure of ammonia.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Volumetric apparatus consisting of solvent vessel and buret with three calibrated bulbs. Pressure measured with mercury manometer and cathetometer. Solvent stirred with magnet enclosed in glass. Mole fraction absorbed calculated from knowledge of amount of gas before and after absorption. Solvent carefully degassed.

SOURCE AND PURITY OF MATERIALS:

1. Research grade gas, purity 99.99 mole per cent minimum.
2. Sample of purity 99 mole per cent further purified by double vacuum distillation.

ESTIMATED ERROR:

$\delta T/K = \pm 0.1$; $\delta p/kPa = \pm 0.01$; $\delta x_{NH_3} < \pm 2\%$.

REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
1. Ammonia; NH_3; [7664-41-7] 2. Methylhydrazine; $N_2H_3CH_3$; [60-34-4]	Chang, E.T.; Gocken, N.A. Poston, T.M. *J. Chem. Engng. Data.* 1971, *16*, 404-8
VARIABLES:	**PREPARED BY:**
Temperature, pressure	C.L. Young

EXPERIMENTAL VALUES:

T/K	p^+/atm	p^+/kPa	Mole fraction of ammonia in liquid, x_{NH_3}
253.17	0.1561	15.82	0.0786
	0.2693	27.29	0.1310
273.15	0.1825	18.49	0.0424
	0.5266	53.36	0.1157
293.15	0.3425	34.70	0.0423
	0.6206	62.88	0.0752
	1.0055	101.88	0.1190

+ partial pressure of ammonia.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Volumetric apparatus consisting of solvent vessel and buret with three calibrated bulbs. Pressure measured with mercury manometer and cathetometer. Solvent stirred with magnet enclosed in glass. Mole fraction absorbed calculated from knowledge of amount of gas before and after absorbtion. Solvent carefully degassed.

SOURCE AND PURITY OF MATERIALS:

1. Research grade gas, purity 99.99 mole per cent minimum.
2. Sample of purity 99 mole per cent, further purified by double vacuum distillation.

ESTIMATED ERROR:

$\delta T/K = \pm 0.1$; $\delta p/kPa = \pm 0.01$; $\delta x_{NH_3} < \pm 2\%$

REFERENCES:

COMPONENTS:

1. Ammonia; NH_3; [7664-41-7]
2. 1,1-Dimethylhydrazine; $N_2H_2(CH_3)_2$ [57-14-7]

ORIGINAL MEASUREMENTS:

Chang, E.T.; Gocken, N.A.; Poston, T.M.

J. Chem. Engng. Data. 1971, *16*, 404-8

VARIABLES:

Temperature, pressure

PREPARED BY:

C.L. Young

EXPERIMENTAL VALUES:

T/K	p^+/atm	p^+/kPa	Mole fraction of ammonia in liquid, x_{NH_3}
253.17	0.0752	7.62	0.0320
	0.2328	23.59	0.0973
	0.9413	95.38	0.3315
	1.5035	152.34	0.6222
273.15	0.3133	31.75	0.0650
	0.4827	48.91	0.0982
	1.1635	117.89	0.2456
	1.8406	186.50	0.3963
293.14	0.3336	33.80	0.0363
	0.7237	73.33	0.0786
	0.9594	97.21	0.1042
	1.4999	151.98	0.1662
	2.1459	217.43	0.2377

\+ partial pressure of ammonia.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Volumetric apparatus consisting of solvent vessel and buret with three calibrated bulbs. Pressure measured with mercury manometer and cathetometer. Solvent stirred with magnet enclosed in glass. Mole fraction absorbed calculated from knowledge of amount of gas before and after absorption. Solvent carefully degassed.

SOURCE AND PURITY OF MATERIALS:

1. Research grade gas, purity 99.99 mole per cent minimum.
2. Sample of purity 99 mole per cent further purified by vacuum distillation.

ESTIMATED ERROR:

$\delta T/K = \pm 0.1$; $\delta p/kPa = \pm 0.01$; $\delta x_{NH_3} < \pm 2\%$.

REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
1. Ammonia; NH_3; [7664-41-7] 2. Benzenamine (aniline); C_6H_7N; [62-53-3]	Stoica, T.; Bota, T. D.; Teusdea, G. M.; Sarbu, L.; Herscovici, J. *Rev. Chim. (Bucharest)* 1981 *32*, 1018-1019.
VARIABLES:	PREPARED BY:
Temperature	P. G. T. Fogg

EXPERIMENTAL VALUES:

T/K	Bunsen coefficient# β	Mole fraction*, x_{NH_3}
298.2	33.34	0.1198
323.2	17.29	0.0672
343.2	10.04	0.0409
368.2	4.60	0.0196
393.2	1.59	0.0070
423.2	1.07	0.0049

Volume of NH_3 (corrected to 273.2K and 1 atm) dissolved by one volume of C_6H_7N when the total pressure is 1 atm. (Incorrectly stated by the authors to be the Bunsen α coefficient.)

* Calculated by the compiler using densities of benzenamine given in ref. 1. Values correspond to a total pressure equal to barometric (unspecified).

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Benzenamine was saturated with ammonia at a total pressure equal to barometric pressure (unspecified) by bubbling the gas through a known volume of liquid. The dissolved ammonia was then removed from the solution by a stream of air which, in turn, passed through a known volume of standard sulfuric acid. The ammonia was then estimated by back titration. The authors do not seem to have made any allowance for the vapor pressure of the benzenamine.

SOURCE AND PURITY OF MATERIALS:

No details given.

ESTIMATED ERROR:

REFERENCES:

1. Timmermans, J. *Physico-Chemical Constants of Pure Organic Compounds*, Vol. 2, Elsevier, New York, 1965.

COMPONENTS:

1. Ammonia; NH_3; [7664-41-7]
2. Amines and quinoline

ORIGINAL MEASUREMENTS:

Kuznetsov, A. I.; Panchenkov, G. M.; Gogoleva, T. V.

Zh. Fiz. Khim. 1968, *42*, 982-3

(*Russ. J. Phys. Chem.* 1968, *42*, 510-11).

VARIABLES:

PREPARED BY:

P. G. T. Fogg

EXPERIMENTAL VALUES:

Solvent	T/K	p_{NH_3}/mmHg	Mole ratio $mol_{NH_3}/mol_{solv.}$	Mole fraction* x_{NH_3}
Benzenamine (aniline); C_6H_7N; [62-53-3]	291.2	760	0.15	0.13
2-Aminoethanol; C_2H_7NO; [141-43-5]	290.2	760	0.23	0.19
N,*N*-Diethylethanamine (triethylamine); $C_6H_{15}N$; [121-44-8]	294.2	760	0.09	0.08
Quinoline; C_9H_7N; [91-22-5]	291.2	760	0.06	0.06

The authors stated that the total pressure was varied from about 100 mmHg to about 800 mmHg but only solubilities at p_{NH_3} = 760 mmHg were reported.

The authors also stated that Henry's law in the form:

$$mol_{NH_3}/mol_{solvent} = p_{NH_3} \times \text{constant}$$

was "satisfactorily" obeyed.

*Calculated by the compiler. 760 mmHg = 1 atm = 1.013×10^5 Pa.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Conventional gas handling apparatus attached to a vacuum line was used. A measured volume of solvent was admitted to the absorption vessel which was fitted with a magnetic stirrer. Portions of ammonia at a measured volume and pressure were then admitted to the absorption vessel and equilibrium pressures in this vessel were measured by a mercury manometer. Allowance was made for the vapor pressure of the solvent but the method of making the allowance was not stated.

SOURCE AND PURITY OF MATERIALS:

1. Obtained from a commercial cylinder.

2. "Pure" grade.

ESTIMATED ERROR:

$\delta T/K = \pm 0.5$; $\delta p/mmHg = \pm 0.5$

(estimated by the authors).

REFERENCES:

COMPONENTS:

1. Ammonia; NH_3; [7664-41-7]
2. Hexanedinitrile (adiponitrile); $C_6H_8N_2$; [111-69-3]

ORIGINAL MEASUREMENTS:

Freidson, G. S.; Furmer, I. E.; Amelin, A. G.

1974, VINITI deposited document 1543-74.

VARIABLES:

Temperature, pressure

PREPARED BY:

P. G. T. Fogg

EXPERIMENTAL VALUES:

T/K	p_{NH_3}/ mmHg*	Volume of gas, corrected to 273.2 K and 760 mmHg, dissolved by one volume of solvent.*	Mole fraction# x_{NH_3}
283.2	67	3.7	0.018
	129	6.6	0.032
	287	14.7	0.068
	421	22.6	0.101
	530	28.2	0.123
	691	36.3	0.153
	719	38.2	0.160
298.2	127	4.3	0.021
	224	7.6	0.037
	335	10.9	0.052
	465	15.4	0.071
	519	17.5	0.080
	592	19.8	0.090
	651	21.8	0.098
	712	24.2	0.108

(cont.)

* Values taken, by the compiler, from a graph showing experimental points which was given by the authors.

\# Calculated by the compiler using the density of the solvent at 20°C given in ref. 1. No allowance was made for change of density with temperature.

AUXILIARY INFORMATION

METHOD APPARATUS/PROCEDURE:

A quantity of ammonia, measured by changes in pressure of a known volume, was allowed into contact with a known volume of solvent in a thermostatted absorption vessel. The liquid in this vessel was nagnetically stirred and the final pressure of gas in contact with solution was measured (refs. 2-4). The authors gave the results in graphical form with volume of gas (corrected to 273.2 K and 1 atm) absorbed by one volume of solvent plotted as a function of gas pressure. One graph corresponded to pressures below 1 atm. In this case experimental points lay close to straight lines. Henry's law constants, based on these measurements below 1 atm, were given by the authors. A second graph corresponded to higher pressures. There was not a linear variation of corrected volume of gas absorbed with variation of pressure at these higher pressures.

SOURCE AND PURITY OF MATERIALS:

No information given.

REFERENCES:

1. *Handbook of Chemistry and Physics* (63rd edition), C.R.C. Press, Cleveland, Ohio, 1982.
2. Shenderei, E.R.; Zel'venskii, Ya. D.; Ivanovskii, F.P. *Khim. Prom.* 1960, 370.
3. Braude, G. E.; Shakhova, S. F. *Khim. Prom.* 1961, 177.
4. Braude, G. E.; Leites, I. L.; Dedova, I. V. *Khim. Prom.* 1961, 232.

COMPONENTS:	ORIGINAL MEASUREMENTS:
1. Ammonia; NH_3; [7664-41-7] 2. Hexanedinitrile (adiponitrile); $C_6H_8N_2$; [111-69-3]	Freidson, G. S.; Furmer, I. E.; Amelin, A. G. <u>1974</u>, VINITI deposited document 1543-74.

EXPERIMENTAL VALUES:

T/K	p_{NH_3}/ mmHg*	Volume of gas, corrected to 273.2 K and 760 mmHg, dissolved by one volume of solvent.*	Mole fraction# x_{NH_3}
313.2	113	2.7	0.013
	202	4.6	0.022
	329	7.2	0.035
	401	9.1	0.043
	506	11.5	0.054
	674	15.5	0.072
	715	16.3	0.075
328.2	156	2.5	0.012
	300	4.4	0.021
	422	6.3	0.030
	495	7.6	0.037
	588	8.6	0.041
	690	10.5	0.050
	714	10.8	0.051
343.2	153	1.9	0.009
	241	3.0	0.015
	343	3.9	0.019
	420	4.9	0.024
	515	6.4	0.031
	577	6.9	0.033
	665	8.5	0.041
	712	8.9	0.043

* Values taken, by the compiler, from a graph showing experimental points which was given by the authors.

\# Calculated by the compiler.

T/K	Henry's constant** /mmHg
283.2	4480
298.2	6720
313.2	9610
328.2	14080

** Henry's constant = p_{NH_3}/x_{NH_3}.

These values of the Henry's law constant are based upon measurements at pressures up to 1 atm and should not be used for calculating solubilities at higher pressures. The authors gave the following equation for the Henry's law constant, K_H.

$$\log_{10}(K_H/\text{mmHg}) = 7.19 - (1008/T).$$

However, the compiler considers that the values are better fitted by the following equation:

$$\log_{10}(K_H/\text{mmHg}) = 7.26 - (1023/T).$$

(cont.)

COMPONENTS:

1. Ammonia; NH_3; [7664-41-7]
2. Hexanedinitrile (adiponitrile); $C_6H_8N_2$; [111-69-3]

ORIGINAL MEASUREMENTS:

Freidson, G. S.; Furmer, I. E.; Amelin, A. G.

1974, VINITI deposited document 1543-74.

EXPERIMENTAL VALUES:

T/K	p_{NH_3}/atm *	Volume of gas, corrected to 273.2 K and 760 mmHg, dissolved by one volume of solvent.*	Mole fraction# x_{NH_3}
283.2	2.57	125	0.38
	3.13	176	0.47
	3.57	245	0.55
	4.21	359	0.64
	4.63	522	0.72
	5.62	1152	0.85
298.2	3.24	101	0.34
	6.18	359	0.64
	6.79	429	0.68
	6.98	502	0.71
	7.35	587	0.75
	8.00	891	0.82
	8.39	1064	0.84
313.2	2.16	37	0.16
	4.58	108	0.35
	5.88	157	0.44
	7.13	230	0.53
	7.46	243	0.55
	7.78	274	0.58
	8.26	305	0.60
	9.06	370	0.65
	10.37	629	0.76
	11.54	1004	0.83
328.2	3.46	43	0.18
	4.88	67	0.25
	5.84	89	0.31
	7.11	115	0.36
	9.08	211	0.51
	10.24	258	0.56
	11.43	341	0.63
	11.89	377	0.65
	12.97	499	0.71
	14.14	712	0.78
	15.67	1173	0.85

* Values taken, by the compiler, from a graph showing experimental points which was given by the authors.

\# Calculated by the compiler.

760 mmHg = 1 atm = 1.013×10^5 Pa.

COMPONENTS:

(1) Ammonia; NH_3; [7664-41-7]

(2) Tetramethylsilane; $C_4H_{12}Si$; [75-76-3]

ORIGINAL MEASUREMENTS:

Horsman-van den Dool, L. E. W.; Warman, J. W.

Interuniversity Reactor Institute (IRI)-Report 134-81-01

VARIABLES:

$T/K = 292.9$

p_1/kPa not given

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

Temperature		Ostwald Coefficient	Number of Runs
$t/{}^\circ C$	T/K	$L/cm^3\ cm^{-3}$	
19.7	292.9	5.73	1

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

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

The chromatograph is a Hewlett-Packard model 5750 equiped with a thermal conductivity cell detector. The carrier gas is helium. A 90 cm column packed with Porapak Q coated with 10 % polyethyleneimine is used for the separation.

SOURCE AND PURITY OF MATERIALS:

(1) Ammonia. Baker Chemical Co. Anhydrous, 99.99 percent. Used as received.

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

ESTIMATED ERROR:

$\delta L/L = \pm 0.05$

REFERENCES:

COMPONENTS:	EVALUATOR:
1. Methanamine (methylamine); CH_5N; [74-89-5] *N*-Methylmethanamine (dimethylamine); C_2H_7N; [124-40-3] *N,N*-Dimethylmethanamine (trimethylamine); C_3H_9N; [75-50-3] 2. Organic liquids	P. G. T. Fogg, School of Chemistry, Polytechnic of North London, Holloway, London, U.K. August 1983

CRITICAL EVALUATION:

The solubility of amines in organic liquids has been reviewed and assessed by Gerrard (1) and by Counsell, Ellender and Hicks (2). In the case of many systems only one series of measurements has been carried out and therefore the reliability of the data must then be judged by testing whether a particular set fits into a general pattern shown for closely related systems.

Methanamine

Mole fraction solubilities of methanamine show a similar pattern to those of ammonia in that values are higher when the solvent contains oxygen or nitrogen as compared with values for hydrocarbons.

Hydrocarbon solvents

Solubilities in hydrocarbons have been measured by Gerrard (1) and by Wolff *et al.* (3-6). Very detailed investigation of the systems with butane, hexane and nonane were made by Wolff and co-workers. The measurements on the system with butane (4) extended to temperatures above the boiling point of pure butane at 1 atm. Mole fraction solubilities at a partial pressure of 1 atm for these three hydrocarbons, calculated from measurements by Wolff *et al.*, show an appreciable decrease with increase in chain length at 273 K but insignificant change at 283 K and 293 K. However the mole fraction solubility in decane at 273 K and 1 atm partial pressure, as determined by Gerrard, is 0.413 compared with the value of 0.353 for nonane at this temperature and partial pressure, as determined by Wolff *et al.*

The solubility in benzene was measured by Gerrard (1) at 283 K and 1 atm partial pressure. The mole fraction solubility is about double that in n-alkanes under similar conditions but is smaller than the value corresponding to a reference line based upon the equation

$$x_1 = p_1 / p_1^{\circ}$$

where p_1 is the partial pressure of methanamine and p_1° is the vapor pressure of liquified methanamine at the temperature of measurement. Measurements by Gerrard indicate that substitution of methyl groups into benzene lowers the mole fraction solubility of methanamine. Ammonia shows a similar pattern of solubility behaviour in benzene and substituted benzenes and there is no reason to doubt the values reported by Gerrard.

Solvents containing oxygen

The solubilities of methanamine in numerous solvents containing oxygen have been reported by Gerrard (1) and may be accepted as tentative values. Mole fraction solubilities in alcohols are above the reference line values and higher than those in other solvents containing oxygen. Gerrard's measurements of the solubilities in 1,2-ethanediol and 1,2,3-propanetriol at 283 K indicate that mole fraction solubility increases with increase in the number of hydroxyl groups as is the case with ammonia. Measurements at 305 K and a partial pressure of methanamine of 1223 mmHg were made by Copley *et al.* (7) on 1,2-ethanediol, 2,2'-oxybisethanol and 1,2,3-propanetriol . In this case the reported mole fraction solubility in 1,2-ethanediol is greater than that in 1,2,3-propanetriol but these values may be less reliable than the values reported by Gerrard because of the nature of the apparatus used.

Cont.

COMPONENTS:	EVALUATOR:
1. Methanamine (methylamine); CH_5N; [74-89-5] *N*-Methylmethanamine (dimethylamine); C_2H_7N; [124-40-3] *N*,*N*-Dimethylmethanamine (trimethylamine); C_3H_9N; [75-50-3] 2. Organic liquids	P. G. T. Fogg, School of Chemistry, Polytechnic of North London, Holloway, London, U.K. August 1983

CRITICAL EVALUATION:

Solvents containing oxygen (cont.)

Values published by Gerrard (1) of the mole fraction solubilities in 1,1′-oxybispentane, 1,1′-oxybisoctane, ethoxybenzene and 1,4-dioxane fall below reference line values, i.e. show positive deviations from Raoult's law, but are greater than values for hydrocarbons, as expected by analogy with ammonia. There is a marked variation in the mole fraction solubility in 1,1′-oxybisoctane with change in temperature. At a partial pressure of methanamine of 1 atm the mole fraction solubility is 0.604 at 273 K and 0.388 at 283 K. The mole fraction solubility at a partial pressure of methanamine of 1 atm in *N*,*N*-dimethylformamide, also reported by Gerrard, shows a similar marked variation so there is no reason to question the values.

Solvents containing nitrogen

The solubilities of methanamine in a wide range of solvents containing nitrogen have been investigated by Gerrard (1). The methanamine and *N*,*N*-dimethylmethanamine system has also been studied by Wolff and Würtz (6) over the whole of the concentration range at temperatures from 223 K to 293 K. There are no obvious inconsistencies in any of these measurements which should be accepted as tentative.

Measurements by Gerrard on benzenamine and *N*-substituted benzenamines give an interesting series of mole fraction solubilities at 283 K with the values in the order: benzenamine > *N*-methyl- > *N*-ethyl- > *N*,*N*-dimethyl- > *N*,*N*-diethyl-. He also found that the mole fraction solubility in quinoline and pyridine at 283 K and a partial pressure of 1 atm were greater than the value of the solubility in benzene under the same conditions. This is to be expected since other workers (see ammonia evaluation p.3) have found that the mole fraction solubility of ammonia in quinoline is greater than that in benzene at 291 K.

Solvents containing halogens

The equilibrium between methanamine and tetrachloromethane at 253 K, 273 K, and 293 K and the full composition range has been investigated by Wolff and Würtz (4). The mole fraction solubility of methanamine at 283 K and a total pressure of 1 atm was measured by Gerrard (1). The evaluator has estimated that this value agrees to about 1% with a corresponding value interpolated from the measurements reported by Wolff and Würtz. Unlike ammonia, methanamine has greater mole fraction solubility in tetrachloromethane than in hydrocarbons, at the same temperature and partial pressure.

Gerrard also measured mole fraction solubilities in trichloromethane at 273 K and 283 K. Values are similar to ones reported by the same author for dissolution in long chain alcohols.

Gerrard (1) measured solubilities in benzene and bromobenzene and found that introduction of a bromine atom into the benzene nucleus increases the mole fraction solubility of methanamine at 283 K. Ammonia shows a similar behaviour in benzene and chlorobenzene but the reported mole fraction solubility of ammonia in bromobenzene (9) is slightly less than that in benzene (10). Gerrard also found that the mole fraction solubilities in 1-methyl-3-bromobenzene were lower than those in bromobenzene at 283 K but close to those in 1-bromo-naphthalene. Again ammonia shows analogous behaviour in benzene and toluene. (See ammonia evaluation p.10 .) There is therefore no reason to doubt Gerrard's measurements.

Cont.

COMPONENTS:	EVALUATOR:
1. Methanamine (methylamine); CH_5N; [74-89-5] *N*-Methylmethanamine (dimethylamine); C_2H_7N; [124-40-3] *N*,*N*-Dimethylmethanamine (trimethylamine); C_3H_9N; [75-50-3] 2. Organic liquids	P. G. T. Fogg, School of Chemistry, Polytechnic of North London, Holloway, London, U.K. August 1983

CRITICAL EVALUATION:

N-Methylmethanamine

N-Methylmethanamine has a higher boiling point than methanamine and has therefore the greater tendency to condense. Relative mole fraction solubilities in different organic solvents are similar for the two gases.

Hydrocarbon solvents

As is the case with ammonia and methanamine, the mole fraction solubility is lower in hydrocarbons than in alcohols.

The *N*-methylmethanamine and hexane system has been studied over the whole of the concentration range at temperatures from 223 K to 293 K by Wolff *et al.*(10,11). Gerrard (1) measured the mole fraction solubility in decane at various partial pressures and temperatures from 283 K to 298 K. The evaluator has calculated that Wolff's data indicate a mole fraction solubility of 0.473 at 293 K and a partial pressure of 1 atm when the solvent is hexane. This is close to the value of 0.501 given by Gerrard for the mole fraction solubility in decane under the same conditions of temperature and pressure.

Gerrard (1) has also measured the solubility in benzene and methyl benzenes. As expected by analogy with the behaviour of ammonia and methanamine, the mole fraction solubility is greater in benzene than in alkanes. However he did not observe the regular change in mole fraction solubilities of *N*-methylmethanamine with increase in number of methyl groups substituted into the benzene nucleus which he had observed for methanamine.

Solvents containing oxygen

Mole fraction solubilities in methanol, ethanol and 1-propanol have been measured by Niepel *et al.* (12) and in 1-butanol and 1-octanol by Gerrard (1). Mole fraction solubilities tend to increase with increase in chain length but the solubility in methanol is greater than that in ethanol. Ammonia shows a similar pattern of behaviour with anomalous solubility in methanol and there is no reason to reject the values for *N*-methylmethanamine. Gerrard measured the mole fraction solubilities in 1,2-ethanediol and 1,2,3-propanetriol at 283 K. As with ammonia, increase in number of hydroxyl groups increases the mole fraction solubility. The solubility in 1,2,3-propanetriol was also measured by Copley *et al.* (7) but direct comparison with Gerrard's values is not possible because the temperature of measurement was 305 K.

Gerrard measured the mole fraction solubilities in three ethers and in dioxane at 293 K. As expected by analogy with ammonia and methanamine, solubilities are higher than in the two alkanes which have been studied but lower than in alcohols. Gerrard showed that the mole fraction solubility in ethoxybenzene is higher than the solubility in benzene. Methanamine behaves in a similar way in these two solvents so the measurements fall into a consistent pattern. Gerrard's measurements indicate that the mole fraction solubilities at 293 K in 1-phenylethanone and in ethyl benzoate are similar to solubilities in the ethers which were studied. However the mole fraction solubility in 1-phenyl benzoate is slightly less than the solubility in methylbenzene under the same conditions. This differs from the pattern reported for methanamine.

Cont.

COMPONENTS:

1. Methanamine (methylamine); CH_5N; [74-89-5]
   N-Methylmethanamine (dimethylamine); C_2H_7N; [124-40-3]
   N,*N*-Dimethylmethanamine (trimethylamine); C_3H_9N; [75-50-3]
2. Organic liquids

EVALUATOR:

P. G. T. Fogg,
School of Chemistry,
Polytechnic of North London,
Holloway,
London, U.K.

August 1983

CRITICAL EVALUATION:

Solvents containing nitrogen

The solubilities of *N*-methylmethanamine in a wide range of organic solvents containing nitrogen have been measured by Gerrard (1). There is no reason to doubt their reliability as values appear to fall into a consistent pattern but there are no measurements by other workers for direct comparison. Measurements on benzenamine and *N*-substituted benzenamines lead to a series of mole fraction solubilities at 293 K and 1 atm which is similar to the order of solubilities of methanamine at 283 K. Values are in the order: benzenamine > *N*-methyl- > *N*-ethyl- > *N*,*N*-diethyl- > *N*,*N*-dimethyl-. The two last mentioned compounds are in the reverse order in the case of the solubilities of methanamine. As in the case of methanamine however, the mole fraction solubility in benzylamine is less than the solubility in benzenamine. The mole fraction solubility in pyridine was found to be higher than that in quinoline at 293 K. Gerrard found that methanamine behaved in the same way at 283 K.

Solvents containing halogens

The *N*-methylmethanamine and tetrachloromethane system was studied by Wolff and Höppel (10) at 253 K to 293 K over the whole of the concentration range. Gerrard measured the mole fraction solubility of *N*-methylmethanamine in tetrachloromethane and in several other halogenated solvents at 293 K (1).

Gerrard reported that the mole fraction solubility in tetrachloromethane at a total pressure of 1 atm and 293 K was 0.596. The evaluator has estimated that this corresponds to a mole fraction solubility of 0.624 at a partial pressure of *N*-methylamine of 1 atm. This is close to the value of 0.604 which the evaluator has calculated from measurements reported by Wolff and Höppel. The mole fraction solubility in this solvent is higher than that in hydrocarbons but lower than that in alcohols under the same conditions. The behaviour of methanamine is similar.

Gerrard also found that the mole fraction solubility in trichloromethane was higher than that in tetrachloromethane at 293 K and a total pressure of 1 atm. This is again similar to the behaviour of methanamine at 283 K.

The mole fraction solubility of *N*-methymethanamine in chloro-, bromo- and iodobenzene (1) was found to be higher than the solubility in benzene at 293 K at a total pressure of 1 atm just as the solubility of methanamine in chlorobenzene was found to be higher than that in benzene.

N,*N*-Dimethylmethanamine

N,*N*-dimethylmethanamine has a boiling point, and hence a tendency to condense, in between that of methanamine and that of *N*-methylmethanamine. However replacement of all three hydrogen atoms in ammonia by methyl groups causes significant differences in behaviour from that of the primary or secondary amine.

Hydrocarbon solvents

Solubilities in hydrocarbons have been measured by Gerrard (1), by Halban (13) and by Wheeler and Levy (14). Wolff and Würtz (5) have investigated the *N*,*N*-dimethylmethanamine and hexane system at 223 K to 293 K over the whole of the concentration range. The evaluator has calculated from data given by Wolff and Würtz that the mole fraction solubility in hexane is 0.024 at 298 K and a partial pressure of *N*,*N*-dimethylmethanamine of 42 mmHg. The value given by Halban for the mole fraction solubility under these conditions is 0.022. Although the Halban value is likely to be the less accurate it gives support to the work by Wolff and Würtz.

. Cont.

COMPONENTS:	EVALUATOR:
1. Methanamine (methylamine); CH_5N; [74-89-5] *N*-Methylmethanamine (dimethylamine); C_2H_7N; [124-40-3] *N*,*N*-Dimethylmethanamine (trimethylamine); C_3H_9N; [75-50-3] 2. Organic liquids	P. G. T. Fogg, School of Chemistry, Polytechnic of North London, Holloway, London, U.K. August 1983

CRITICAL EVALUATION:

Hydrocarbon solvents (cont.)

Direct comparison cannot be made between solubilities in benzene measured by Gerrard and those measured by Halban because they were made at different temperatures. However in each case the mole fraction solubility is less than the mole fraction solubility in hexane under the same conditions as may be calculated from the data given by Wolff. This contrasts with the behaviour of ammonia, methanamine and of *N*-methylmethanamine which have greater mole fraction solubilities in benzene than in alkanes at temperatures between 273 K and 293 K.

Wheeler and Levy (14) apparently calculated the Henry's law constant for heptane at 233 K from a linear variation of mole fraction solubility with variation of pressure to about 70 mmHg. In the same way the Henry's law constant for 273 K was calculated from a linear variation of mole fraction solubility to about 140 mmHg. The evaluator has calculated that the corresponding mole fraction solubility at 233 K and 70 mmHg is 0.473 and that at 273 K and 140 mmHg is 0.162. These may be compared with values for hexane which the evaluator has calculated from data provided by Wolff and Würtz. At 233 K and 70 mmHg the mole fraction solubility in hexane is 0.653 and at 273 K and 140 mmHg the value is 0.189 . The study carried out by Wolff and Würtz covers the whole of the concentration range and, in the opinion of the evaluator, is more reliable than that carried out by Wheeler and Levy. In the light of the comparison of apparent solubilities in hexane and heptane the values for heptane should be used with caution.

Gerrard (1) measured the mole fraction solubilities in decane at 283 K. The value which was reported for a pressure of 1 atm is 0.786. This value compares favourably with the value of 0.771 for mole fraction solubility in hexane under the same conditions, which the evaluator has calculated from data given by Wolff and Würtz.

Solvents containing oxygen

The solubility in a number of alcohols has been measured by Gerrard (1) at pressures to 1 atm and by Halban (13) at low pressures. There is no reason to question the general pattern of solubilities.

Benzenemethanol is the only alcohol studied by both workers. For this solvent the evaluator has plotted Gerrard's values of mole fraction solubilities against pressure for 298 K and pressures from 100 mmHg to 760 mmHg. (Fig. 1) On the same graph he has plotted values calculated from data given by Halban for the same temperature but for pressures from 1 mmHg to 25 mmHg. All experimental points may be joined by a smooth curve passing through the origin indicating that there is no inconsistency between the two sets of measurements for this solvent. A linear extrapolation of Halban's solubility data to give solubilities for a pressure of 1 atm is clearly not justified in the case of this solvent and is likely to lead to errors in the case of other solvents studied by Halban. This has been discussed in more detail by Gerrard (1).

Mole fraction solubilities in straight chain aliphatic alcohols show a small increase with increase in chain length, although Halban's measurements indicate that mole fraction solubilities in methanol are greater than those in ethanol at 298 K and pressures less than 10 mmHg. No measurements of solubilities in these two solvents have been made at higher pressures. The solubilities of ammonia, methanamine and *N*-methylmethanamine in alcohols show a similar pattern of behaviour.

Cont.

COMPONENTS:	EVALUATOR:
1. Methanamine (methylamine); CH_5N; [74-89-5] *N*-Methylmethanamine (dimethylamine); C_2H_7N; [124-40-3] *N*,*N*-Dimethylmethanamine (trimethylamine); C_3H_9N; [75-50-3] 2. Organic liquids	P. G. T. Fogg, School of Chemistry, Polytechnic of North London, Holloway, London, U.K. August, 1983

CRITICAL EVALUATION:

Solvents containing oxygen (cont.)

Gerrard found that the mole fraction solubilities in 1,2-ethanediol and in 1,2,3-propanetriol at 283 K and 298 K were less than in the aliphatic monohydric alcohols which he had studied. This is in contrast to the behaviour of ammonia, methanamine and *N*-methylmethanamine. Gerrard attributed this difference to a greatly reduced tendency to form hydrogen bonds with the solvent when all the hydrogen atoms in ammonia are replaced by methyl groups.

He also found that the mole fraction solubilities in 2,2,2-trichloroethanol were greater than in other alcohols. This is similar to the behaviour found for ammonia, methanamine and *N*-methylmethanamine.

Gerrard (1) measured the mole fraction solubilities in three ethers. There is no reason to doubt the reliability of these measurements. Solubilities in ethoxybenzene were measured at 283 K and at pressures from 100 mmHg to 760 mmHg. Values are close to those obtained for methylbenzene at the same temperature. Solubilities in 1,1′-oxybisoctane were measured at 293 K and 298 K and pressures from 100 mmHg to 760 mmHg. Mole fraction solubilities are close to values for 1-octanol. Extrapolation of mole fraction solubilities to 283 K gives values which are close to those for decane indicating that the presence of the ether linkage may have little influence on the solubility.

Halban measured the solubility in 1,1′-oxybisethane at 298 K and pressures to 47 mmHg. Extrapolation of these values to 760 mmHg is unreliable because such systems deviate markedly from Henry's law and reliable comparison cannot be made with systems studied at higher pressures.

Gerrard (1) also measured the mole fraction solubility in 1,4-dioxane at 283 K and a total pressure of 1 atm.

The solubilities in ethyl benzoate were measured by Gerrard (1) at 293 K and 298 K and pressures from 100 mmHg to 760 mmHg. Halban (13) made measurements on this compound at 298 K and pressures of 38 mmHg and 39 mmHg. Extrapolation of Gerrard's mole fraction solubilities at 298 K to the pressures at which Halban worked leads to solubilities which are about 10% lower than Halban's values. Halban also measured solubilities in ethyl acetate at 298 K and pressures to 59 mmHg but again extrapolation of these measurements to 760 mmHg would be unreliable. Comparisons may be made, however, with solubilities in other solvents at low pressures which have been measured by Halban or found by extrapolation of Gerrard's data. (See below.)

Gerrard measured the solubility in 1-phenylethanone at 298 K and pressures from 100 mmHg to 760 mmHg. Extrapolation of these results to 40 mmHg give values which again differ by about 10% from mole fraction solubilities calculated from data given by Halban (see below). There is no reason to doubt, however, the general pattern of solubilities of *N*,*N*-dimethylmethanamine in solvents containing oxygen which has been presented by Gerrard.

Estimated mole fraction solubilities 298K; 40 mmHg

ethyl acetate	0.017
ethyl benzoate	0.023 (Halban), 0.020 (Gerrard)
1,1′-bisoxyethane	0.012
2-propanone	0.012
1-phenylethanone	0.014 (Halban), 0.016 (Gerrard)

Cont.

COMPONENTS:	EVALUATOR:
1. Methanamine (methylamine); CH_5N; [74-89-5] *N*-Methylmethanamine (dimethylamine); C_2H_7N; [124-40-3] *N*,*N*-Dimethylmethanamine (trimethylamine); C_3H_9N; [75-50-3] 2. Organic liquids	P. G. T. Fogg, School of Chemistry, Polytechnic of North London, Holloway, London, U.K. August, 1983

CRITICAL EVALUATION:

Solvents containing nitrogen

Gerrard (1) measured the solubilities in benzeneamine and several *N*-substituted benzeneamines. The measurements show that substitution of the first hydrogen atom has little effect on the mole fraction solubilities but substitution of the second hydrogen atom causes a decrease in solubilities. The solubility in 1-octamine was also reported to be close to that in benzeneamine. That in benzenemethanamine was reported to be less than those in benzeneamine. The mole fraction solubilities, at 283 K, in pyridine and in quinoline were less than in benzeneamine at the same pressure, with solubilities in pyridine greater than those in quinoline. Methanamine and *N*-methylmethanamine were reported to behave in a similar way in these two solvents. There is no reason to doubt the reliability of any of the solubility data for nitrogen bases reported by Gerrard.

Gerrard also measured mole fraction solubilities in nitrobenzene at 283 K and 298 K and in 1-methyl-2-nitrobenzene at 278 K to 298 K and pressures from 100 mmHg to 760 mmHg. There was little difference in solubilities in the two solvents when conditions were the same. Halban (13) also made measurements of solubilities in these two solvents at 298 K and lower pressures. Mole fraction solubilities from Halban's data, (H), are lower than values obtained by extrapolation of Gerrard's measurements (G).

i.e.

nitrobenzene;	63 mmHg;	x_1 = 0.018 (H), 0.020 (G)
	82 mmHg;	x_1 = 0.024 (H), 0.026 (G)
	94 mmHg;	x_1 = 0.027 (H), 0.030 (G)
1-methyl-2-nitrobenzene;	87 mmHg;	x_1 = 0.029 (H), 0.035 (G)
	85 mmHg;	x_1 = 0.029 (H), 0.034 (G)

Halban also measured solubilities in nitromethane at 298 K and pressures to 56 mmHg. The mole fraction solubilities are low compared with values for aromatic nitro compounds.

Gerrard (1) measured the solubility in benzonitrile at 283 K and pressures from 100 mmHg to 760 mmHg. Mole fraction solubilities are less than reference values based upon the equation:

$$x_1 = p_1/p_1^0$$

Halban measured solubilities in acetonitrile at 298 K and pressures to 47 mmHg. Mole fraction solubilities based upon these data are also less than the reference line values but the difference is even more marked than in the case of benzonitrile. This is in line with the observed difference between the behaviour of nitromethane and aromatic nitro compounds.

Solubilities in *N*,*N*-dimethylformamide at 278 K, 283 K and 298 K and pressures from 100 mmHg to 760 mmHg were measured by Gerrard (1). Solubilities were found to be very low in this solvent compared with the reference line and with other solvents which were studied. The solubilities in water are also low and, in both cases, there may be little tendency for the gas to break up the hydrogen bonded structure of the solvent. As mentioned above, a similar explanation has been put forward for the relatively low solubility in 1,2-ethanediol and in 1,2,3-propanetriol. The values reported for *N*,*N*-dimethylformamide are therefore in accord with those for other solvents and are likely to be reliable.

Cont.

COMPONENTS:	EVALUATOR:
1. Methanamine (methylamine); CH_5N; [74-89-5] *N*-Methylmethanamine (dimethylamine); C_2H_7N; [124-40-3] *N,N*-Dimethylmethanamine (trimethylamine); C_3H_9N; [75-50-3] 2. Organic liquids	P. G. T. Fogg, School of Chemistry, Polytechnic of North London, Holloway, London, U.K. August 1983

CRITICAL EVALUATION:

Solvents containing halogens

The *N,N*- dimethylmethanamine and tetrachloromethane system has been studied at 253 K, 273 K and 293 K over the whole of the concentration range. This work (5), and other studies of amine systems carried out by Wolff *et al.*, seems to the evaluator to be of very high standard. Solubilities in several other solvents containing halogens have been measured by Gerrard (1) and by Halban (13).

Gerrard found that the mole fraction solubility in trichloromethane at 298 K and a total pressure of 1 atm was 0.554. The evaluator has estimated that this corresponds to a mole fraction solubility of 0.62 at a partial pressure of *N,N*-dimethylmethanamine of 1 atm. This may be compared with the reference line or Raoult's law value of 0.464 and the value for tetrachloromethane, under the same conditions, of 0.52 which the evaluator has estimated by extrapolation of mole fraction solubilities calculated from data given by Wolff and Würtz. A similar difference in solubilities of *N*-methylmethanamine in the two solvents has been reported and therefore these values for *N,N*-dimethylmethanamine fit into a general pattern of behaviour.

Halban also measured the solubility in trichloromethane at 298 K but at partial pressures from 5 mmHg to 9 mmHg. Direct comparison with Gerrard's value is not possible but solubilities measured by the two workers are not inconsistent with the marked curvature of plots of mole fraction solubilities against partial pressure of amine which has been observed for other solvents such as benzenemethanol. Gerrard measured solubilities in chlorobenzene, iodobenzene and 1-bromo-3-methylbenzene at 283 K and pressures from 100 mmHg to 760 mmHg. In all cases values were close to those given by the equation:

$$x_1 = p_1 / p_1^{\circ}$$

Gerrard also measured solubilities in 1-chloronaphthalene and in 1-bromonaphthalene at 298 K and pressures from 100 mmHg to 760 mmHg. Mole fraction solubilities were less than reference values based upon the above equation and there was little difference between values for the two solvents. Halban also measured solubilities in 1-bromonaphthalene at 298 K at pressures from 48 mmHg to 84 mmHg. Mole fraction solubilities calculated by the compiler from Halban's data, (H), are not consistent with mole fraction solubilities found by extrapolation of Gerrard's values to lower pressures, (G). i.e.

Mole fraction solubility in 1-bromonaphthalene at 298 K

48 mmHg	0.017 (H);	0.024 (G)
60 mmHg	0.020 (H);	0.030 (G)
84 mmHg	0.027 (H);	0.042 (G)

cont.

General pattern of the solubilities of ammonia, methanamine, *N*-methylmethanamine and *N*,*N*-dimethylmethanamine

Mole fraction solubilities may be fitted to equations of the form:

$$-RT \ln x_1 = a + bT$$

with a wide variation of values of a and b.

Approximate values of activity coefficients may be calculated from the relationship:

$$f_1 = p_1/(p_1^\circ x_1)$$

where p_1° is the vapor pressure of pure solute at temperature T and x_1 is the mole fraction solubility at a partial pressure p_1 and temperature T.

Systems fall into two groups:

i) those in which values of f_1 decrease with increase in temperature;

ii) those in which values of f_1 increase with increase in temperature.

For the first group the value of x_1, as a percentage of the corresponding value of p_1/p_1°, increases with increase in temperature. The reverse is true for the second group.

Increase in temperature will disrupt short range order associated with solvent-solvent interaction and this will favor dissolution of gas. Increase in temperature will also disrupt short range order associated with solvent-solute interaction and this will have the opposite effect on the solubility. The variation of activity coefficient with temperature is a measure of the variation of mole fraction solubility relative to the corresponding value of p_1/p_1° and gives an indication of the comparative significance of the above two factors which lead to an increase in disorder in the liquid phase.

Heats of vaporization of ammonia, methanamine, *N*-methylmethanamine and *N*,*N*-dimethylmethanamine at 298 K may be estimated from the Clausius-Clapeyron equation, i.e.,

$$d \ln p^\circ/dT = \Delta H^\circ/RT^2.$$

Values of ΔH° estimated by the evaluator from vapor pressure data are as follows:

ammonia	22420 J mol^{-1}
methanamine	26070 J mol^{-1}
N-methylmethanamine	27400 J mol^{-1}
N,*N*-dimethylmethanamine	23970 J mol^{-1}.

For systems in which (a + ΔH°) is positive the value of the activity coefficient, f_1, decreases with increase in temperature (i.e., x_1 *increases* relative to p_1/p_1°). For systems in which (a + ΔH°) is negative the reverse is true.

Values of a, b, and (a + ΔH°) for a partial pressure of gas, p_1, of 1 atm are given in Table 2. The corresponding smoothing equations are valid only for the ranges of temperature of the experimental measurements. In some cases values of a and b are based upon data for only two temperatures. These are included so as to indicate the general pattern of values.

The solubilities of ammonia in hexadecane, bicyclohexyl and 1-methylnaphthalene were measured by Tremper and Prausnitz (17) over a wide temperature range. Mole fraction solubilities for 1 atm partial pressure, based upon these data, fall on smooth curves when plotted against temperature. However, the smoothing equation with two constants, a and b, is not fully adequate for the whole temperature range. The values of a and b for these systems, given in the table and corresponding to the best fit of data with the smoothing equation used, are for qualitative comparison with values for other systems. They should not be used for precise calculation of values of solubilities.

Systems in which a monohydric or polyhydric alcohol is the solvent have positive values for $(a + \Delta H^\circ)$ with the exception of *N,N*-dimethylmethanamine in 1,2-ethanediol which has a small negative value. For most of these systems the ratio of mole fraction solubility to the value of (p_1/p_1°) increases with increase of temperature. Compared with other solvents, alcohols show smaller variation of $(a + \Delta H^\circ)$ with increase in number of methyl groups in the gas. These observations are in accord with the hypothesis that the breaking of hydrogen bonds between alcohol molecules with increase in temperature is a factor favoring the solubility of these gases.

The values of $(a + \Delta H^\circ)$ for methanamine and methylmethanamine from measurements by Gerrard (1), fall into the pattern for these gases in hexane and nonane from the more detailed measurements by Wolff *et al.* (3,4). In general, the values of $(a + \Delta H^\circ)$ which are available for solubilities in the straight chain alkanes, butane, hexane, nonane and decane are negative, in contrast with values for alcohols. Solubilities of all four gases have been measured in hexane and there is very marked variation of values of $(a + \Delta H^\circ)$ with change of gas, again in contrast with alcohol systems. The ammonia-hexadecane system appears to be anomalous when compared with systems in lower alkanes because $(a + \Delta H^\circ)$ is positive. However the ammonia-bicyclohexyl system also has a positive value of $(a + \Delta H^\circ)$.

The variation of the mole fraction solubilities of the three amines with variation of temperature has been measured in *N,N*-dimethylformamide and in tetrachloromethane. In the first case values of $(a + \Delta H^\circ)$ become increasingly negative with number of methyl groups in the amine suggesting a corresponding increase in the tendency for hydrogen bonding between amine and solvent. In the case of the second solvent the value of $(a + \Delta H^\circ)$ is negative for methanamine but is increasingly positive from *N*-methylmethanamine to *N,N*-dimethylmethanamine, suggesting a corresponding decrease in the interaction between solute and solvent.

There are insufficient measurements of the solubilities of the gases in other solvents to justify generalisations about the effect of temperature or to pick out apparently anomalous behaviour.

References

1. Gerrard, W. *Solubility of Gases in Liquids*, Plenum Press, New York, 1976.
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COMPONENTS:

1. Methanamine (methylamine); CH_5N; [74-89-5]
   N-Methylmethanamine (dimethylamine); C_2H_7N; [124-40-3]
   N,N-Dimethylmethanamine (trimethylamine); C_3H_9N; [75-50-3]
2. Organic liquids

EVALUATOR:

P. G. T. Fogg,
School of Chemistry,
Polytechnic of North London,
Holloway,
London, U.K.
August 1983

CRITICAL EVALUATION:

Table 2. Values of the constants a and b in the smoothing equation for solubilities at a partial pressure of gas of 1 atm, together with values of (a + ΔH°).

Solvent	NH_3			CH_3NH_2		
	a/J mol^{-1}	b/J mol^{-1} K^{-1}	(a + ΔH°)/J mol^{-1}	a/J mol^{-1}	b/J mol^{-1} K^{-1}	(a + ΔH°)/J mol^{-1}
Butane				-52320	197.5	-26250
Hexane	-61860	242.6	-39440	-40060	154.8	-13990
Nonane				-33530	131.4	- 7460
Decane				-32320	125.6	- 6250
Hexadecane	- 6911	55.3	15509			
Bicyclohexyl	- 6317	61.6	16103			
Cyclohexene	-17010	92.9	5410			
Benzene	-17360	86.4	5060			
1,3-Dimethylbenzene						
1-Methylnaphthalene	-10360	64.2	12060			
Methanol	-11570	48.7	10850			
Ethanol	-13720	57.7	8700			
2,2,2-Trichloroethanol				- 8620	33.0	17450
1-Propanol	-15370	63.8	7050			
2-Propanol	-14710	62.3	7710			
1-Butanol				-12190	46.5	13880
1-Octanol				-12130	46.2	13940
Benzenemethanol				- 9890	37.9	16180
1,2-Ethanediol						
1,2,3-Propanetriol						
1,1'-Oxybisoctane				-28470	108.4	- 2400
2,2'-Oxybisethanol	-18850	70.9	3570			
Ethyl benzoate				-23970	90.6	2100
Hydrazine	-21690	94.1	730			
Methylhydrazine	-21820	92.3	600			
1,1-Dimethylhydrazine	-18210	80.3	4210			
1-Octanamine						
Benzenamine	-25180	101.1	- 2760			
N-Methylbenzenamine				-17960	67.7	8110
N-Ethylbenzenamine				-17740	67.0	8330
N,*N*-Dimethylbenzenamine				-32730	123.1	- 6660
N,*N*-Diethylbenzenamine				-38500	144.4	-12430
Benzenmethanamine						
Benzonitrile						
Nitrobenzene						
1-Methyl-2-nitrobenzene						
N,*N*-Dimethylformamide				-26250	98.5	- 180
Tetrachloromethane				-34150	127.7	- 8080

COMPONENTS:

1. Methanamine (methylamine); CH_5N; [74-89-5]
   N-Methylmethanamine (dimethylamine); C_2H_7N; [124-40-3]
   N,N-Dimethylmethanamine (trimethylamine); C_3H_9N; [75-50-3]
2. Organic liquids

EVALUATOR:

P. G. T. Fogg,
School of Chemistry,
Polytechnic of North London,
Holloway,
London, U.K.
August 1983

CRITICAL EVALUATION:

Table 2. Values of the constants a and b in the smoothing equation for solubilities at a partial pressure of gas of 1 atm, together with values of (a + ΔH°).

Solvent	$(CH_3)_2NH$ a/J mol^{-1}	$(CH_3)_2NH$ b/J mol^{-1} K^{-1}	$(CH_3)_2NH$ (a + ΔH°)/J mol^{-1}	$(CH_3)_3N$ a/J mol^{-1}	$(CH_3)_3N$ b/J mol^{-1} K^{-1}	$(CH_3)_3N$ (a + ΔH°)/J mol^{-1}
Butane						
Hexane	-41420	147.5	-14020	-25230	91.2	- 1260
Nonane						
Decane	-36320	129.6	- 8920			
Hexadecane						
Bicyclohexyl						
Cyclohexane						
Benzene						
1,3-Dimethylbenzene	-29290	104.6	- 1890			
1-Methylnaphthalene						
Methanol	-13610	49.6	13790			
Ethanol	-15830	57.3	11570			
2,2,2-Trichloroethanol	-11470	41.4	15930	-12090	44.2	11880
1-Propanol	-15080	54.5	12320			
2-Propanol						
1-Butanol				-16420	60.7	7550
1-Octanol	-15040	54.0	12360	-16940	61.5	7030
Benzenemethanol	-14910	53.8	12490	-18670	67.9	5300
1,2-Ethanediol				-24750	90.7	- 780
1,2,3-Propanetriol				-22300	82.2	1670
1,1'-Oxybisoctane				-15320	56.1	8650
2,2'-Oxybisethanol						
Ethyl benzoate				-26050	94.5	- 2080
Hydrazine						
Methylhydrazine						
1,1-Dimethylhydrazine						
1-Octanamine	-24140	86.2	3260	-21020	76.2	2950
Benzenamine						
N-Methylbenzenamine						
N-Ethylbenzenamine						
N,N-Dimethylbenzenamine	-31410	112.3	- 4010			
N,N-Diethylbenzenamine						
Benzenmethanamine	-23480	84.6	3920			
Benzonitrile	-26700	95.7	700			
Nitrobenzene				-35370	127.9	-11400
1-Methyl-2-nitrobenzene				-35210	127.4	-11240
N,N-Dimethylformamide	-34560	123.3	- 7160	-51100	185.3	-27130
Tetrachloromethane	-26840	95.7	560	-19830	71.9	4140

COMPONENTS:

1. Methanamine, (methylamine); CH_5N; [74-89-5]
2. Butane; C_4H_{10}; [106-97-8]

ORIGINAL MEASUREMENTS:

Wolff, A.; Höpfner, A.; Höpfner, H.-M.
Ber. Bunsenges. Phys. Chem.
1964, *68*, 410-417.

VARIABLES:

Composition, temperature

PREPARED BY:

P. G. T. Fogg

EXPERIMENTAL VALUES:

Variation of the total vapor pressure/Torr with variation of temperature and of mole fraction of CH_5N in the liquid phase, x_{CH_5N}

	T/K				
x_{CH_5N}	218.15	233.15	253.15	273.15	288.15
0	52.0	125.2	339.5	775.9	1319.4
0.0043	55.2	131.1	349.8	793.3	1348.6
0.0086	58.5	136.8	362.3	814.7	1380.5
0.0334	68.1	160.3	417.8	914.8	1523.8
0.1089	82.3	196.0	513.2	1123.1	1860.3
0.134	83.7	200.5	530.3	1167.9	1934.3
0.208	85.3	207.9	560.9	1257.5	2105.1
0.257	86.2	211.4	575.6	1305.5	2203.1
0.314	86.6	212.0	580.7	1324.4	2225.1
0.365	86.2	212.9	586.4	1342.0	2283.9
0.454	86.6	213.9	590.8	1362.4	2329.1
0.517	86.8	214.1	595.7	1369.4	2349.1
0.532	86.5	213.6	592.4	1369.5	2352.9
0.577	86.6	214.1	592.2	1372.1	2359.7
0.602	86.3	213.4	591.0	1372.0	2362.4
0.654	86.2	212.9	589.5	1370.3	2361.2
0.731	85.3	211.4	585.6	1361.7	2344.0
0.738	85.4	210.3	583.6	1356.7	2343.0
0.774	84.9	209.6	579.3	1347.2	2325.6

Cont.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Apparatus described previously was used (1). Liquid mixtures of accurately known composition were introduced into a cell held in a thermostat controlled to ± 0.02°C. The total vapor pressures were measured by a mercury manometer.

The authors calculated activity coefficients of each component from the vapor pressure data by a method described by Barker (2). Constants for Redlich-Kister equations (3) for activity coefficients were evaluated and reported.

SOURCE AND PURITY OF MATERIALS:

1. From commercial *reinst* methylammonium chloride by reaction with KOH; gas dried with KOH and Li; liquified gas treated with Li and repeatedly fractionated until first and last fractions had vapor pressures between 2191 and 2193 Torr at 20°C.
2. Commercial product; dried with P_2O_5 repeatedly fractionated until first and last fractions had the same vapor pressures measured by the manometer as described for Hexane (1).

ESTIMATED ERROR:

$\delta T/K = \pm\ 0.02$ (estimated by authors)

REFERENCES:

1. Wolff, H.; Höpfner, A. *Z. Elektrochem.* 1962, *66*, 149.
2. Barker, J.A. *Aust. J. Chem.* 1953, *6*, 207.
3. Redlich, O.; Kister, A.T. *Ind. Eng. Chem.* 1948, *21*, 345.

COMPONENTS:

1. Methanamine, (methylamine); CH_5N; [74-89-5]

2. Butane; C_4H_{10}; [106-97-8]

ORIGINAL MEASUREMENTS:

Wolff, A.; Höpfner, A.; Höpfner, H.-M.
Ber. Bunsenges. Phys. Chem.
1964, *68*, 410-417.

VARIABLES:

Composition, temperature

PREPARED BY:

P. G. T. Fogg

EXPERIMENTAL VALUES: Cont.

x_{CH_5N}	T/K 218.15	233.15	253.15	273.15	288.15
0.847	82.5	202.4	561.2	1308.6	2269.0
0.938	70.6	177.4	500.8	1198.0	2102.3
0.957	67.1	169.3	482.2	1158.3	2042.7
1	45.8	126.3	394.2	1001.8	1826.3

760 Torr = 1 atm = 1.013×10^5 Pa

Constants for calculation of activity coefficients from the Redlich-Kister equations given below

T/K	A	B	C
218.15	2.261	-0.054	0.412
223.15	2.213	-0.030	0.381
228.15	2.143	-0.017	0.371
233.15	2.095	-0.008	0.353
243.15	1.976	+0.008	0.313
253.15	1.857	+0.032	0.259
263.15	1.741	+0.066	0.214
273.15	1.623	+0.079	0.189
283.15	1.517	+0.087	0.157
288.15	1.461	+0.095	0.150

$$\ln f_1 = A x_2^2 - B x_2^2(1 - 4 x_1) + C x_2^2(1 - 8 x_1 + 12 x_1^2)$$
$$\ln f_2 = A x_1^2 + B x_1^2(1 - 4 x_2) + C x_1^2(1 - 8 x_2 + 12 x_2^2)$$

where f_1 = activity coefficient of methylamine
f_2 = activity coefficient of butane
x_1 = mole fraction of methylamine in the liquid phase
x_2 = mole fraction of butane in the liquid phase

COMPONENTS:

1. Methanamine, (methylamine); CH_5N; [74-89-5]
2. Hexane, C_6H_{14}; [110-54-3]

ORIGINAL MEASUREMENTS:

Wolff, H.; Höpfner, A.

Z. Elektrochem.

1962, *66*, 149-159.

VARIABLES:

Composition, temperature

PREPARED BY:

P. G. T. Fogg

EXPERIMENTAL VALUES:

Variation of the total vapor pressure/Torr with variation of temperature and of mole fraction of CH_5N in the liquid phase, x_{CH_5N}

	T/K									
x_{CH_5N}	218.15	223.15	228.15	233.15	243.15	253.15	263.15	273.15	283.15	293.15
0	0.97*	1.52*	2.33*	3.48*	7.34*	14.4	26.5	46.0	76.1	121.7
0.0068	5.9	7.8	10.1	12.6	20.8	32.9	51.4	78.7	118.5	174.9
0.0154	11.4	14.3	18.3	23.2	36.0	54.7	80.9	118.4	169.6	239.5
0.0274	17.3	22.6	28.6	36.1	55.9	83.1	120.3	171.2	238.5	327.6
0.0415	22.7	30.2	38.4	48.7	75.4	112.8	162.4	228.5	314.3	424.8
0.0626	29.0	38.5	49.8	63.7	100.1	150.7	217.3	305.9	417.7	560.3
0.086	32.9	44.0	58.0	74.8	119.9	181.4	264.3	371.0	506.2	672.6
0.129	37.7	51.1	68.1	89.5	147.5	228.7	338.1	482.3	663.5	887.5
0.175	39.8	55.1	74.5	99.2	166.2	263.1	395.1	569.5	794.8	1074.1
0.215	41.1	57.7	77.9	103.9	177.4	284.1	432.8	631.4	887.7	1208.6
0.282	42.4	59.2	81.1	109.1	189.8	308.3	476.2	706.4	1006.9	1389.4
0.360	43.6	61.2	83.9	113.6	199.0	327.0	510.9	767.8	1107.1	1545.1
0.449	43.4	61.5	84.7	115.2	204.0	339.3	536.0	814.4	1188.5	1678.0
0.543	43.5	61.2	85.4	116.7	207.4	348.6	554.7	849.9	1250.9	1781.9
0.629	43.7	62.1	86.1	117.9	210.2	355.8	569.7	878.1	1300.4	1863.2
0.662	43.7	62.0	86.3	117.7	210.6	356.4	574.8	885.3	1314.8	1887.6
0.735	44.0	62.4	86.7	118.9	214.0	362.3	583.0	905.0	1348.1	1943.3
0.783	43.8	62.1	86.8	119.2	215.0	365.6	590.1	917.2	1370.0	1982.5

Cont.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Liquid mixtures of accurately known composition were introduced into a cell held in a thermostat controlled to ± 0.02°C. The total vapor pressures were measured by a mercury manometer.

The authors calculated activity coefficients of each component from the vapor pressure data by a method described by Barker (2). Constants for Redlich-Kister equations (3) for activity coefficients were evaluated and reported. The compositions of the vapor phase were also calculated by the authors.

SOURCE AND PURITY OF MATERIALS:

1. From commercial *reinst* methylammonium chloride by reaction with KOH; gas dried with KOH and Na; liquified gas treated with Li and repeatedly fractionated until first and last fractions had vapor pressures between 2191 and 2193 Torr at 20°C.
2. Commercial product; dried over P_2O_5 distilled and repeatedly fractionated until first and last fractions had the same vapor pressures as measured by the manometer.

ESTIMATED ERROR:

$\delta T/K = \pm 0.02$ (estimated by authors)

REFERENCES:

1. Wolff, A.; Höpfner, A.; Höpfner, H.-M. *Ber. Bunsenges. Phys. Chem.* 1964, *68*, 410.
2. Barker, J.A. *Aust. J. Chem.* 1953, *6*, 207.
3. Redlich, O.; Kister, A.T. *Ind. Eng. Chem.* 1948, *21*, 345.

COMPONENTS:

1. Methanamine, (methylamine); CH_5N; [74-89-5]
2. Hexane, C_6H_{14}; [110-54-3]

ORIGINAL MEASUREMENTS:

Wolff, H; Höpfner, A.
Z. Elektrochem.
1962, *66*, 149-159.

VARIABLES:

Composition, temperature

PREPARED BY:

P. G. T. Fogg

EXPERIMENTAL VALUES: Cont.

	T/K									
x_{CH_5N}	218.15	223.15	228.15	233.15	243.15	253.15	263.15	273.15	283.15	293.15
0.827	44.0	62.6	87.4	120.1	216.1	369.1	597.0	929.0	1392.6	2017.1
0.877	44.3	63.2	88.7	121.6	219.9	375.3	607.6	948.8	1422.4	2062.9
0.925	44.6	63.6	89.1	122.6	222.1	380.1	617.5	964.4	1448.3	2104.5
0.969	44.9	64.9	90.8	125.3	227.4	389.0	631.5	985.9	1483.7	2152.8
1	44.9‡	65.4	91.9	126.3	229.8	394.2	640.5	1001.8	1506.6	2191.7

760 Torr = 1 atm = 1.013×10^5 Pa

*by extrapolation

‡corrected value of 45.8 given in later ref. (1)

Constants* for calculation of activity coefficients from the Redlich-Kister equations given below

T/K	A	B	C
218.15	2.392	0.122	0.527
223.15	2.338	0.130	0.472
228.15	2.266	0.138	0.395
233.15	2.213	0.150	0.384
243.15	2.087	0.163	0.300
253.15	1.956	0.180	0.250
263.15	1.833	0.198	0.212
273.15	1.709	0.214	0.185
283.15	1.588	0.224	0.164
293.15	1.470	0.231	0.148

$$\ln f_1 = A\,x_2^2 - B\,x_2^2(1 - 4\,x_1) + C\,x_2^2(1 - 8\,x_1 + 12\,x_1^2)$$

$$\ln f_2 = A\,x_1^2 + B\,x_1^2(1 - 4\,x_2) + C\,x_1^2(1 - 8\,x_2 + 12\,x_2^2)$$

where f_1 = activity coefficient of methylamine
f_2 = activity coefficient of hexane
x_1 = mole fraction of methylamine in the liquid phase
x_2 = mole fraction of hexane in the liquid phase.

* revised values given by the authors in a later paper (1).

COMPONENTS:

1. Methanamine, (methylamine); CH_5N; [74-89-5]
2. Nonane; C_9H_{20}; [111-84-2]

ORIGINAL MEASUREMENTS:

Wolff, H.; Höpfner, A.; Höpfner,H.-M

Ber. Bunsenges. Phys. Chem.

1964, *68*, 410-417.

VARIABLES:

Composition, temperature

PREPARED BY:

P. G. T. Fogg

EXPERIMENTAL VALUES:

Variation of the total vapor pressure/Torr with variation of temperature and of mole fraction of CH_5N in the liquid phase, x_{CH_5N}

	T/K			
x_{CH_5N}	233.15	253.15	273.15	293.15
0	0.0	0.2	0.9	3.4
0.0083	10.2	20.6	37.0	61.5
0.0165	19.3	39.5	71.3	116.7
0.0245	27.6	56.8	103.4	169.8
0.0324	35.1	73.7	134.0	221.2
0.0403	41.9	89.1	163.3	270.8
0.0452	45.7	97.0	176.0	286.3
0.0862	72.2	162.2	308.0	515.1
0.1278	88.6	212.5	420.0	725.1
0.188	103.1	263.2	546.9	977.5
0.251	111.3	297.9	644.4	1193.2
0.311	115.9	319.7	714.2	1359.2
0.381	118.9	337.1	774.3	1518.4
0.440	120.2	347.0	809.9	1613.1
0.533	121.2	357.1	853.4	1745.7
0.588	121.4	361.5	872.4	1807.1
0.692	121.6	366.3	899.5	1898.2

Cont.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Apparatus described previously was used (1). Liquid mixtures of accurately known composition were introduced into a cell held in a thermostat controlled to ± 0.02°C. The total vapor pressures were measured by a mercury manometer.

The authors calculated activity coefficients of each component from the vapor pressure data by a method described by Barker (2). Constants for Redlich-Kister equations (3) for activity coefficients were evaluated and reported.

SOURCE AND PURITY OF MATERIALS:

1. From commercial *reinst* methylammonium chloride by reaction with KOH; gas dried with KOH and Na; liquified gas treated with Li and repeatedly fractionated until first and last fractions had vapor pressures between 2191 and 2193 Torr at 20°C (1).
2. Commercial product; dried over P_2O_5; distilled and repeatedly fractionated until first and last fractions had the same vapor pressures as measured by the manometer (1).

ESTIMATED ERROR:

$\delta T/K = \pm\ 0.02$ (estimated by authors)

REFERENCES:

1. Wolff, H.; Höpfner, A. *Z. Elektrochem.* 1962, *66*, 149.
2. Barker, J.A. *Aust. J. Chem.* 1953, *6*, 207.
3. Redlich, O.; Kister, A.T. *Ind. Eng. Chem.* 1948, *21*, 345.

COMPONENTS:	ORIGINAL MEASUREMENTS:
1. Methanamine, (methylamine); CH_5N; [74-89-5] 2. Nonane; C_9H_{20}; [111-84-2]	Wolff, H.; Höpfner, A.; Höpfner, H.-M *Ber. Bunsenges. Phys. Chem.* 1964, *68*, 410-417.
VARIABLES:	**PREPARED BY:**
Composition, temperature	P. G. T. Fogg

EXPERIMENTAL VALUES: Cont.

	T/K			
x_{CH_5N}	233.15	253.15	273.15	293.15
0.735	122.4	368.9	909.1	1932.4
0.767	122.2	369.3	915.7	1954.2
0.938	122.3	379.2	958.7	2100.7
0.968	123.4	383.6	974.4	2129.8
1	126.3	394.2	1001.8	2191.7

760 Torr = 1 atm = 1.013×10^5 Pa

Constants for calculation of activity coefficients from the Redlich-Kister equations given below

T/K	A	B	C
233.15	2.323	0.338	0.393
243.15	2.174	0.362	0.336
253.15	2.024	0.379	0.286
263.15	1.881	0.392	0.255
273.15	1.738	0.399	0.229
283.15	1.597	0.401	0.214
293.15	1.463	0.400	0.204

$$\ln f_1 = A\,x_2^2 - B\,x_2^2(1 - 4\,x_1) + C\,x_2^2(1 - 8\,x_1 + 12\,x_1^2)$$
$$\ln f_2 = A\,x_1^2 + B\,x_1^2(1 - 4\,x_2) + C\,x_1^2(1 - 8\,x_2 + 12\,x_2^2)$$

where f_1 = activity coefficient of methylamine
f_2 = activity coefficient of nonane
x_1 = mole fraction of methylamine in the liquid phase
x_2 = mole fraction of nonane in the liquid phase.

COMPONENTS:

1. Methanamine, (methylamine); CH_5N; [74-89-5]
2. Decane; $C_{10}H_{22}$; [124-18-5]

ORIGINAL MEASUREMENTS:

Gerrard, W.

Solubility of Gases and Liquids,

Plenum, 1976, Chapter 10.

VARIABLES:

Temperature, pressure

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	P/mmHg	$P/10^5$Pa	Mole fraction of methylamine in liquid, $x_{CH_3NH_2}$
273.15	100	0.133	0.028
	200	0.267	0.061
	300	0.400	0.097
	400	0.533	0.141
	500	0.667	0.193
	600	0.800	0.262
	700	0.933	0.350
	760	1.013	0.413
278.15	100	0.133	0.022
	200	0.267	0.047
	300	0.400	0.075
	400	0.533	0.109
	500	0.667	0.144
	600	0.800	0.190
	700	0.933	0.256
	760	1.013	0.318
283.15	100	0.133	0.020
	200	0.267	0.044
	300	0.400	0.070
	400	0.533	0.100
	500	0.667	0.132
	600	0.800	0.168
	700	0.933	0.206
	760	1.013	0.253

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Amine was passed into a known weight pf 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:

1. British Drug Houses or Cambrian Gases sample.

2. Purified and attested 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* 623-650.
2. Gerrard, W.
Solubility of Gases and Liquids. *Plenum Press, New York.* 1976.
Chapter 1.

COMPONENTS:

1. Methanamine (methylamine); CH_5N; [74-89-5]
2. Decane; $C_{10}H_{22}$; [124-18-5]

ORIGINAL MEASUREMENTS:

Gerrard, W.

Solubility of Gases and Liquids

Plenum, 1976, Chapter 10.

EXPERIMENTAL VALUES:

T/K	P/mmHg	$P/10^5$ Pa	Mole fraction of methylamine in liquid, CH_3NH_2
293.15	100	0.133	0.011
	200	0.267	0.023
	300	0.400	0.037
	400	0.533	0.055
	500	0.667	0.078
	600	0.800	0.103
	700	0.933	0.134
	760	1.013	0.156

COMPONENTS:

1. Methanamine; (methylamine); CH_5N; [74-89-5]
2. Aromatic hydrocarbons

ORIGINAL MEASUREMENTS:

Gerrard, W.

Solubility of Gases and Liquids,

Plenum, 1976, Chapter 10.

VARIABLES:

Pressure

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	P/mmHg	$P/10^5$Pa	Mole fraction of methylamine in liquid, $x_{CH_3NH_2}$
		Benzene; C_6H_6; [71-43-2]	
283.15	760	1.013	0.408
		Methylbenzene (toluene); C_7H_8; [108-88-3]	
283.15	760	1.013	0.393
		1,3-Dimethylbenzene (*m*-xylene); C_8H_{10}; [108-38-3]	
283.15	100	0.133	0.027
	200	0.267	0.064
	300	0.400	0.100
	400	0.533	0.145
	500	0.667	0.196
	600	0.800	0.275
	700	0.933	0.320
	760	1.013	0.358
		1,3,5-Trimethylbenzene (mesitylene); C_9H_{12}; [108-67-8]	
283.15	100	0.133	0.032
	200	0.267	0.068
	300	0.400	0.109
	400	0.533	0.155
	500	0.667	0.200
	600	0.800	0.253
	700	0.933	0.310
	760	1.013	0.326

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Amine 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:

1. British Drug Houses or Cambrian Gases sample.

2. Purified and attested 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* 623-650.

2. Gerrard, W.
Solubility of Gases and Liquids. Plenum Press, New York. 1976.
Chapter 1.

COMPONENTS:	ORIGINAL MEASUREMENTS:
1. Methanamine (Methylamine); CH_5N; [74-89-5] 2. 1,2-Ethanediol (Ethylene glycol); $C_2H_6O_2$; [107-21-1]	Gerrard, W. *Solubility of Gases and Liquids,* *Plenum* 1976, Chapter 10.
VARIABLES:	**PREPARED BY:**
Pressure	C. L. Young

EXPERIMENTAL VALUES:

T/K	P/mmHg	$P/10^5$Pa	Mole fraction of methylamine in liquid, $x_{CH_3NH_2}$
283.15	100	0.133	0.375
	200	0.267	0.476
	300	0.400	0.537
	400	0.533	0.583
	500	0.667	0.623
	600	0.800	0.660
	700	0.933	0.691
	760	1.013	0.709

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Amine 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:

1. British Drug Houses or Cambrian Gases sample.

2. Purified and attested 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* 623-650.

2. Gerrard, W.
Solubility of Gases and Liquids. *Plenum Press, New York.* 1976. Chapter 1.

COMPONENTS:

1. Methanamine (Methylamine); CH_5N; [74-89-5]
2. Glycols and glycerol

ORIGINAL MEASUREMENTS:

Copley, M.J.; Ginsberg, E.; Zellhoefer, G.F.; Marvel, C.S.

J. Amer. Chem. Soc. 1941, *63*, 254-256.

VARIABLES:

PREPARED BY:

P. G. T. Fogg

EXPERIMENTAL VALUES:

Solvent	T/K	p_{CH_5N}/mmHg*	Mole fraction x_{CH_5N}
1,2-Ethanediol, (Ethylene glycol); $C_2H_6O_2$; [107-21-1]	305.4	1223	0.662
2,2'-Oxybis-ethanol, (Diethylene glycol); $C_4H_{10}O_3$; [111-46-6]	305.4	1223	0.653
1,2,3-Propanetriol, (Glycerol); $C_3H_8O_3$; [56-81-5]	305.4	1223	0.653

760 mmHg = 1 atm = 1.013×10^5 Pa.

* The pressure of methylamine was said by the authors to correspond to its vapor pressure at 4.5°C. The magnitude of this pressure has been estimated by the compiler from vapor pressure data given in ref. (1).

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The absorption apparatus was developed for studies of refrigeration systems (2) and consisted of a copper drum 4 x 12 cm, fitted with a needle valve and two-way outlet with one outlet connected to a manometer. The drum was evacuated to a pressure of 1 mmHg and about 40 cm^3 of solvent drawn into this drum which was then reweighed and immersed in a water bath at 32.2°C. The drum was agitated and gaseous methanamine allowed to flow slowly into it. The final pressure in the drum corresponded to the vapor pressure of methanamine at 4.5°C. The magnitude of this pressure was not stated by the authors. The drum and contents were weighed again to find the weight of gas which had been absorbed.

SOURCE AND PURITY OF MATERIALS:

The authors stated that the materials used were all purified carefully by chemical means and fractional distillation where feasible.

ESTIMATED ERROR:

REFERENCES:

1. Dreisbach, R.R. *Physical Properties of Chemical Compounds* Vol. 2, A.C.S. Washington. 1959.
2. Zellhoefer, G.F. *Ind. Eng. Chem.* 1937, *29*, 548.

COMPONENTS:	ORIGINAL MEASUREMENTS:
1. Methanamine (Methylamine); CH_5N; [74-89-5] 2. 1,2,3-Propanetriol (Glycerol); $C_3H_8O_3$; [56-81-5]	Gerrard, W. *Solubility of Gases and Liquids, Plenum* <u>1976</u>, Chapter 10.
VARIABLES:	**PREPARED BY:**
Pressure	C. L. Young

EXPERIMENTAL VALUES:

T/K	P/mmHg	$P/10^5$Pa	Mole fraction of methylamine in liquid, $x_{CH_3NH_2}$
283.15	100	0.133	0.448
	200	0.267	0.546
	300	0.400	0.603
	400	0.533	0.645
	500	0.667	0.680
	600	0.800	0.708
	700	0.933	0.727
	760	1.013	0.736

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Amine 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:

1. British Drug Houses or Cambrian Gases sample.

2. Purified and attested 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* 623-650.

2. Gerrard, W.
Solubility of Gases and Liquids. Plenum Press, New York. <u>1976</u>. Chapter 1.

COMPONENTS:

1. Methanamine (Methylamine); CH_5N; [74-89-5]

2. 1,4-Dioxane; $C_4H_8O_2$; [123-91-1]

ORIGINAL MEASUREMENTS:

Gerrard, W.

Solubility of Gases and Liquids, *Plenum* 1976, Chapter 10.

VARIABLES:

Pressure

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	P/mmHg	$P/10^5$Pa	Mole fraction of methylamine in liquid, $x_{CH_3NH_2}$
283.15	700	0.933	0.429
	760	1.013	0.481

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Amine as passed into a known weight of pure liquid in a bubbler tube at a total pressure measured by a manometer assembly. The amount of abosrbed 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:

1. British Drug Houses or Cambrian Gases sample.

2. Purified and attested 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* 623-650.

2. Gerrard, W.
Solubility of Gases and Liquids. Plenum Press, New York. 1976. Chapter 1.

COMPONENTS:

1. Methanamine (methylamine); CH_5N; [74-89-5]
2. 1-Butanol; $C_4H_{10}O$; [71-36-3]

ORIGINAL MEASUREMENTS:

Gerrard, W.

Solubility of Gases and Liquids,

Plenum 1976, Chapter 10.

VARIABLES:

Temperature, pressure

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	P/mmHg	$P/10^5$Pa	Mole fraction of methylamine in liquid, $x_{CH_3NH_2}$
283.15	600	0.800	0.580
	700	0.933	0.630
	760	1.013	0.661
293.15	760	1.013	0.554

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Amine 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:

1. British Drug Houses or Cambrian Gases sample.

2. Purified and attested 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* 623-650.

2. Gerrard, W.
Solubility of Gases and Liquids. Plenum Press, New York. 1976.
Chapter 1.

COMPONENTS:

1. Methanamine (Methylamine); CH_5N; [74-89-5]

2. Benzenemethanol (Benzyl alcohol); C_7H_8O; [100-51-6]

ORIGINAL MEASUREMENTS:

Gerrard, W.

Solubility of Gases and Liquids,

Plenum 1976, Chapter 10.

VARIABLES:

Temperature, pressure

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	P/mmHg	$P/10^5$Pa	Mole fraction of methylamine in liquid, $x_{CH_3NH_2}$
273.15	100	0.133	0.420
	200	0.267	0.506
	300	0.400	0.571
	400	0.533	0.630
	500	0.667	0.680
	600	0.800	0.731
	700	0.933	0.785
	760	1.013	0.816
278.15	760	1.013	0.747
283.15	760	1.013	0.690
293.15	100	0.133	0.312
	200	0.267	0.410
	300	0.400	0.460
	400	0.533	0.500
	500	0.667	0.533
	600	0.800	0.560
	700	0.933	0.588
	760	1.013	0.605

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Amine 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 abosrbed 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:

1. British Drug Houses or Cambrian Gases sample.

2. Purified and attested 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* 623-650.

2. Gerrard, W.
Solubility of Gases and Liquids. Plenum Press, New York. 1976. Chapter 1.

COMPONENTS:	ORIGINAL MEASUREMENTS:
1. Methanamine (methylamine): CH_5N; [74-89-5] 2. 1-Phenylethanone (methyl phenyl ketone); C_8H_8O; [98-86-2]	Gerrard, W. *Solubility of Gases and Liquids,* *Plenum* 1976, Chapter 10.
VARIABLES:	PREPARED BY:
Pressure	C. L. Young

EXPERIMENTAL VALUES:

T/K	P/mmHg	$P/10^5$Pa	Mole fraction of methylamine in liquid, $x_{CH_3NH_2}$
293.15	100	0.133	0.045
	200	0.267	0.090
	300	0.400	0.132
	400	0.533	0.180
	500	0.667	0.244
	600	0.800	0.270
	700	0.933	0.315
	760	1.013	0.342

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Amine 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:

1. British Drug Houses or Cambrian Gases sample.

2. Purified and attested 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* 623-650.

2. Gerrard, W.
Solubility of Gases and Liquids. Plenum Press, New York. 1976. Chapter 1.

COMPONENTS: 1. Methanamine (Methylamine); CH_5N; [74-89-5] 2. Ethoxybenzene (ethyl phenyl ether); $C_8H_{10}O$; [103-73-1]	ORIGINAL MEASUREMENTS: Gerrard, W. *Solubility of Gases and Liquids, Plenum* 1976, Chapter 10.
VARIABLES: Pressure	PREPARED BY: C. L. Young

EXPERIMENTAL VALUES:

T/K	P/mmHg	$P/10^5$Pa	Mole fraction of methylamine in liquid, $x_{CH_3NH_2}$
283.15	500	0.667	0.285
	600	0.800	0.342
	700	0.933	0.402
	760	1.013	0.436

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Amine 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 descrbbed by Gerrard [1,2].

SOURCE AND PURITY OF MATERIALS:

1. British Drug Houses or Cambrian Gases sample.

2. Purified and attested 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* 623-650.

2. Gerrard, W.
Solubility of Gases and Liquids. Plenum Press, New York. 1976. Chapter 1.

COMPONENTS:	ORIGINAL MEASUREMENTS:
1. Methanamine (methylamine); CH_5N; [74-89-5] 2. 1-Octanol; $C_8H_{18}O$; [111-87-5]	Gerrard, W. *Solubility of Gases and Liquids,* *Plenum* 1976, Chapter 10.
VARIABLES:	**PREPARED BY:**
Temperature, pressure	C. L. Young

EXPERIMENTAL VALUES:

T/K	P/mmHg	$P/10^5$Pa	Mole fraction of methylamine in liquid, $x_{CH_3NH_2}$
273.15	100	0.133	0.300
	200	0.267	0.425
	300	0.400	0.511
	400	0.533	0.582
	500	0.667	0.644
	600	0.800	0.705
	700	0.933	0.763
	760	1.013	0.796
278.15	600	0.800	0.636
	700	0.933	0.692
	760	1.013	0.728
283.15	100	0.133	0.255
	200	0.267	0.355
	300	0.400	0.424
	400	0.533	0.485
	500	0.667	0.537
	600	0.800	0.586
	700	0.933	0.635
	760	1.013	0.663
293.15	100	0.133	0.200
	200	0.267	0.292
	300	0.400	0.357
	400	0.533	0.412
	500	0.667	0.458
	600	0.800	0.498
	700	0.933	0.534
	760	1.013	0.554

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Amine 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:

1. British Drug Houses or Cambrian Gases sample.

2. Purified and attested 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* 623-650.

2. Gerrard, W.
Solubility of Gases and Liquids. Plenum Press, New York. 1976.
Chapter 1.

COMPONENTS:	ORIGINAL MEASUREMENTS:
1. Methanamine (methylamine); CH_5N; [74-89-5] 2. Benzoic acid, ethyl ester (ethyl benzoate); $C_9H_{10}O_2$; [93-89-0]	Gerrard, W. *Solubility of Gases and Liquids, Plenum* 1976, Chapter 10.
VARIABLES:	PREPARED BY:
Temperature, pressure	C. L. Young

EXPERIMENTAL VALUES:

T/K	P/mmHg	$P/10^5$Pa	Mole fraction of methylamine in liquid, $x_{CH_3NH_2}$
273.15	100	0.133	0.093
	200	0.267	0.187
	300	0.400	0.281
	400	0.533	0.376
	500	0.667	0.466
	600	0.800	0.560
	700	0.933	0.656
	760	1.013	0.715
283.15	100	0.133	0.062
	200	0.267	0.126
	300	0.400	0.188
	400	0.533	0.256
	500	0.667	0.318
	600	0.800	0.373
	700	0.933	0.444
	760	1.013	0.490
293.15	100	0.133	0.044
	200	0.267	0.088
	300	0.400	0.135
	400	0.533	0.180
	500	0.667	0.224
	600	0.800	0.272
	700	0.933	0.320
	760	1.013	0.348

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Amine 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:

1. British Drug Houses or Cambrian Gases sample.

2. Purified and attested 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* 623-650.

2. Gerrard, W.
Solubility of Gases and Liquids. Plenum Press, New York. 1976.
Chapter 1.

COMPONENTS:

1. Methanamine (Methylamine); CH_5N; [74-89-5]
2. 1,1'-Oxybispentane (Dipentyl ether); $C_{10}H_{22}O$; [693-65-2]

ORIGINAL MEASUREMENTS:

Gerrard, W.

Solubility of Gases and Liquids, *Plenum* 1976, Chapter 10.

VARIABLES:

Pressure

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	*P*/mmHg	*P*/10^5Pa	Mole fraction of methylamine in liquid, CH_3NH_2
273.15	100	0.133	0.075
	200	0.267	0.143
	300	0.400	0.212
	400	0.533	0.290
	500	0.667	0.373
	600	0.800	0.474
	700	0.933	0.586
	760	1.013	0.680

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Amine 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:

1. British Drug Houses or Cambrian Gases sample.

2. Purified and attested 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, 22 623-650.

2. Gerrard, W.
Solubility of Gases and Liquids. Plenum Press, New York. 1976.
Chapter 1.

COMPONENTS:	ORIGINAL MEASUREMENTS:
1. Methanamine (Methylamine); CH_5N; [74-89-5] 2. 1,1'-Oxybisoctane (Dioctyl ether); $C_{16}H_{34}O$; [629-82-3]	Gerrard, W. *Solubility of Gases and Liquids,* *Plenum* 1976, Chapter 10.
VARIABLES:	**PREPARED BY:**
Temperature, pressure	C. L. Young

EXPERIMENTAL VALUES:

T/K	P/mmHg	$P/10^5$Pa	Mole fraction of methylamine in liquid, $x_{CH_3NH_2}$
273.15	100	0.133	0.076
	200	0.267	0.144
	300	0.400	0.215
	400	0.533	0.284
	500	0.667	0.356
	600	0.800	0.440
	700	0.933	0.530
	760	1.013	0.604
283.15	100	0.133	0.040
	200	0.267	0.084
	300	0.400	0.135
	400	0.533	0.185
	500	0.667	0.237
	600	0.800	0.291
	700	0.933	0.350
	760	1.013	0.388

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Amine 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:

1. British Drug Houses or Cambrian Gases sample.

2. Purified and attested 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, 22 623-650.

2. Gerrard, W.
Solubility of Gases and Liquids. Plenum Press, New York. 1976. Chapter 1.

COMPONENTS:

1. Methanamine (Methylamine); CH_5N; [74-89-5]
2. *N,N*-Dimethylformamide; C_3H_7NO; [68-12-2]

ORIGINAL MEASUREMENTS:

Gerrard, W.

Solubility of Gases and Liquids,
Plenum 1976, Chapter 10.

VARIABLES:

Temperature, pressure

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	P/mmHg	$P/10^5$Pa	Mole fraction of methylamine in liquid, $x_{CH_3NH_2}$
273.15	100	0.133	0.098
	200	0.267	0.197
	300	0.400	0.296
	400	0.533	0.395
	500	0.667	0.494
	600	0.800	0.593
	700	0.933	0.693
	760	1.013	0.752
278.15	100	0.133	0.080
	200	0.267	0.160
	300	0.400	0.240
	400	0.533	0.335
	500	0.667	0.398
	600	0.800	0.478
	700	0.933	0.560
	760	1.013	0.601
283.15	100	0.133	0.065
	200	0.267	0.130
	300	0.400	0.196
	400	0.533	0.262
	500	0.667	0.326

(cont.)

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Amine 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 asorbed 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:

1. British Drug Houses or Cambrian Gases sample.

2. Purified and attested 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* 623-650.

2. Gerrard, W.
Solubility of Gases and Liquids.
Plenum Press, New York, 1976.
Chapter 1.

COMPONENTS:

1. Methanamine (Methylamine); CH_5N; [74-89-5]
2. *N*,*N*-Dimethylformamide; C_3H_7NO; [68-12-2]

ORIGINAL MEASUREMENTS:

Gerrard, W.

Solubility of Gases and Liquids, *Plenum* 1976, Chapter 10.

EXPERIMENTAL VALUES: Continued:

T/K	*P*/mmHg	*P*/10^5Pa	Mole fraction of methylamine in liquid, $x_{CH_3NH_2}$
283.15	600	0.800	0.394
	700	0.933	0.454
	760	1.013	0.500
293.15	100	0.133	0.040
	200	0.267	0.084
	300	0.400	0.127
	400	0.533	0.172
	500	0.667	0.216
	600	0.800	0.264
	700	0.933	0.311
	760	1.013	0.340

COMPONENTS:

1. Methanamine, (methylamine); CH_5N; 74-89-5
2. *N,N*-Dimethylmethanamine (trimethylamine); C_3H_9N; 75-50-3

ORIGINAL MEASUREMENTS:

Wolff, H.; Würtz, R.

Z. Phys. Chem. (Frankfurt am Main) 1969, *67*, 115-121.

VARIABLES:

Composition, temperature

PREPARED BY:

P. G. T. Fogg

EXPERIMENTAL VALUES:

Variation of the total vapor pressure/Torr with variation of temperature and of mole fraction of CH_5N in the liquid phase, x_{CH_5N}

			T/K		
x_{CH_5N}	223.15	233.15	253.15	273.15	293.15
0	56.4	102.3	288.3	676.9	1387.0
0.0113	58.3	105.3	294.8	688.4	1414.1
0.0287	59.3	106.9	302.0	708.3	1449.9
0.0315	59.8	108.3	303.4	710.2	1458.6
0.0472	60.3	109.7	310.0	725.2	1488.1
0.0496	60.9	110.2	311.1	728.6	1496.0
0.0984	62.8	116.5	329.5	773.9	1585.0
0.1504	66.2	120.8	344.7	812.6	1670.3
0.1983	68.3	125.4	358.2	847.5	1747.9
0.2473	69.3	127.7	368.3	875.8	1812.8
0.2980	70.6	130.6	378.7	905.2	1878.8
0.3693	71.1	132.8	389.3	934.6	1953.2
0.4046	72.5	135.0	394.2	947.3	1982.0
0.4482	73.6	136.2	399.1	963.7	2023.0
0.4995	72.8	136.6	404.0	977.9	2063.3
0.5080	73.6	137.0	404.0	979.7	2067.0
0.5397	72.4	136.7	407.3	990.7	2091.1
0.6000	72.9	137.9	411.2	1002.8	2130.9

Cont.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Apparatus described previously was used (1). Liquid mixtures of accurately known composition were introduced into a cell held in a thermostat controlled to ± 0.02 °C. The total vapor pressure was measured by a mercury manometer.

The authors calculated activity coefficients of each component from the vapor pressure data by a method described by Barker (2). Constants for Redlich-Kister equations (3) for activity coefficients were evaluated and reported.

SOURCE AND PURITY OF MATERIALS:

1 & 2. Prepared from the corresponding hydrochlorides; purified by repeated fractionation until the first and last fractions had vapor pressures which differed by less than the limits of error of the pressure measurements (1), (4).

ESTIMATED ERROR:

$\delta T/K = \pm 0.02$ (estimated by authors)

REFERENCES:

1. Wolff, H.; Höpfner, A. *Z. Elektrochem.* 1962, *66*, 149.
2. Barker, J.A. *Aust. J. Chem.* 1953, *6*, 207.
3. Redlich, O.; Kister, A.T. *Ind. Eng Chem.* 1948, *21*, 345.
4. Wolff, H.; Würtz, R. *Ber. Bunsenges. Phys. Chem.* 1968, *72*, 101.

COMPONENTS:

1. Methanamine, (methylamine); CH_5N; 74-89-5
2. *N,N*-Dimethylmethanamine (trimethylamine); C_3H_9N; 75-50-3

ORIGINAL MEASUREMENTS:

Wolff, H.; Würtz, R.

Z. Phys. Chem. (Frankfurt am Main) 1969, *67*, 115-121.

VARIABLES:

Composition, temperature

PREPARED BY:

P. G. T. Fogg

EXPERIMENTAL VALUES: Cont.

	T/K				
x_{CH_5N}	223.15	233.15	253.15	273.15	293.15
0.6196	74.3	138.8	412.3	1010.7	2139.7
0.6444	73.4	137.7	413.3	1015.4	2149.2
0.6980	73.8	138.0	413.8	1018.8	2175.9
0.7492	73.1	138.2	415.3	1023.3	2191.8
0.7979	72.4	136.9	414.0	1025.4	2202.3
0.8487	71.5	135.8	412.4	1026.6	2207.0
0.8961	70.5	133.6	409.1	1018.7	2212.0
0.9491	67.7	129.6	401.7	1011.8	2205.6
1	65.4	126.3	394.2	1001.8	2191.7

760 Torr = 1 atm = 1.013×10^5 Pa

Constants for calculation of activity coefficients from the Redlich-Kister equations given below

T/K	A	B	C
223.15	0.732	-0.010	0.127
233.15	0.714	-0.025	0.087
243.15	0.685	0.002	0.034
253.15	0.656	0.006	0.043
263.15	0.622	0.016	0.025
273.15	0.581	0.026	0.008
283.15	0.547	0.035	0.003
293.15	0.510	0.037	0.012

$$\ln f_1 = A\,x_2^2 - B\,x_2^2(1 - 4\,x_1) + C\,x_2^2(1 - 8\,x_1 + 12\,x_1^2)$$

$$\ln f_2 = A\,x_1^2 + B\,x_1^2(1 - 4\,x_2) + C\,x_1^2(1 - 8\,x_2 + 12\,x_2^2)$$

where f_1 = activity coefficient of methylamine
f_2 = activity coefficient of trimethylamine
x_1 = mole fraction of methylamine in the liquid phase
x_2 = mole fraction of trimethylamine in the liquid phase

COMPONENTS: 1. Methanamine (Methylamine); CH_5N; [74-89-5] 2. Pyridine; C_5H_5N; [110-86-1] or Quinoline; C_9H_7N; [91-22-5]	ORIGINAL MEASUREMENTS: Gerrard, W. *Solubility of Gases and Liquids, Plenum* 1976, Chapter 10.
VARIABLES: Pressure	PREPARED BY: C. L. Young

EXPERIMENTAL VALUES:

T/K	P/mmHg	$P/10^5$Pa	Mole fraction of methylamine in liquid, $x_{CH_3NH_2}$
		Pyridine; C_5H_5N; [110-86-1]	
283.15	500	0.667	0.308
	600	0.800	0.372
	700	0.933	0.444
	760	1.013	0.488
		Quinoline; C_9H_7N; [91-22-5]	
283.15	100	0.133	0.060
	200	0.267	0.120
	300	0.400	0.181
	400	0.533	0.243
	500	0.667	0.302
	600	0.800	0.362
	700	0.933	0.421
	760	1.013	0.456

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Amine 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:

1. British Drug Houses or Cambrian Gases sample.

2. Purified and attested 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* 623-650.

2. Gerrard, W.
Solubility of Gases and Liquids. Plenum Press, New York. 1976. Chapter 1.

COMPONENTS:

1. Methanamine (Methylamine); CH_5N; [74-89-5]
2. Nitrobenzene; $C_6H_5NO_2$; [98-95-3]

ORIGINAL MEASUREMENTS:

Gerrard, W.

Solubility of Gases and Liquids,
Plenum 1976, Chapter 10.

VARIABLES:

Pressure

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	P/mmHg	$P/10^5$Pa	Mole fraction of methylamine in liquid, $x_{CH_3NH_2}$
283.15	100	0.133	0.053
	200	0.267	0.105
	300	0.400	0.158
	400	0.533	0.209
	500	0.667	0.264
	600	0.800	0.324
	700	0.933	0.391
	760	1.013	0.436

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Amine 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 abosrbed 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:

1. British Drug Houses or Cambrian Gases sample.

2. Purified and attested 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* 623-650.

2. Gerrard, W.
Solubility of Gases and Liquids. Plenum Press, New York. 1976. Chapter 1.

COMPONENTS:

1. Methanamine (Methylamine); CH_5N; [74-89-5]

2. Benzenamine (Aniline); C_6H_7N; [62-53-3]

ORIGINAL MEASUREMENTS:

Gerrard, W.

Solubility of Gases and Liquids,

Plenum 1976, Chapter 10.

VARIABLES:

Pressure

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	P/mmHg	$P/10^5$Pa	Mole fraction of methylamine in liquid, $x_{CH_3NH_2}$
283.15	100	0.133	0.153
	200	0.267	0.269
	300	0.400	0.363
	400	0.533	0.436
	500	0.667	0.496
	600	0.800	0.551
	700	0.933	0.604
	760	1.013	0.634

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Amine 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:

1. British Drug Houses or Cambrian Gases sample.

2. Purified and attested 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* 623-650.

2. Gerrard, W.
Solubility of Gases and Liquids. Plenum Press, New York. 1976. Chapter 1.

COMPONENTS:

1. Methanamine (Methylamine); CH_5N; [74-89-5]
2. Benzonitrile; C_7H_5N; [100-47-0]

ORIGINAL MEASUREMENTS:

Gerrard, W.

Solubility of Gases and Liquids, *Plenum* 1976, Chapter 10.

VARIABLES:

Pressure

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	P/mmHg	$P/10^5$Pa	Mole fraction of methylamine in liquid, $x_{CH_3NH_2}$
283.15	100	0.133	0.075
	200	0.267	0.140
	300	0.400	0.204
	400	0.533	0.273
	500	0.667	0.341
	600	0.800	0.411
	700	0.933	0.497
	760	1.013	0.516

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Amine 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:

1. British Drug Houses or Cambrian Gases sample.

2. Purified and attested 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* 623-650.

2. Gerrard, W.
Solubility of Gases and Liquids. Plenum Press, New York. 1976.
Chapter 1.

COMPONENTS:

1. Methanamine (Methylamine); CH_5N; [74-89-5]
2. 1-Methyl-2-nitrobenzene (*o*-nitrotoluene); $C_7H_7NO_2$; [88-72-2]

ORIGINAL MEASUREMENTS:

Gerrard, W.

Solubility of Gases and Liquids,

Plenum 1976, Chapter 10.

VARIABLES:

Pressure

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	P/mmHg	$P/10^5$Pa	Mole fraction of methylamine in liquid, $x_{CH_3NH_2}$
283.15	100	0.133	0.050
	200	0.267	0.105
	300	0.400	0.158
	400	0.533	0.205
	500	0.667	0.257
	600	0.800	0.311
	700	0.933	0.367
	760	1.013	0.408

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Amine 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:

1. British Drug Houses or Cambrian Gases sample.

2. Purified and attested 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* 623-650.

2. Gerrard, W.
Solubility of Gases and Liquids. Plenum Press, New York. 1976.
Chapter 1.

COMPONENTS:

1. Methanamine, (methylamine); CH_5N; [74-89-5]
2. Benzenemethanamine, (Benzylamine) C_7H_9N; [100-46-9]

ORIGINAL MEASUREMENTS:

Gerrard, W.

Solubility of Gases and Liquids, *Plenum*, 1976, Chapter 10.

VARIABLES:

Pressure

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	*P*/mmHg	$P/10^5$Pa	Mole fraction of methylamine in liquid, $x_{CH_3NH_2}$
283.15	100	0.133	0.084
	200	0.267	0.156
	300	0.400	0.224
	400	0.533	0.289
	500	0.667	0.355
	600	0.800	0.419
	700	0.933	0.482
	760	1.013	0.520

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Amine 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 abd procedure are described by Gerrard [1,2].

SOURCE AND PURITY OF MATERIALS:

1. British Drug Houses or Cambrian Gases sample.

2. Purified and attested 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* 623-650.

2. Gerrard, W.
Solubility of Gases and Liquids. Plenum Press, New York. 1976. Chapter 1.

COMPONENTS:	ORIGINAL MEASUREMENTS:
1. Methanamine (Methylamine); CH_5N; [74-89-5] 2. *N*-Methylaniline (*N*-methylbenzenamine); C_7H_9N; [100-61-8]	Gerrard, W. *Solubility of Gases and Liquids,* *Plenum* 1976, Chapter 10.
VARIABLES:	PREPARED BY:
Temperature, pressure	C. L. Young

EXPERIMENTAL VALUES:

T/K	*P*/mmHg	$P/10^5$Pa	Mole fraction of methylamine in liquid, $x_{CH_3NH_2}$
273.15	100	0.133	0.175
	200	0.267	0.309
	300	0.400	0.421
	400	0.533	0.509
	500	0.667	0.588
	600	0.800	0.666
	700	0.933	0.742
	760	1.013	0.788
283.15	100	0.133	0.126
	200	0.267	0.226
	300	0.400	0.312
	400	0.533	0.384
	500	0.667	0.447
	600	0.800	0.507
	700	0.933	0.564
	760	1.013	0.596

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Amine 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:

1. British Drug Houses or Cambrian Gases sample.

2. Purified and attested 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* 623-650.

2. Gerrard, W.
Solubility of Gases and Liquids. Plenum Press, New York. 1976. Chapter 1.

COMPONENTS:

1. Methanamine (Methylamine); CH_5N; [74-89-5]
2. *N*-Ethylaniline (*N*-ethylbenzenamine); $C_8H_{11}N$; [103-69-5]

ORIGINAL MEASUREMENTS:

Gerrard, W.

Solubility of Gases and Liquids, *Plenum* 1976, Chapter 10.

VARIABLES:

Temperature, pressure

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	*P*/mmHg	*P*/10^{5}Pa	Mole fraction of methylamine in liquid, $x_{CH_3NH_2}$
273.15	100	0.133	0.168
	200	0.267	0.300
	300	0.400	0.410
	400	0.533	0.495
	500	0.667	0.572
	600	0.800	0.650
	700	0.933	0.730
	760	1.013	0.780
283.15	100	0.133	0.117
	200	0.267	0.212
	300	0.400	0.300
	400	0.533	0.382
	500	0.667	0.438
	600	0.800	0.500
	700	0.933	0.557
	760	1.013	0.592

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Amine 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:

1. British Drug Houses or Cambrian Gases sample.

2. Purified and attested 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* 623-650.

2. Gerrard, W.
Solubility of Gases and Liquids. Plenum Press, New York. 1976.
Chapter 1.

COMPONENTS:	ORIGINAL MEASUREMENTS:
1. Methanamine (methylamine); CH_5N; [74-89-5] 2. 1-Octanamine (octylamine); $C_8H_{19}N$; [111-86-4]	Gerrard, W. *Solubility of Gases and Liquids*, *Plenum* 1976, Chapter 10.
VARIABLES:	PREPARED BY:
Pressure	C. L. Young

EXPERIMENTAL VALUES:

T/K	P/mmHg	$P/10^5$Pa	Mole fraction of methylamine in liquid, $x_{CH_3NH_2}$
283.15	100	0.133	0.066
	200	0.267	0.130
	300	0.400	0.196
	400	0.533	0.259
	500	0.667	0.325
	600	0.800	0.390
	700	0.933	0.455
	760	1.013	0.493

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Amine 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 controller to within 0.2K.
The apparatus and procedure are described by Gerrard [1,2].

SOURCE AND PURITY OF MATERIALS:

1. British Drug Houses or Cambrian Gases sample.

2. Purified and attested 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* 623-650.

2. Gerrard, W.
Solubility of Gases and Liquids. Plenum Press, New York. 1976.
Chapter 1.

COMPONENTS:	ORIGINAL MEASUREMENTS:
1. Methanamine (Methylamine); CH_5N; [74-89-5] 2. *N,N*-Dimethylaniline (*N,N*-dimethylbenzenamine); $C_8H_{11}N$; [121-69-7]	Gerrard, W. *Solubility of Gases and Liquids,* *Plenum* 1976, Chapter 10.
VARIABLES:	PREPARED BY:
Temperature, pressure	C. L. Young

EXPERIMENTAL VALUES:

T/K	P/mmHg	$P/10^5$Pa	Mole fraction of methylamine in liquid, $x_{CH_3NH_2}$
273.15	100	0.133	0.076
	200	0.267	0.149
	300	0.400	0.223
	400	0.533	0.302
	500	0.667	0.389
	600	0.800	0.488
	700	0.933	0.600
	760	1.013	0.672
283.15	100	0.133	0.050
	200	0.267	0.102
	300	0.400	0.153
	400	0.533	0.205
	500	0.667	0.256
	600	0.800	0.309
	700	0.933	0.366
	760	1.013	0.404

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Amine 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:

1. British Drug Houses or Cambrian Gases sample.

2. Purified and attested 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* 623-650.

2. Gerrard, W.
Solubility of Gases and Liquids.
Plenum Press, New York. 1976.
Chapter 1.

COMPONENTS:

1. Methanamine (Methylamine); CH_5N; [74-89-5]
2. *N*,*N*-Diethylaniline (*N*,*N*-diethylbenzenamine); $C_{10}H_{15}N$; [91-66-7]

ORIGINAL MEASUREMENTS:

Gerrard, W.

Solubility of Gases and Liquids,

Plenum 1976, Chapter 10.

VARIABLES:

Temperature, pressure

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	P/mmHg	$P/10^5$Pa	Mole fraction of methylamine in liquid, $x_{CH_3NH_2}$
273.15	100	0.133	0.073
	200	0.267	0.144
	300	0.400	0.215
	400	0.533	0.290
	500	0.667	0.376
	600	0.800	0.476
	700	0.933	0.584
	760	1.013	0.655
283.15	100	0.133	0.044
	200	0.267	0.088
	300	0.400	0.130
	400	0.533	0.174
	500	0.667	0.217
	600	0.800	0.263
	700	0.933	0.316
	760	1.013	0.360

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Amine was passed into a known weight or 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:

1. British Drug Houses or Cambrian Gases sample.

2. Purified and attested 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* 623-650.

2. Gerrard, W.
Solubility of Gases and Liquids. Plenum Press, New York. 1976. Chapter 1.

COMPONENTS:

1. Methanamine, (methylamine); CH_5N; [74-89-5]
2. Chlorinated methanes

ORIGINAL MEASUREMENTS:

Gerrard, W.

Solubility of Gases and Liquids, *Plenum*, 1976, Chapter 10.

VARIABLES:

Temperature, pressure

PREPARED BY:

C.L. Young

EXPERIMENTAL VALUES:

T/K	P/mmHg	$P/10^5$Pa	Mole fraction of methylamine in liquid, $x_{CH_3NH_2}$
	Trichloromethane (chloroform); $CHCl_3$; [67-66-3]		
273.15	760	1.013	0.778
283.15	700	0.933	0.614
	760	1.013	0.644
	Tetrachloromethane (carbon tetrachloride); CCl_4; [56-23-5]		
283.15	760	1.013	0.400

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Amine 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:

1. British Drug Houses or Cambrian Gases sample.

2. Purified and attested 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* 623-650.

2. Gerrard, W.
Solubility of Gases and Liquids. Plenum Press, New York. 1976.
Chapter 1.

COMPONENTS:

1. Methanamine, (methylamine); CH_5N; [74-89-5]
2. Tetrachloromethane (carbon tetrachloride); CCl_4; [56-23-5]

ORIGINAL MEASUREMENTS:

Wolff, H.; Würtz, R.
Ber. Bunsenges. Phys. Chem.
<u>1968</u>, *72*, 101-109.

VARIABLES:

Composition, temperature

PREPARED BY:

P. G. T. Fogg

EXPERIMENTAL VALUES:

Variation of total vapor pressure/Torr with variation of temperature and of mole fraction of CH_5N in the liquid phase, x_{CH_5N}

	T/K		
x_{CH_5N}	253.15	273.15	293.15
0	10.0	33.0	90.5
0.0099	18.5	51.6	126.6
0.0250	30.6	79.4	181.2
0.0511	48.1	121.0	265.2
0.0783	69.0	160.9	341.4
0.1016	79.4	193.8	416.0
0.128	91.7	227.6	486.5
0.154	103.7	256.2	536.9
0.201	127.1	313.0	662.7
0.254	149.2	369.0	783.6
0.301	165.6	413.5	882.6
0.353	184.2	461.3	991.4
0.401	199.9	503.1	1078.6
0.454	217.8	547.9	1179.9
0.502	232.4	587.0	1268.6
0.553	248.2	625.9	1347.3
0.605	264.1	667.2	1452.3

Cont.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Apparatus described previously was used (1), (2). Liquid mixtures of accurately known composition were introduced into a cell held in a thermostat controlled to ± 0.02°C. The total vapor pressure was measured by a mercury manometer but contact between vapor and mercury was avoided by using a sensitive quartz spiral manometer as a null instrument with pressure of vapor balanced against that of carbon dioxide. Metal taps were used so as to avoid contact between vapor and tap grease.

The authors calculated activity coefficients of each component from the vapor pressure data by a method described by Barker (3). Constants for Redlich-Kister equations (4) were evaluated and reported. The compositions of the vapor phase were also calculated by the authors.

SOURCE AND PURITY OF MATERIALS:

1. Prepared from commercial *reinst* methylammonium chloride; repeatedly fractionated until the first and last fractions had vapor pressures which differed by less than the limits of error of the pressure measurements (1).
2. Merck "Uvasol".

ESTIMATED ERROR:

$\delta T/K = \pm 0.02$ (estimated by authors)

REFERENCES:

1. Wolff, H.; Höpfner, A. *Z. Elektrochem.* <u>1962</u>, *66*, 149.
2. Wolff, H.; Höppel, H.-E. *Ber. Bunsenges. Phys.Chem.* <u>1966</u>, *70*, 874
3. Barker, J.A. *Aust. J. Chem.* <u>1953</u>, *6*, 207.
4. Redlich, O.; Kister, A.T. *Ind. Eng Chem.* <u>1948</u>, *21*, 345.

COMPONENTS:	ORIGINAL MEASUREMENTS:
1. Methanamine, (methylamine); CH_5N; [74-89-5] 2. Tetrachloromethane (carbon tetrachloride); CCl_4; [56-23-5]	Wolff, H.; Würtz, R. *Ber. Bunsenges. Phys. Chem.* 1968, *72*, 101-109.
VARIABLES: Composition, temperature	PREPARED BY: P. G. T. Fogg

EXPERIMENTAL VALUES: Cont.

x_{CH_5N}	T/K 253.15	 273.15	 293.15
0.652	277.9	703.6	1533.6
0.700	292.6	743.2	1616.9
0.801	323.4	820.1	1795.0
0.900	357.0	903.9	1978.2
1	394.2	1001.8	2191.7

760 Torr = 1 atm = 1.013×10^5 Pa

Constants for calculation of activity coefficients from the Redlich-Kister equations given below

T/K	A	B	C
253.15	0.650	-0.085	0.051
263.15	0.630	-0.071	0.027
273.15	0.587	-0.051	0.023
283.15	0.563	-0.036	0.025
293.15	0.524	- 0.030	0.025

$$\ln f_1 = A x_2^2 - B x_2^2(1 - 4x_1) + C x_2^2(1 - 8x_1 + 12x_1^2)$$
$$\ln f_2 = A x_1^2 + B x_1^2(1 - 4x_2) + C x_1^2(1 - 8x_2 + 12x_2^2)$$

where f_1 = activity coefficient of methylamine

f_2 = activity coefficient of carbon tetrachloride

x_1 = mole fraction of methylamine in the liquid phase

x_2 = mole fraction of carbon tetrachloride in the liquid phase

COMPONENTS:

1. Methanamine, (methylamine); CH_5N; [74-89-5]
2. Bromobenzene; C_6H_5Br; [108-86-1]

ORIGINAL MEASUREMENTS:

Gerrard, W.

Solubility of Gases and Liquids, *Plenum*, 1976, Chapter 10.

VARIABLES:

Pressure

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	*P*/mmHg	*P*/10^5Pa	Mole fraction of methylamine in liquid, $x_{CH_3NH_2}$
283.15	100	0.133	0.055
	200	0.267	0.105
	300	0.400	0.158
	400	0.533	0.212
	500	0.667	0.270
	600	0.800	0.333
	700	0.933	0.404
	760	1.013	0.454

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Amine 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 abosrbed 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:

1. British Drug Houses or Cambrian Gases sample.

2. Purified and attested 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, 22 623-650.

2. Gerrard, W.
Solubility of Gases and Liquids. Plenum Press, New York. 1976.
Chapter 1.

COMPONENTS:

1. Methanamine (Methylamine); CH_5N; [74-89-5]
2. 1-Bromo-3-methylbenzene (*m*-bromotoluene); C_7H_7Br; [95-46-5]

ORIGINAL MEASUREMENTS:

Gerrard, W.

Solubility of Gases and Liquids,

Plenum 1976, Chapter 10.

VARIABLES:

Pressure

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	P/mmHg	$P/10^5$Pa	Mole fraction of methylamine in liquid, $x_{CH_3NH_2}$
283.15	100	0.133	0.044
	200	0.267	0.089
	300	0.400	0.136
	400	0.533	0.185
	500	0.667	0.235
	600	0.800	0.288
	700	0.933	0.350
	760	1.013	0.395

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Amine 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:

1. British Drug Houses or Cambrian Gases sample.

2. Purified and attested 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* 623-650

2. Gerrard, W.
Solubility of Gases and Liquids, Plenum Press, New York. 1976.
Chapter 1.

COMPONENTS:	ORIGINAL MEASUREMENTS:
1. Methanamine (methylamine); CH_5N; [74-89-5] 2. 1-Bromonaphthalene; $C_{10}H_7Br$; [90-11-9]	Gerrard, W. *Solubility of Gases and Liquids, Plenum*, 1976, Chapter 10.
VARIABLES:	PREPARED BY:
Pressure	C. L. Young

EXPERIMENTAL VALUES:

T/K	P/mmHg	$P/10^5$Pa	Mole fraction of methylamine in liquid, $x_{CH_3NH_2}$
283.15	100	0.133	0.048
	200	0.267	0.095
	300	0.400	0.144
	400	0.533	0.191
	500	0.667	0.242
	600	0.800	0.295
	700	0.933	0.356
	760	1.013	0.397

AUXILIARY INFORMATION

METHOD APPARATUS/PROCEDURE:

Amine 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:

1. British Drug Houses or Cambrian Gases sample.
2. Purified and attested 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*, 623-650.
2. Gerrard, W. *Solubility of Gases and Liquids, Plenum Press, New York.* 1976, Chapter 1.

COMPONENTS:	ORIGINAL MEASUREMENTS:
1. Methanamine (Methylamine); CH_5N; [74-89-5] 2. 2,2,2-Trichloroethanol, (1,1,1-trichloro-2-hydroxyethane); $C_2H_3Cl_3O$; [115-20-8]	Gerrard, W. *Solubility of Gases and Liquids,* *Plenum* 1976, Chapter 10.
VARIABLES:	PREPARED BY:
Temperature, pressure	C. L. Young

EXPERIMENTAL VALUES:

T/K	P/mmHg	$P/10^5$Pa	Mole fraction of methylamine in liquid, $x_{CH_3NH_2}$
273.15	100	0.133	0.524
	200	0.267	0.581
	300	0.400	0.628
	400	0.533	0.676
	500	0.667	0.722
	600	0.800	0.766
	700	0.933	0.815
	760	1.013	0.848
278.15	700	0.933	0.760
	760	1.013	0.781
283.15	100	0.133	0.494
	200	0.267	0.552
	300	0.400	0.588
	400	0.533	0.624
	500	0.667	0.655
	600	0.800	0.683
	700	0.933	0.710
	760	1.013	0.723
293.15	100	0.133	0.464
	200	0.267	0.515
	300	0.400	0.548
	400	0.533	0.576
	500	0.667	0.600
	600	0.800	0.622
	700	0.933	0.642
	760	1.013	0.653

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Amine 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 abosrbed 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:

1. British Drug Houses or Cambrian Gases sample.

2. Purified and attested 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* 623-650.
2. Gerrard, W.
Solubility of Gases and Liquids. Plenum Press, New York. 1976. Chapter 1.

COMPONENTS:

1. *N*-Methylmethanamine, (dimethylamine); C_2H_7N; [124-40-3]
2. Hexane; C_6H_{14}; [110-54-3]

ORIGINAL MEASUREMENTS:

Wolff, H.; Höppel, H.-E.
Ber. Bunsenges. Phys. Chem.
1966, *70*, 874-883.

VARIABLES:

Composition, temperature

PREPARED BY:

P. G. T. Fogg

EXPERIMENTAL VALUES:

Variation of the total vapor pressure/Torr with variation of temperature and of mole fraction of C_2H_7N in the liquid phase, $x_{C_2H_7N}$

	T/K				
$x_{C_2H_7N}$	223.15	233.15	253.15	273.15	293.15
0	2.2	3.8	14.3	45.4	121.0
0.0126	3.6	6.8	23.7	66.0	159.8
0.0315	5.9	11.2	36.0	92.2	198.7
0.0498	7.7	14.8	45.7	110.0	239.7
0.0714	9.7	18.2	53.8	131.9	282.3
0.0860	10.3	20.3	59.8	147.3	314.0
0.1005	11.7	22.5	65.9	161.3	341.2
0.142	14.2	26.4	80.0	191.4	402.3
0.196	16.5	31.4	96.2	234.7	497.2
0.214	17.3	32.8	102.3	247.5	525.2
0.262	18.4	36.1	114.8	278.3	590.4
0.325	20.0	39.6	124.8	315.0	682.3
0.375	21.1	41.7	133.9	340.8	739.6
0.450	22.6	44.6	144.2	373.0	818.2
0.512	23.5	46.4	152.3	397.3	879.5
0.587	24.5	48.9	160.0	424.4	948.9
0.643	25.2	50.3	166.7	443.7	992.0

Cont.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Apparatus described previously was used (1). Liquid mixtures of accurately known composition were introduced into a cell held in a thermostat controlled to ± 0.02°C. The total vapor pressures were measured by a mercury manometer.

The authors calculated activity coefficients of each component from the vapor pressure data by a method described by Barker (2). Constants for Redlich-Kister equations (3) for activity coefficients were evaluated and reported. The compositions of the vapor phase were also calculated by the authors.

SOURCE AND PURITY OF MATERIALS:

1. Vacuum distilled; purity checked by i.r. spectrometry.
2. Supplied by FLUKA; purity 99.96 mol %.

ESTIMATED ERROR:

$\delta T/K = \pm 0.02$ (estimated by authors)

REFERENCES:

1. Wolff, H.; Höpfner, A. *Z. Elektrochem.* 1962, *66*, 149.
2. Barker, J.A. *Aust. J. Chem.* 1953, *6*, 207.
3. Redlich, O.; Kister, A.T. *Ind. Eng. Chem.* 1948, *21*, 345.

COMPONENTS:

1. *N*-Methylmethanamine, (dimethylamine); C_2H_7N; [124-40-3]
2. Hexane; C_6H_{14}; [110-54-3]

ORIGINAL MEASUREMENTS:

Wolff, H.; Höppel, H.-E.
Ber. Bunsenges. Phys. Chem. 1966, *70*, 874-883.

VARIABLES:

Composition, temperature

PREPARED BY:

P. G. T. Fogg

EXPERIMENTAL VALUES: Cont.

$x_{C_2H_7N}$	T/K 223.15	233.15	253.15	273.15	293.15
0.692	25.7	51.8	171.0	458.5	1030.9
0.760	26.3	52.7	178.3	478.0	1083.1
0.830	27.0	54.3	184.8	494.7	1120.5
0.867	27.4	55.3	188.5	506.5	1156.1
0.932	28.2	57.5	197.0	528.5	1201.6
0.956	28.6	58.6	201.0	537.8	1222.7
1	29.0	60.6	206.5	562.9	1271.5

760 Torr = 1 atm = 1.013×10^5 Pa

Constants for calculation of activity coefficients from the Redlich-Kister equations given below

T/K	A	B	C
223.15	1.496	0.149	0.216
233.15	1.385	0.065	0.159
243.15	1.304	0.061	0.118
253.15	1.192	0.069	0.111
263.15	1.092	0.122	0.111
273.15	0.965	0.082	0.096
283.15	0.901	0.116	0.086
293.15	0.811	0.133	0.103

$$\ln f_1 = A x_2^2 - B x_2^2(1 - 4 x_1) + C x_2^2(1 - 8 x_1 + 12 x_1^2)$$
$$\ln f_2 = A x_1^2 + B x_1^2(1 - 4 x_2) + C x_1^2(1 - 8 x_2 + 12 x_2^2)$$

where f_1 = activity coefficient of dimethylamine
f_2 = activity coefficient of hexane
x_1 = mole fraction of dimethylamine in the liquid phase
x_2 = mole fraction of hexane in the liquid phase.

Note: The authors, in a later paper (4), reported vapor pressure measurements on the same system which they considered to be more precise than measurements reported in this paper.

COMPONENTS:

1. *N*-Methylmethanamine, (dimethylamine); C_2H_7N; [124-40-3]
2. Hexane; C_6H_{14}; [110-54-3]

ORIGINAL MEASUREMENTS:

Wolff, H.; Würtz, R.
J. Phys. Chem.
<u>1970</u>, *74*, 1600-1606.

VARIABLES:

Composition, temperature

PREPARED BY:

P. G. T. Fogg

EXPERIMENTAL VALUES:

Variation of the total vapor pressure/Torr with variation of temperature and of mole fraction of C_2H_7N in the liquid phase, $x_{C_2H_7N}$

T/K

$x_{C_2H_7N}$	223.15	233.15	243.15	253.15	263.15	273.15	283.15	293.15
0	2.2	3.8	7.7	14.3	26.7	45.5	75.6	121.3
0.0206	4.7	9.0	15.9	27.4	45.6	73.3	113.5	171.6
0.0706	10.4	19.1	33.4	55.2	87.5	133.5	198.2	285.9
0.1014	12.8	23.2	41.5	68.7	108.4	164.9	243.1	347.7
0.1508	15.3	29.1	51.8	86.1	136.1	206.5	303.5	428.8
0.2008	17.3	33.2	59.9	98.8	160.8	245.3	360.7	512.4
0.2707	19.6	37.6	68.6	116.5	187.7	289.1	428.3	612.0
0.2720	19.6	37.7	68.8	117.2	188.3	290.1	430.4	615.0
0.4031	21.9	43.2	79.6	137.7	224.9	350.4	522.7	750.0
0.6022	24.3	49.4	92.1	162.1	268.2	424.7	644.0	939.9
0.7157	25.7	52.4	98.8	174.2	289.4	461.5	704.0	1031.1
1.0	30.3	61.7	117.4	208.9	349.8	560.7	862.4	1276.9

760 Torr = 1 atm = 1.013×10^5 Pa

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Apparatus described previously was used (1). Liquid mixtures of accurately known composition were introduced into a cell held in a thermostat controlled to ± 0.02°C. The total vapor pressure was measured by a mercury manometer.

The authors considered that these measurements were more precise than measurements on the same system which they had reported in an earlier paper (2).

The authors calculated activity coefficients of each component from the vapor pressure data by a method described by Barker (3). Constants for Redlich-Kister equations (4) for activity coefficients were evaluated and reported.

SOURCE AND PURITY OF MATERIALS:

1. Prepared from dimethylammonium chloride; repeatedly fractionated until first and last fractions had vapor pressures within 0.2 Torr.
2. Research grade from Phillips Petroleum Co., Bartlesville, Oklahoma.

ESTIMATED ERROR:

$\delta T/K = \pm 0.02$ (estimated by authors)

REFERENCES:

1. Wolff, H.; Höpfner, A. *Z. Elektrochem.* <u>1962</u>, *66*, 149.
2. Wolff, H.; Höpfner, A. *Ber. Bunsenges. Phys. Chem.* <u>1966</u>, *70*, 874.
3. Barker, J.A. *Aust. J. Chem.* <u>1953</u>, *6*, 207.
4. Redlich, O.; Kister, A.T. *Ind. Eng. Chem.* <u>1948</u>, *21*, 345.

COMPONENTS:

1. *N*-Methylmethanamine, (dimethylamine); C_2H_7N; [124-40-3]
2. Hexane; C_6H_{14}; [110-54-3]

ORIGINAL MEASUREMENTS:

Wolff, H.; Würtz, R.

J. Phys. Chem.

1970, *74*, 1600-1606.

EXPERIMENTAL VALUES:

Constants for calculation of activity coefficients from the Redlich-Kister equations given below

T/K	A	B	C
223.15	1.474	-0.059	0.076
233.15	1.404	+0.002	0.124
243.15	1.294	+0.002	0.089
253.15	1.187	+0.027	0.086
263.15	1.085	+0.035	0.055
273.15	0.989	+0.048	0.057
283.15	0.892	+0.045	0.050
293.15	0.794	+0.042	0.048

$$\ln f_1 = A\,x_2^2 - B\,x_2^2(1 - 4\,x_1) + C\,x_2^2(1 - 8\,x_1 + 12\,x_1^2)$$

$$\ln f_2 = A\,x_1^2 + B\,x_1^2(1 - 4\,x_2) + C\,x_1^2(1 - 8\,x_2 + 12\,x_2^2)$$

where f_1 = activity coefficient of dimethylamine

f_2 = activity coefficient of hexane

x_1 = mole fraction of dimethylamine in the liquid phase

x_2 = mole fraction of hexane in the liquid phase.

COMPONENTS:

1. *N*-Methylmethanamine, (dimethylamine); C_2H_7N; [124-40-3]
2. Decane; $C_{10}H_{22}$; [124-18-5]

ORIGINAL MEASUREMENTS:

Gerrard, W.

Solubility of Gases and Liquids, *Plenum*, 1976, Chapter 10.

VARIABLES:

Temperature, pressure

PREPARED BY:

C.L. Young

EXPERIMENTAL VALUES:

T/K	P/mmHg	$P/10^5$Pa	Mole fraction of dimethylamine in liquid, $x_{(CH_3)_2NH}$
283.15	100	0.133	0.068
	200	0.267	0.140
	300	0.400	0.235
	400	0.533	0.338
	500	0.667	0.456
	600	0.800	0.598
	700	0.933	0.755
	760	1.013	0.840
288.15	760	1.013	0.665
293.15	100	0.133	0.065
	200	0.267	0.110
	300	0.400	0.168
	400	0.533	0.225
	500	0.667	0.288
	600	0.800	0.352
	700	0.933	0.436
	760	1.013	0.501
298.15	760	1.013	0.390

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Amine 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 abosrbed 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:

1. British Drug Houses or Cambrian Gases sample.

2. Purified and attested 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* 623-650.

2. Gerrard, W.
Solubility of Gases and Liquids. Plenum Press, New York. 1976.
Chapter 1.

COMPONENTS:

1. *N*-Methylmethanamine, (dimethylamine); C_2H_7N; [124-40-3]
2. Aromatic hydrocarbons

ORIGINAL MEASUREMENTS:

Gerrard, W.

Solubility of Gases and Liquids, *Plenum*, 1976, Chapter 10.

VARIABLES:

Temperature, pressure

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	P/mmHg	$P/10^5$Pa	Mole fraction of dimethylamine in liquid, $x_{(CH_3)_2NH}$
	Benzene; C_6H_6; [71-43-2]		
293.15	760	1.013	0.541
	Methylbenzene (toluene); C_7H_8; [108-88-3]		
293.15	760	1.013	0.580
	1,3-Dimethylbenzene (*m*-xylene); C_8H_{10}; [108-38-3]		
283.15	100	0.133	0.070
	200	0.267	0.157
	300	0.400	0.262
	400	0.533	0.382
	500	0.667	0.517
	600	0.800	0.651
	700	0.933	0.790
	760	1.013	0.862
293.15	400	0.533	0.260
	500	0.667	0.336
	600	0.800	0.415
	700	0.933	0.504
	760	1.013	0.564

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Amine 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:

1. British Drug Houses or Cambrian Gases sample.

2. Purified and attested 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* 623-650.

2. Gerrard, W.
Solubility of Gases and Liquids. *Plenum Press, New York.* 1976. Chapter 1.

COMPONENTS:

1. *N*-Methylmethanamine (dimethylamine); C_2H_7N; [124-40-3]
2. 1,3,5-Trimethylbenzene (mesitylene); C_9H_{12}; [108-67-8]

ORIGINAL MEASUREMENTS:

Gerrard, W.

Solubility of Gases and Liquids, *Plenum*, 1976, Chapter 10.

VARIABLES:

Pressure

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	P/mmHg	$P/10^5$Pa	Mole fraction of dimethylamine in liquid, $x_{(CH_3)_2NH}$
293.15	100	0.133	0.060
	200	0.267	0.124
	300	0.400	0.188
	400	0.533	0.255
	500	0.667	0.327
	600	0.800	0.404
	700	0.933	0.492
	760	1.013	0.549

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Amine 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:

1. British Drug Houses or Cambrian Gases sample.

2. Purified and attested 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* 623-650.

2. Gerrard, W.
Solubility of Gases and Liquids. *Plenum Press, New York.* 1976.
Chapter 1.

COMPONENTS:	ORIGINAL MEASUREMENTS:
1. N-Methylmethanamine, (Dimethylamine); C_2H_7N; [124-40-3] 2. Methanol; CH_4O; [67-56-1]	Niepel, W.; Novak, J.P.; Matous, J.; Sobr, J. *Chem. Zvesti* 1972, *26* (1), 44-48.
VARIABLES:	PREPARED BY:
Temperature, pressure	P. G. T. Fogg

EXPERIMENTAL VALUES:

T/K	p_{total}/Torr	$p_{C_2H_7N}$/Torr*	$x_{C_2H_7N}$
293.2	744.5	734	0.669
	786.5	778	0.6945
	836.5	829	0.7205
	889.5	883	0.7485
298.2	740	721	0.597
	766	748	0.616
	790	772	0.6285
	813	797	0.640
	835	820	0.6455
	840	825	0.646
	862	848	0.655
	884	870	0.660
303.2	744.5	712	0.542
	788.5	758	0.5565
	836.5	808	0.572
313.2	748	671	0.4505
	791	718	0.4655
	841.5	774	0.4845
	891	830	0.5065

Cont.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Dimethylamine from a cylinder was bubbled through the solvent in three thermostatted glass vessels in series. The total pressure above each vessel was measured. The absorption of dimethylamine was estimated by reacting weighed samples of solutions with standard sulphuric acid and back-titrating with standard sodium hydroxide solution.

The authors gave equations to calculate activity coefficients of dimethylamine and of methanol which were derived from the experimental data.

SOURCE AND PURITY OF MATERIALS:

1. Obtained from a cylinder supplied by FLUKA A.G.; at least 97% pure with methylamine and trimethylamine as impurities.
2. Supplied by Lachema, Brno; distilled through a 60 theoretical plate column; density (25°C) 0.7866; n_D (25°C) 1.3266.

ESTIMATED ERROR:

REFERENCES:

1. Wichterle, I.; Linek, J. *Antoine Vapor Pressure Constants of Pure Compounds*, Academia, Prague. 1971.

COMPONENTS:	ORIGINAL MEASUREMENTS:
1. *N*-Methylmethanamine, (dimethylamine); C_2H_7N; [124-40-3] 2. Methanol; CH_4O; [67-56-1]	Niepel, W.; Novak, J.P.; Matous, J.; Sobr, J. *Chem. Zvesti* 1972, *26*, 44-48.

EXPERIMENTAL VALUES: Cont.

* The partial pressure of dimethylamine was calculated by the compiler by subtracting the partial pressure of the solvent from the total pressure. The compiler assumed that the partial pressure of methanol was equal, in each case, to the product of the vapor pressure of pure methanol, the mole fraction of methanol in the solution and the activity coefficient of methanol as calculated from the equation given. The vapor pressure of pure methanol was calculated by the compiler from an Antoine type equation using constants from other work (ref. (1)) quoted in the paper. (The compiler noted an error in a sign in the Antoine equation given.)

The authors gave the following equations for activity coefficients:

$$\log_{10} f_1 = x_2^2 [-0.9829 + 0.25 (3 x_1 - x_2)]$$

$$\log_{10} f_2 = x_1^2 [-0.9829 + 0.25 (x_1 - 3 x_2)]$$

where f_1 = activity coefficient of dimethylamine
f_2 = activity coefficient of methanol
x_1 = mole fraction of dimethylamine in the liquid phase
x_2 = mole fraction of methanol in the liquid phase

COMPONENTS:

1. *N*-Methylmethanamine, (Dimethylamine); C_2H_7N; [124-40-3]
2. Ethanol, C_2H_6O; [64-17-5]

ORIGINAL MEASUREMENTS:

Niepel, W.; Novak, J.P.; Matous, J.; Sobr, J.

Chem. Zvesti

1972, *26* (1), 44-48.

VARIABLES:

Temperature, pressure

PREPARED BY:

P. G. T. Fogg

EXPERIMENTAL VALUES:

T/K	p_{total}/Torr	$p_{C_2H_7N}$/Torr*	$x_{C_2H_7N}$
293.2	744	737	0.659
	789	783	0.6835
	840	835	0.7145
	890	885	0.7415
298.2	748	735	0.5865
	789.5	777	0.604
	844.5	834	0.6305
	902.5	893	0.6575
303.2	748.5	727	0.534
	789	769	0.547
	841	822	0.5665
	894	876	0.5815
313.2	747	693	0.420
	787.5	736	0.4335
	842.5	795	0.4545
	889.5	844	0.4705

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Dimethylamine from a cylinder was bubbled through the solvent in three thermostatted glass vessels in series. The total pressure above each vessel was measured. The absorption of dimethylamine was estimated by reacting weighed samples of solutions with standard sulphuric acid and back-titrating with standard sodium hydroxide solution.

The authors gave equations to calculate activity coefficients of dimethylamine and of ethanol which were derived from the experimental data.

SOURCE AND PURITY OF MATERIALS:

1. Obtained from a cylinder supplied by FLUKA A.G.; at least 97% pure with methylamine and trimethylamine as impurities.
2. Prepared from commercial ethanol by azeotropic distillation with excess benzene; density (25°C) 0.7854; n_D (25°C) 1.3590.

ESTIMATED ERROR:

REFERENCES:

1. Wichterle, I. ; Linek, J. *Antoine Vapor Pressure Constants of Pure Compounds*, Academia, Prague. 1971.

COMPONENTS:	ORIGINAL MEASUREMENTS:
1. *N*-Methylmethanamine (dimethylamine); C_2H_7N; [124-40-3] 2. Ethanol; C_2H_6O; [64-17-5]	Niepel, W.; Novak, J.P.; Matous, J.; Sobr, J. *Chem. Zvesti* 1972, *26*, 44-48.

EXPERIMENTAL VALUES:

* The partial pressure of dimethylamine was calculated by the compiler by subtracting the partial pressure of the solvent from the total pressure. The compiler assumed that the partial pressure of ethanol was equal, in each case, to the product of the vapor pressure of pure ethanol, the mole fraction of ethanol in the solution and the activity coefficient of ethanol as calculated from the equations given. The vapor pressure of pure ethanol was calculated from an Antoine type equation using constants from other work (ref. (1)) quoted in the paper. (The compiler noted an error in a sign in the Antoine equation given.)

The authors gave the following equations for activity coefficients:

$$\log_{10} f_1 = x_2^2 \, [-0.6691 + 0.13 \, (3\, x_1 - x_2)]$$

$$\log_{10} f_2 = x_1^2 \, [-0.6691 + 0.13 \, (x_1 - 3\, x_2)]$$

where f_1 = activity coefficient of dimethylamine

f_2 = activity coefficient of ethanol

x_1 = mole fraction of dimethylamine in the liquid phase

x_2 = mole fraction of ethanol in the liquid phase

COMPONENTS:

1. *N*-Methylmethanamine, (Dimethylamine); C_2H_7N; [124-40-3]
2. 1-Propanol; C_3H_8O; [71-23-8]

ORIGINAL MEASUREMENTS:

Niepel, W.; Novak, J.P.; Matous, J.; Sobr, J.

Chem. Zvesti

1972, *26*, 44-48.

VARIABLES:

Temperature, pressure

PREPARED BY:

P. G. T. Fogg

EXPERIMENTAL VALUES:

T/K	p_{total}/Torr	$p_{C_2H_7N}$/Torr*	$x_{C_2H_7N}$
293.2	744	742	0.6845
	796	794	0.712
	845	844	0.742
	897	896	0.767
298.2	742	738	0.6045
	787	783	0.628
	839	836	0.652
	891	888	0.6765
303.2	746	739	0.551
	796	790	0.575
	841	835	0.595
	893	888	0.614
313.2	745	726	0.4475
	750	731	0.451
	795	778	0.4745
	845	829	0.4945
	895	880	0.510

760 Torr = 1 atm = 1.013×10^5 Pa

Cont.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Dimethylamine from a cylinder was bubbled through the solvent in three thermostatted glass vessels in series The total pressure above each vessel was measured. The absorption of dimethylamine was estimated by reacting weighed samples of solutions with standard sulphuric acid and back-titrating with standard sodium hydroxide solution.

The authors gave equations to calculate activity coefficients of dimethylamine and of propanol which were derived from the experimental data.

SOURCE AND PURITY OF MATERIALS:

1. Obtained from a cylinder supplied by FLUKA A.G.; at least 97% pure with methylamine and trimethylamine as impurities.
2. Supplied by Lachema, Brno; distilled through a 60 theoretical plate column; density (25°C) 0.8035; n_D(25°C) 1.3266.

ESTIMATED ERROR:

REFERENCES:

1. Wichterle, I.; Linek, J. *Antoine Vapor Pressure Constants of Pure Compounds*, Academia, Prague, 1971.

COMPONENTS:	ORIGINAL MEASUREMENTS:
1. *N*-Methylmethanamine, (dimethylamine) C_2H_7N; [124-40-3] 2. 1-Propanol; C_3H_8O; [71-23-8]	Niepel, W.; Novak, J.P.; Matous, J.; Sobr, J. *Chem. Zvesti* 1972, *26*, 44-48.

EXPERIMENTAL VALUES: Cont.

* The partial pressure of dimethylamine was calculated by the compiler by subtracting the partial pressure of the solvent from the total pressure. The compiler assumed that the partial pressure of methanol was equal, in each case, to the product of the vapor pressure of pure propanol, the mole fraction of propanol in the solution and the activity coefficient of propanol as calculated from the equations given. The vapor pressure of pure propanol was calculated by the compiler from an Antoine type equation using constants from other work (1) quoted in the paper.

The authors gave the following equations for activity coefficients:

$$\log_{10} f_1 = x_2^2 \, [-0.7397 + 0.05\,(3\,x_1 - x_2)]$$

$$\log_{10} f_2 = x_1^2 \, [-0.7397 + 0.05\,(x_1 - 3\,x_2)]$$

where f_1 = activity coefficient of dimethylamine

f_2 = activity coefficient of 1-propanol

x_1 = mole fraction of dimethylamine in the liquid phase

x_2 = mole fraction of 1-propanol in the liquid phase

COMPONENTS:	ORIGINAL MEASUREMENTS:
1. *N*-Methylmethanamine,[1] (dimethylamine); C_2H_7N; [124-40-3] 2. 1-Octanol; $C_8H_{18}O$; [111-87-5] or 1-Butanol; $C_4H_{10}O$; [71-36-3]	Gerrard, W. *Solubility of Gases and Liquids*, *Plenum* 1976, Chapter 10.
VARIABLES:	**PREPARED BY:**
Temperature, pressure	C. L. Young

EXPERIMENTAL VALUES:

T/K	P/mmHg	$P/10^5$Pa	Mole fraction of dimethylamine in liquid, $x_{(CH_3)_2NH}$
		1-butanol	
293.15	760	1.013	0.709
		1-octanol	
283.15	100	0.133	0.332
	200	0.267	0.442
	300	0.400	0.530
	400	0.533	0.616
	500	0.667	0.696
	600	0.800	0.775
	700	0.933	0.848
	760	1.013	0.894
293.15	100	0.133	0.261
	200	0.267	0.371
	300	0.400	0.455
	400	0.533	0.520
	500	0.667	0.575
	600	0.800	0.634
	700	0.933	0.686
	760	1.013	0.719

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Amine 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:

1. British Drug Houses or Cambrian Gases sample.

2. Purified and attested 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* 623-650.

2. Gerrard, W.
Solubility of Gases and Liquids. Plenum Press, New York. 1976.
Chapter 1.

COMPONENTS:	ORIGINAL MEASUREMENTS:
1. *N*-Methylmethanamine (dimethylamine); C_2H_7N; [124-40-3] 2. 1,2-Ethanediol (Ethylene glycol); $C_2H_6O_2$; [107-21-1]	Gerrard, W. *Solubility of Gases and Liquids*, *Plenum* 1976, Chapter 10.
VARIABLES:	**PREPARED BY:**
Pressure	C. L. Young

EXPERIMENTAL VALUES:

T/K	P/mmHg	$P/10^5$Pa	Mole fraction of dimethylamine in liquid, $x_{(CH_3)_2NH}$
293.15	100	0.133	0.267
	200	0.267	0.382
	300	0.400	0.455
	400	0.533	0.524
	500	0.667	0.584
	600	0.800	0.637
	700	0.933	0.685
	760	1.013	0.719

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Amine 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:

1. British Drug Houses or Cambrian Gases sample.

2. Purified and attested 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* 623-650.

2. Gerrard, W.
Solubility of Gases and Liquids. Plenum Press, New York. 1976. Chapter 1.

COMPONENTS:

1. N-Methylmethanamine (dimethylamine); C_2H_7N; [124-40-3]
2. 1,2,3-Propanetriol (Glycerol); $C_3H_8O_3$; [56-81-5]

ORIGINAL MEASUREMENTS:

Gerrard, W.

Solubility of Gases and Liquids, *Plenum* 1976, Chapter 10.

VARIABLES:

Pressure

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	P/mmHg	$P/10^5$Pa	Mole fraction of dimethylamine in liquid, $x_{(CH_3)_2NH}$
293.15	100	0.133	0.300
	200	0.267	0.430
	300	0.400	0.520
	400	0.533	0.584
	500	0.667	0.636
	600	0.800	0.690
	700	0.933	0.736
	760	1.013	0.759

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Amine 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 abosrbed 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:

1. British Drug Houses or Cambrian Gases sample.

2. Purified and attested 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* 623-650.

2. Gerrard, W.
Solubility of Gases and Liquids. Plenum Press, New York. 1976. Chapter 1.

COMPONENTS:

1. *N*-Methylmethanamine, (dimethylamine); C_2H_7N; [124-40-3]
2. 1,2,3-Propanetriol (glycerol); $C_3H_8O_3$; [56-81-5]

ORIGINAL MEASUREMENTS:

Copley, M.J.; Ginsberg, E.; Zellhoefer, G.F.; Marvel, C.S.
J. Amer. Chem. Soc.
1941, *63*, 254-256.

VARIABLES:

PREPARED BY:

P. G. T. Fogg

EXPERIMENTAL VALUES:

T/K	$p_{C_2H_7N}$/mmHg*	Mole fraction $x_{C_2H_7N}$
305.4	691	0.572

760 mmHg = 1 atm = 1.013×10^5 Pa.

* The pressure of dimethylamine was said by the authors to correspond to its vapor pressure at 4.5°C. The magnitude of this pressure has been estimated by the compiler from vapor pressure data given in ref. (1).

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The absorption apparatus was developed for studies of refrigeration systems (ref. (2)) and consisted of a copper drum, 4 x 12 cm, fitted with a needle valve and two-way outlet with one outlet connected to a manometer. The drum was evacuated to a pressure of 1 mmHg and about 40 cm^3 of solvent drawn into this drum which was then reweighed and immersed in a water bath at 32.2°C. The drum was agitated and gaseous dimethylamine allowed to flow slowly into it. The final pressure in the drum corresponded to the vapor pressure of dimethylamine at 4.5°C. The magnitude of this pressure was not stated by the authors. The drum and contents were weighed again to find the weight of gas which had been absorbed.

SOURCE AND PURITY OF MATERIALS:

The authors stated that the materials used were all purified carefully by chemical means and fractional distillation where feasible.

ESTIMATED ERROR:

REFERENCES:

1. Dreisbach, R.R. *Physical Properties of Chemical Compounds* Vol. 2, A.C.S., Washington. 1959.
2. Zellhoefer, G.F. *Ind. Eng. Chem.* 1937, *29*, 548.

COMPONENTS:

1. *N*-Methylmethanamine (dimethylamine); C_2H_7N; [124-40-3]
2. 1,4-Dioxane; $C_4H_8O_2$; [123-91-1]

ORIGINAL MEASUREMENTS:

Gerrard, W.

Solubility of Gases and Liquids,

Plenum 1976, Chapter 10.

VARIABLES:

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	P/mmHg	$P/10^5$Pa	Mole fraction of dimethylamine in liquid, $x_{(CH_3)_2NH}$
293.15	760	1.013	0.549

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Amine 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:

1. British Drug Houses or Cambrian Gases sample.

2. Purified and attested 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* 623-650.

2. Gerrard, W.
Solubility of Gases and Liquids. Plenum Press, New York. 1976. Chapter 1.

COMPONENTS:	ORIGINAL MEASUREMENTS:
1. *N*-Methylmethanamine (dimethylamine); C_2H_7N; [124-40-3] 2. Benzenemethanol (Benzyl alcohol); C_7H_8O; [100-51-6]	Gerrard, W. *Solubility of Gases and Liquids,* *Plenum* 1976, Chapter 10.
VARIABLES:	**PREPARED BY:**
Temperature, pressure	C. L. Young

EXPERIMENTAL VALUES:

T/K	*P*/mmHg	*P*/10⁵Pa	Mole fraction of dimethylamine in liquid, $x_{(CH_3)_2NH}$
283.15	100	0.133	0.388
	200	0.267	0.486
	300	0.400	0.558
	400	0.533	0.625
	500	0.667	0.696
	600	0.800	0.760
	700	0.933	0.830
	760	1.013	0.875
288.15	760	1.013	0.783
293.15	100	0.133	0.340
	200	0.267	0.422
	300	0.400	0.480
	400	0.533	0.536
	500	0.667	0.587
	600	0.800	0.631
	700	0.933	0.675
	760	1.013	0.705

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Amine 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:

1. British Drug Houses or Cambrian Gases sample.

2. Purified and attested 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, 22 623-650.

2. Gerrard, W.
Solubility of Gases and Liquids. *Plenum Press, New York.* 1976.
Chapter 1.

COMPONENTS:

1. *N*-Methylmethanamine (dimethylamine); C_2H_7N; [124-40-3]
2. 1-Phenylethanone (methyl phenyl ketone); C_8H_8O; [98-86-2]

ORIGINAL MEASUREMENTS:

Gerrard, W.

Solubility of Gases and Liquids,

Plenum 1976, Chapter 10.

VARIABLES:

Pressure

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	P/mmHg	$P/10^5$Pa	Mole fraction of dimethylamine in liquid, $x_{(CH_3)_2NH}$
293.15	100	0.133	0.068
	200	0.267	0.135
	300	0.400	0.204
	400	0.533	0.276
	500	0.667	0.344
	600	0.800	0.418
	700	0.933	0.500
	760	1.013	0.559

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Amine 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 abosrbed 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:

1. British Drug Houses or Cambrian Gases sample.

2. Purified and attested 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, 22 623-650.
2. Gerrard, W.
Solubility of Gases and Liquids. Plenum Press, New York. 1976. Chapter 1.

COMPONENTS:

1. *N*-Methylmethanamine (dimethylamine); C_2H_7N; [124-40-3]
2. Ethoxybenzene (ethyl phenyl ether); $C_8H_{10}O$; [103-73-1]

ORIGINAL MEASUREMENTS:

Gerrard, W.

Solubility of Gases and Liquids, *Plenum* 1976, Chapter 10.

VARIABLES:

Pressure

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	P/mmHg	$P/10^5$Pa	Mole fraction of dimethylamine in liquid, $x_{(CH_3)_2NH}$
293.15	100	0.133	0.067
	200	0.267	0.136
	300	0.400	0.206
	400	0.533	0.278
	500	0.667	0.350
	600	0.800	0.423
	700	0.933	0.502
	760	1.013	0.554

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Amine 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:

1. British Drug Houses or Cambrian Gases sample.

2. Purified and attested 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* 623-650.
2. Gerrard, W.
Solubility of Gases and Liquids. Plenum Press, New York. 1976.
Chapter 1.

COMPONENTS:	ORIGINAL MEASUREMENTS:
1. *N*-Methylmethanamine (dimethylamine); C_2H_7N; [124-40-3] 2. Benzoic acid, ethyl ester (ethyl benzoate); $C_9H_{10}O_2$; [93-89-0]	Gerrard, W. *Solubility of Gases and Liquids,* *Plenum* 1976, Chapter 10.
VARIABLES:	**PREPARED BY:**
Pressure	C. L. Young

EXPERIMENTAL VALUES:

T/K	P/mmHg	$P/10^5$Pa	Mole fraction of dimethylamine in liquid, $x_{(CH_3)_2NH}$
293.15	100	0.133	0.072
	200	0.267	0.146
	300	0.400	0.218
	400	0.533	0.291
	500	0.667	0.367
	600	0.800	0.442
	700	0.933	0.523
	760	1.013	0.572

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Amine 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:

1. British Drug Houses or Cambrian Gases sample.

2. Purified and attested 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, 22 623-650.

2. Gerrard, W.
Solubility of Gases and Liquids.
Plenum Press, New York. 1976.
Chapter 1.

COMPONENTS:	ORIGINAL MEASUREMENTS:
1. *N*-Methylmethanamine (dimethylamine); C_2H_7N; [124-40-3] 2. 1,1'-Oxybispentane (dipentyl ether); $C_{10}H_{22}O$; [693-65-2]	Gerrard, W. *Solubilities of Gases and Liquids, Plenum* 1976, Chapter 10.
VARIABLES:	PREPARED BY:
Pressure	C. L. Young

EXPERIMENTAL VALUES:

T/K	*P*/mmHg	*P*/10^5Pa	Mole fraction of dimethylamine in liquid, $x_{(CH_3)_2NH}$
293.15	100	0.133	0.080
	200	0.267	0.160
	300	0.400	0.240
	400	0.533	0.318
	500	0.667	0.397
	600	0.800	0.477
	700	0.933	0.554
	760	1.013	0.596

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Amine 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:

1. British Drug Houses or Cambrian Gases sample.

2. Purified and attested 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* 623-650.
2. Gerrard, W.
Solubility of Gases and Liquids. Plenum Press, New York. 1976.
Chapter 1.

COMPONENTS:

1. *N*-Methylmethanamine (dimethylamine); C_2H_7; [124-40-3]
2. 1,1'-Oxybisoctane (dioctyl ether); $C_{16}H_{34}O$; [629-82-3]

ORIGINAL MEASUREMENTS:

Gerrard, W.

Solubility of Gases and Liquids,

Plenum 1976, Chapter 10.

VARIABLES:

Pressure

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	*P*/mmHg	$P/10^5$Pa	Mole fraction of dimethylamine in liquid, $x_{(CH_3)_2NH}$
293.15	100	0.133	0.090
	200	0.267	0.173
	300	0.400	0.253
	400	0.533	0.330
	500	0.667	0.404
	600	0.800	0.477
	700	0.933	0.559
	760	1.013	0.605

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Amine 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:

1. British Drug Houses or Cambrian Gases sample.

2. Purified and attested 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
623-650.

2. Gerrard, W.
Solubility of Gases and Liquids.
Plenum Press, New York. 1976.
Chapter 1.

COMPONENTS:

1. *N*-Methylmethanamine (dimethylamine); C_2H_7N; [124-40-3]
2. *N,N*-Dimethylformamide; C_3H_7NO; [68-12-2]

ORIGINAL MEASUREMENTS:

Gerrard, W.

Solubility of Gases and Liquids, *Plenum* 1976, Chapter 10.

VARIABLES:

Temperature, pressure

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	P/mmHg	$P/10^5$Pa	Mole fraction of dimethylamine in liquid, $x_{(CH_3)_2NH}$
283.15	100	0.133	0.066
	200	0.267	0.155
	300	0.400	0.255
	400	0.533	0.364
	500	0.667	0.490
	600	0.800	0.625
	700	0.933	0.766
	760	1.013	0.848
288.15	760	1.013	0.686
293.15	200	0.267	0.102
	300	0.400	0.160
	400	0.533	0.221
	500	0.667	0.294
	600	0.800	0.375
	700	0.933	0.461
	760	1.013	0.511
298.15	760	1.013	0.412

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Amine 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:

1. British Drug Houses or Cambrian Gases sample.

2. Purified and attested 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* 623-650.

2. Gerrard, W.
Solubility of Gases and Liquids, *Plenum Press, New York.* 1976.
Chapter 1.

COMPONENTS:

1. *N*-Methylmethanamine (dimethylamine); C_2H_7N; [124-40-3]
2. Pyridine; C_5H_5N; [110-86-1] or Quinoline; C_9H_7N; [91-22-5]

ORIGINAL MEASUREMENTS:

Gerrard, W.

Solubility of Gases and Liquids, *Plenum* 1976, Chapter 10.

VARIABLES:

Pressure

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	P/mmHg	$P/10^5$Pa	Mole fraction of dimethylamine in liquid, $x_{(CH_3)_2NH}$
		Pyridine; C_5H_5N; [110-86-1]	
293.15	700	0.933	0.507
	760	1.013	0.564
		Quinoline; C_9H_7N; [91-22-5]	
293.15	100	0.133	0.060
	200	0.267	0.126
	300	0.400	0.191
	400	0.533	0.255
	500	0.667	0.322
	600	0.800	0.394
	700	0.933	0.472
	760	1.013	0.522

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Amine 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 manaully controlled to within 0.2K.
The apparatus and procedure are described by Gerrard [1,2].

SOURCE AND PURITY OF MATERIALS:

1. British Drug Houses or Cambrian Gases sample.

2. Purified and attested by conventional procedures.

ESTIMATED ERROR:

$\delta T/K$ - ±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. *N*-Methylmethanamine (dimethylamine); C_2H_7N; [124-40-3]

2. Nitrobenzene; $C_6H_5NO_2$; [98-95-3]

ORIGINAL MEASUREMENTS:

Gerrard, W.

Solubility of Gases and Liquids,

Plenum 1976, Chapter 10.

VARIABLES:

Pressure

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	P/mmHg	$P/10^5$Pa	Mole fraction of dimethylamine in liquid, $x_{(CH_3)_2NH}$
293.15	100	0.133	0.053
	200	0.267	0.110
	300	0.400	0.169
	400	0.533	0.233
	500	0.667	0.300
	600	0.800	0.375
	700	0.933	0.456
	760	1.013	0.506

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Amine was passed into a known weight of pure liquid in a bubbler tube at a total pressure measured by 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:

1. British Drug Houses or Cambrian Gases sample.

2. Purified and attested 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* 623-650.

2. Gerrard, W.
Solubility of Gases and Liquids. Plenum Press, New York. 1976. Chapter 1.

COMPONENTS:	ORIGINAL MEASUREMENTS:
1. *N*-Methylmethanamine (dimethylamine); C_2H_7N; [124-40-3] 2. Benzenamine (Aniline); C_6H_7N; [62-53-3]	Gerrard, W. *Solubility of Gases and Liquids,* *Plenum* 1976, Chapter 10.
VARIABLES:	PREPARED BY:
Pressure	C. L. Young

EXPERIMENTAL VALUES:

T/K	P/mmHg	$P/10^5$Pa	Mole fraction of dimethylamine in liquid, $x_{(CH_3)_2NH}$
293.15	100	0.133	0.137
	200	0.267	0.253
	300	0.400	0.350
	400	0.533	0.437
	500	0.667	0.515
	600	0.800	0.584
	700	0.933	0.648
	760	1.013	0.687

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Amine 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:

1. British Drug Houses or Cambrian Gases sample.

2. Purified and attested 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* 623-650.

2. Gerrard, W.
Solubility of Gases and Liquids. Plenum Press, New York. 1976.
Chapter 1.

COMPONENTS:

1. *N*-Methylmethanamine (dimethylamine); C_2H_7N; [124-40-3]
2. Benzonitrile; C_7H_5N; [100-47-0]

ORIGINAL MEASUREMENTS:

Gerrard, W.

Solubility of Gases and Liquids, Plenum 1976, Chapter 10.

VARIABLES:

Temperature, pressure

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	P/mmHg	$P/10^5$Pa	Mole fraction of dimethylamine in liquid, $x_{(CH_3)_2NH}$
283.15	100	0.133	0.100
	200	0.267	0.200
	300	0.400	0.310
	400	0.533	0.424
	500	0.667	0.540
	600	0.800	0.660
	700	0.933	0.780
	760	1.013	0.848
293.15	100	0.133	0.075
	200	0.267	0.150
	300	0.400	0.224
	400	0.533	0.296
	500	0.667	0.368
	600	0.800	0.443
	700	0.933	0.524
	760	1.013	0.576

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Amine 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 abosrbed 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:

1. British Drug Houses or Cambrian Gases sample.

2. Purified and attested 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* 623-650.
2. Gerrard, W.
Solubility of Gases and Liquids. Plenum Press, New York. 1976.
Chapter 1.

COMPONENTS:	ORIGINAL MEASUREMENTS:
1. *N*-Methylmethanamine (dimethylamine); C_2H_7N; [124-40-3] 2. 1-Methyl-2-nitrobenzene (*o*-nitrotoluene); $C_7H_7NO_2$; [88-72-2]	Gerrard, W. *Solubility of Gases and Liquids, Plenum* 1976, Chapter 10.
VARIABLES:	PREPARED BY:
Pressure	C. L. Young

EXPERIMENTAL VALUES:

T/K	P/mmHg	$P/10^5$Pa	Mole fraction of dimethylamine in liquid, $x_{(CH_3)_2NH}$
293.15	100	0.133	0.060
	200	0.267	0.117
	300	0.400	0.178
	400	0.533	0.240
	500	0.667	0.303
	600	0.800	0.370
	700	0.933	0.450
	760	1.013	0.505

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Amine 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:

1. British Drug Houses or Cambrian Gases sample.

2. Purified and attested 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* 623-650.

2. Gerrard, W.
Solubility of Gases and Liquids. Plenum Press, New York. 1976. Chapter 1.

COMPONENTS:

1. *N*-Methylmethanamine (dimethylamine); C_2H_7N; [124-40-3]
2. *N*-Methylbenzenamine (*N*-methylaniline); C_7H_9N; [100-61-8]

ORIGINAL MEASUREMENTS:

Gerrard, W.

Solubility of Gases and Liquids, *Plenum* 1976, Chapter 10.

VARIABLES:

Pressure

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	P/mmHg	$P/10^5$Pa	Mole fraction of dimethylamine in liquid, $x_{(CH_3)_2NH}$
293.15	200	0.267	0.240
	300	0.400	0.334
	400	0.533	0.414
	500	0.667	0.482
	600	0.800	0.547
	700	0.933	0.611
	760	1.013	0.650

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Amine 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:

1. British Drug Houses or Cambrian Gases sample.

2. Purified and attested 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* 623-650.

2. Gerrard, W.
Solubility of Gases and Liquids. Plenum Press, New York. 1976. Chapter 1.

COMPONENTS:	ORIGINAL MEASUREMENTS:
1. N-Methylmethanamine (dimethylamine); C_2H_7N; [124-40-3] 2. Benzenemethanamine, (Benzylamine); C_7H_9N; [100-46-9]	Gerrard, W. *Solubility of Gases and Liquids, Plenum,* 1976, Chapter 10.
VARIABLES:	**PREPARED BY:**
Temperature, pressure	C. L. Young

EXPERIMENTAL VALUES:

T/K	P/mmHg	$P/10^5$Pa	Mole fraction of dimethylamine in liquid, $x_{(CH_3)_2NH}$
283.15	760	1.013	0.815
293.15	100	0.133	0.075
	200	0.267	0.145
	300	0.400	0.220
	400	0.533	0.296
	500	0.667	0.375
	600	0.800	0.452
	700	0.933	0.532
	760	1.013	0.580

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Amine 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:

1. British Drug Houses or Cambrian Gases sample.

2. Purified and attested 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, 22 623-650.

2. Gerrard, W.
Solubility of Gases and Liquids. Plenum Press, New York. 1976.
Chapter 1.

COMPONENTS:

1. *N*-Methylmethanamine (dimethylamine); C_2H_7N; [124-40-3]
2. *N*-Ethylbenzenamine (*N*-ethylaniline); $C_8H_{11}N$; [103-69-5]

ORIGINAL MEASUREMENTS:

Gerrard, W.

Solubility of Gases and Liquids, *Plenum* 1976, Chapter 10.

VARIABLES:

Pressure

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	P/mmHg	$P/10^5$Pa	Mole fraction of dimethylamine in liquid, $x_{(CH_3)_2NH}$
293.15	200	0.267	0.238
	300	0.400	0.332
	400	0.533	0.411
	500	0.667	0.480
	600	0.800	0.547
	700	0.933	0.611
	760	1.013	0.650

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Amine 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 abosrbed 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:

1. British Drug Houses or Cambrian Gases sample.

2. Purified and attested 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, 22 623-650.

2. Gerrard, W.
Solubility of Gases and Liquids. Plenum Press, New York. 1976. Chapter 1.

COMPONENTS:

1. N-Methylmethanamine (dimethylamine); C_2H_7N; [124-40-3]
2. N,N-Dimethylbenzenamine (N,N-dimethylaniline); $C_8H_{11}N$; [121-69-7]

ORIGINAL MEASUREMENTS:

Gerrard, W.

Solubility of Gases and Liquids, Plenum 1976, Chapter 10.

VARIABLES:

Temperature, pressure

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	P/mmHg	$P/10^5$Pa	Mole fraction of dimethylamine in liquid, $x_{(CH_3)_2NH}$
283.15	100	0.133	0.086
	200	0.267	0.180
	300	0.400	0.280
	400	0.533	0.386
	500	0.667	0.508
	600	0.800	0.638
	700	0.933	0.780
	760	1.013	0.848
293.15	100	0.133	0.061
	200	0.267	0.127
	300	0.400	0.192
	400	0.533	0.257
	500	0.667	0.330
	600	0.800	0.404
	700	0.933	0.485
	760	1.013	0.538

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Amine 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 abosrbed 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:

1. British Drug Houses or Cambrian Gases sample.

2. Purified and attested 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, 22 623-650.
2. Gerrard, W.
Solubility of Gases and Liquids. Plenum Press, New York. 1976.
Chapter 1.

COMPONENTS:	ORIGINAL MEASUREMENTS:
1. *N*-Methylmethanamine, (dimethylamine); C_2H_7N; [124-40-3] 2. 1-Octanamine (octylamine); $C_8H_{19}N$; [111-86-4]	Gerrard, W. *Solubility of Gases and Liquids, Plenum* 1976, Chapter 10.
VARIABLES:	PREPARED BY:
Temperature, pressure	C. L. Young

EXPERIMENTAL VALUES:

T/K	P/mmHg	$P/10^5$Pa	Mole fraction of dimethylamine in liquid, $x_{(CH_3)_2NH}$
283.15	100	0.133	0.120
	200	0.267	0.242
	300	0.400	0.363
	400	0.533	0.486
	500	0.667	0.603
	600	0.800	0.713
	700	0.933	0.825
	760	1.013	0.888
293.15	100	0.133	0.093
	200	0.267	0.183
	300	0.400	0.266
	400	0.533	0.347
	500	0.667	0.428
	600	0.800	0.506
	700	0.933	0.583
	760	1.013	0.626

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Amine 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:

1. British Drug Houses or Cambrian Gases sample.

2. Purified and attested 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, 22 623-650.

2. Gerrard, W.
Solubility of Gases and Liquids. Plenum Press, New York. 1976.
Chapter 1.

COMPONENTS:

1. N-Methylmethanamine (dimethylamine); C_2H_7N; [124-40-3]
2. N,N-Diethylbenzenamine (N,N-diethylaniline); $C_{10}H_{15}N$; [91-66-7]

ORIGINAL MEASUREMENTS:

Gerrard, W.

Solubility of Gases and Liquids, *Plenum* 1976, Chapter 10.

VARIABLES:

Pressure

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	P/mmHg	$P/10^5$Pa	Mole fraction of dimethylamine in liquid, $x_{(CH_3)_2NH}$
293.15	100	0.133	0.072
	200	0.267	0.141
	300	0.400	0.211
	400	0.533	0.281
	500	0.667	0.354
	600	0.800	0.429
	700	0.933	0.510
	760	1.013	0.557

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Amine 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:

1. British Drug Houses or Cambrian Gases sample.

2. Purified and attested 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* 623-650.

2. Gerrard, W.
Solubility of Gases and Liquids. Plenum Press, New York. 1976.
Chapter 1,

COMPONENTS:

1. *N*-Methylmethanamine, (dimethylamine); C_2H_7N; [124-40-3]
2. Tetrachloromethane (carbon tetrachloride); CCl_4; [56-23-5]

ORIGINAL MEASUREMENTS:

Wolff, H.; Höppel, H.-E.

Ber. Bunsenges. Phys. Chem.

1966, *70*, 874-883.

VARIABLES:

Composition, temperature

PREPARED BY:

P. G. T. Fogg

EXPERIMENTAL VALUES:

Variation of the total vapor pressure/Torr with variation of temperature and of mole fraction of C_2H_7N in the liquid phase, $x_{C_2H_7N}$

	T/K		
$x_{C_2H_7N}$	253.15	273.15	293.15
0	9.8	33.0	90.9
0.0067	11.8	37.4	100.2
0.0488	23.6	68.6	167.0
0.0660	26.1	75.5	184.8
0.0887	28.0	79.0	200.2
0.115	32.7	90.6	220.1
0.121	33.5	94.4	224.3
0.189	46.5	128.4	302.8
0.219	51.6	141.7	333.6
0.225	52.4	146.2	342.4
0.249	57.1	156.7	366.2
0.264	60.0	165.1	385.1
0.306	68.0	187.4	436.0
0.348	75.3	206.1	470.7
0.384	83.1	226.6	522.3
0.442	93.4	256.1	589.5
0.494	104.1	282.5	650.5
0.542	113.8	307.7	693.9

Cont.

AUXILIARY INFORMATION

METHOD APPARATUS/PROCEDURE:

A modified version of apparatus described previously (1) was used. Liquid mixtures of accurately known composition were introduced into a cell held in a thermostat controlled to ± 0.02°C. The total vapor pressures were measured by a mercury manometer but a sensitive quartz spiral manometer was used as a null instrument to prevent carbon tetrachloride vapour from coming into contact with mercury. The authors calculated activity coefficients of each component from the vapor pressure data by a method described by Barker (2). Constants for Redlich-Kister equations (3) for activity coefficients were evaluated and reported. The compositions of the vapor phase were also calculated by the authors.

SOURCE AND PURITY OF MATERIALS:

1. Vacuum distilled; purity checked by i.r. spectroscopy.
2. Purity checked by i.r. spectroscopy.

ESTIMATED ERROR:

$\delta T/K = \pm\ 0.02$; $\delta p/\text{Torr} = 0.1\text{-}0.2$ at low pressure

$\delta p/\text{Torr} = 1$ at high pressure (authors' estimate)

REFERENCES:

1. Wolff, H.; Höpfner, A. *Z. Elektrochem.* 1962, *66*, 149.
2. Barker, J.A. *Aust. J. Chem.* 1953, *6*, 207.
3. Redlich, O.; Kister, A.T. *Ind. Eng. Chem.* 1948, *21*, 345.

COMPONENTS:	ORIGINAL MEASUREMENTS:
1. *N*-Methylmethanamine, (dimethylamine); C_2H_7N; [124-40-3] 2. Tetrachloromethane (carbon tetrachloride); CCl_4; [56-23-5]	Wolff, H.; Höppel, H.-E. *Ber. Bunsenges. Phys. Chem.* 1966, *70*, 874-883.

EXPERIMENTAL VALUES: Cont.

	T/K		
$x_{C_2H_7N}$	253.15	273.15	293.15
0.608	126.9	343.9	798.0
0.650	136.2	366.1	847.9
0.711	147.9	397.5	913.8
0.762	158.5	424.9	980.2
0.810	168.9	451.8	1027.4
0.861	178.8	480.4	1094.2
0.910	189.5	504.4	1152.8
0.969	200.6	539.9	1227.8
1	206.5	562.9	1271.5

760 Torr = 1 atm = 1.013×10^5 Pa

Constants for calculation of activity coefficients from the Redlich-Kister equations given below.

T/K	A	B	C	D	E	F
253.15	-0.001	-0.080	+0.129	-0.094	-	-
263.15	-0.005	-0.079	+0.119	-0.105	-	-
273.15	-0.024	-0.073	+0.031	-0.223	-	-
283.15	-0.015	-0.068	+0.058	-0.146	-	-
293.15	+0.005	-0.031	+0.102	-0.173	-	-
293.15	+0.021	-0.096	+0.071	+0.133	+0.144	-0.517

$$\begin{aligned}\ln f_1 = {} & A x_2^2 - B x_2^2(1 - 4x_1) + C x_2^2(1 - 8x_1 + 12x_1^2) \\ & - D x_2^2(1 - 12x_1 + 36x_1^2 - 32x_1^3) \\ & + E x_2^2(1 - 16x_1 + 72x_1^2 - 128x_1^3 + 80x_1^4) \\ & - F x_2^2(1 - 20x_1 + 120x_1^2 - 320x_1^3 + 400x_1^4 - 192x_1^5)\end{aligned}$$

$$\begin{aligned}\ln f_2 = {} & A x_1^2 + B x_1^2(1 - 4x_2) + C x_1^2(1 - 8x_2 + 12x_2^2) \\ & + D x_1^2(1 - 12x_2 + 36x_2^2 - 32x_2^3) \\ & + E x_1^2(1 - 16x_2 + 72x_2^2 - 128x_2^3 + 80x_2^4) \\ & + F x_1^2(1 - 20x_2 + 120x_2^2 - 320x_2^3 + 400x_2^4 - 192x_2^5)\end{aligned}$$

where f_1 = activity coefficient of dimethylamine
f_2 = activity coefficient of carbon tetrachloride
x_1 = mole fraction of dimethylamine in the liquid phase
x_2 = mole fraction of carbon tetrachloride in the liquid phase

Four constants only were evaluated for each temperature except in the case of 293.2 K. In this case the use of six constants gave greater consistency than the use of four constants.

COMPONENTS:

1. *N*-Methylmethanamine (dimethylamine); C_2H_7N; [124-40-3]
2. Chlorinated methanes

ORIGINAL MEASUREMENTS:

Gerrard, W.

Solubility of Gases and Liquids, *Plenum*, 1976, Chapter 10.

VARIABLES:

Pressure

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	*P*/mmHg	*P*/10^5Pa	Mole fraction of dimethylamine in liquid, $x_{(CH_3)_2NH}$
Trichloromethane (chloroform); $CHCl_3$; [67-66-3]			
293.15	600	0.800	0.610
	700	0.933	0.672
	760	1.013	0.708
Tetrachloromethane (carbon tetrachloride); CCl_4; [56-23-5]			
293.15	700	0.933	0.550
	760	1.013	0.596

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Amine 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:

1. British Drug Houses or Cambrian Gases sample.

2. Purified and attested 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* 623-650.
2. Gerrard, W. *Solubility of Gases and Liquids. Plenum Press, New York.* 1976. Chapter 1.

COMPONENTS:

1. *N*-Methylmethanamine (dimethylamine); C_2H_7N; [124-40-3]
2. 2,2,2-Trichloroethanol (1,1,1-trichloro-2-hydroxyethane); $C_2H_3Cl_3O$; [115-20-8]

ORIGINAL MEASUREMENTS:

Gerrard, W.

Solubility of Gases and Liquids, *Plenum* 1976, Chapter 10.

VARIABLES:

Temperature, pressure

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	P/mmHg	$P/10^5$Pa	Mole fraction of dimethylamine in liquid, $x_{(CH_3)_2NH}$
283.15	100	0.133	0.518
	200	0.267	0.588
	300	0.400	0.644
	400	0.533	0.690
	500	0.667	0.740
	600	0.800	0.800
	700	0.933	0.861
	760	1.013	0.900
288.15	760	1.013	0.826
293.15	100	0.133	0.474
	200	0.267	0.537
	300	0.400	0.582
	400	0.533	0.621
	500	0.667	0.658
	600	0.800	0.695
	700	0.933	0.733
	760	1.013	0.756
298.15	760	1.013	0.706

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Amine 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:

1. British Drug Houses or Cambrian Gases sample.

2. Purified and attested 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* 623-650.

2. Gerrard, W.
Solubility of Gases and Liquids. Plenum Press, New York. 1976.
Chapter 1.

COMPONENTS:

1. *N*-Methylmethanamine (dimethylamine); C_2H_7N; [124-40-3]
2. Chlorobenzene; C_6H_5Cl; [108-90-7]
   or
   Bromobenzene; C_6H_5Br; [108-86-1]
   or
   Iodobenzene; C_6H_5I; [591-50-4]

ORIGINAL MEASUREMENTS:

Gerrard, W.

Solubility of Gases and Liquids,

Plenum, 1976, Chapter 10.

VARIABLES:

Pressure

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	*P*/mmHg	$P/10^5$Pa	Mole fraction of dimethylamine in liquid, $x_{(CH_3)_2NH}$
		Benzene, chloro-; C_6H_5Cl; [108-90-7]	
293.15	600	0.800	0.429
	700	0.933	0.520
	760	1.013	0.575
		Benzene, bromo-; C_6H_5Br; [108-86-1]	
293.15	700	0.933	0.532
	760	1.013	0.580
		Benzene, iodo-; C_6H_5I; [591-50-4]	
293.15	100	0.133	0.097
	200	0.267	0.132
	300	0.400	0.203
	400	0.533	0.341
	500	0.667	0.417
	600	0.800	0.495
	700	0.933	0.570
	760	1.013	0.612

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Amine 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:

1. British Drug Houses or Cambrian Gases sample.

2. Purified and attested 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* 623-650.

2. Gerrard, W.
Solubility of Gases and Liquids. Plenum Press, New York. 1976.
Chapter 1.

COMPONENTS:

1. *N*-Methylmethanamine (dimethylamine); C_2H_7N; [124-40-3]
2. 1-Bromo-3-methylbenzene (*m*-bromotoluene); C_7H_7Br; [95-46-5]

ORIGINAL MEASUREMENTS:

Gerrard, W.

Solubility of Gases and Liquids,

Plenum 1976, Chapter 10.

VARIABLES:

Pressure

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	P/mmHg	$P/10^5$Pa	Mole fraction of dimethylamine in liquid, $x_{(CH_3)_2NH}$
283.15	100	0.133	0.065
	200	0.267	0.132
	300	0.400	0.203
	400	0.533	0.275
	500	0.667	0.349
	600	0.800	0.428
	700	0.933	0.510
	760	1.013	0.563

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Amine 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:

1. British Drug House or Cambrian Gases sample.

2. Purified and attested 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* 623-650.

2. Gerrard, W.
Solubility of Gases and Liquids. Plenum Press, New York. 1976.
Chapter 1.

COMPONENTS:	ORIGINAL MEASUREMENTS:
1. *N*-Methylmethanamine (dimethylamine); C_2H_7N; [124-40-3] 2. 1-Bromonaphthalene; $C_{10}H_7Br$; [90-11-9]	Gerrard, W. *Solubility of Gases and Liquids* *Plenum* 1976, Chapter 10.
VARIABLES:	PREPARED BY:
Pressure	C. L. Young

EXPERIMENTAL VALUES:

T/K	P/mmHg	$P/10^5$Pa	Mole fraction of dimethylamine in liquid, $x_{(CH_3)_2NH}$
293.15	100	0.133	0.060
	200	0.267	0.117
	300	0.400	0.175
	400	0.533	0.237
	500	0.667	0.300
	600	0.800	0.368
	700	0.933	0.446
	760	1.013	0.500

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Amine 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:

1. British Drug Houses or Cambrian Gases sample.

2. Purified and attested 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* 623-650.
2. Gerrard, W.
Solubility of Gases and Liquids. Plenum Press, New York. 1976. Chapter 1.

COMPONENTS:	ORIGINAL MEASUREMENTS:
1. *N,N*-Dimethylmethanamine, (Trimethylamine); C_3H_9N; [75-50-3] 2. Hexane; C_6H_{14}; [110-54-3]	Halban, H. *Z. Phys. Chem.* 1913, *84*, 129-159.

VARIABLES:	PREPARED BY:
Concentration	P. G. T. Fogg

EXPERIMENTAL VALUES:

T/K	Concentration of C_3H_9N in solution/ mol dm^{-3}	$p_{C_3H_9N}$/mmHg	Concentration of C_3H_9N in solution/ concentration in gas phase	Mole fraction in solution* $x_{C_3H_9N}$
298.2	0.0886	22.0	75.0	0.0115
	0.1661	41.1	75.0	0.0214
	0.1702	41.9	75.3	0.0219

* Calculated by the compiler, using the density of the solvent given in ref. (1), on the assumption that dissolution of gas caused negligible change of volume of the liquid phase.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The partial pressures of trimethylamine above solutions of concentrations determined by titration, were measured by a dynamic method (refs. (2) & (3)). Mixtures of hydrogen and oxygen, produced by electrolysis of sodium hydroxide solution, were passed through each solution of trimethylamine. The trimethylamine in the gas stream was absorbed in hydrochloric acid and estimated from changes in electrical conductivity due to partial neutralisation of the acid. The volumes of hydrogen/oxygen gas mixture produced by electrolysis were found from the barometric pressure and changes in a copper voltameter in series with the cell for producing the gas. The partial pressures of trimethylamine were calculated on the assumption that equilibrium was established between trimethylamine in solution and that in the gas phase, during passage of hydrogen/oxygen mixture through the solution.

SOURCE AND PURITY OF MATERIALS:

1. Hydrated chloride from Kahlbaum; reacted with KOH; gas dried with NaOH.
2. Kahlbaum *n-Hexan aus Propyljodid;* distilled over Na; b.p. 67.85-68.10 °C (745 mmHg).

ESTIMATED ERROR:

REFERENCES:

1. Dreisbach, R.R. *Physical Properties of Chemical Compounds*, Vol. 2, A.C.S. Washington, 1959.
2. Gaus, *Z. Anorg. Chem.* 1900, *25*, 236.
3. Abegg, R.; Riesenfeld, H. *Z. Phys. Chem.* 1902, *40*, 84.

COMPONENTS:

1. *N,N*-Dimethylmethanamine, (trimethylamine); C_3H_9N; [75-50-3]
2. Hexane; C_6H_{14}; [110-54-3]

ORIGINAL MEASUREMENTS:

Wolff, H.: Würtz, R.
Ber. Bunsenges. Phys. Chem.
1968, *72*, 101-109.

VARIABLES:

Composition, temperature

PREPARED BY:

P. G. T. Fogg

EXPERIMENTAL VALUES:

Variation of total vapor pressure/Torr with variation of temperature and of mole fraction of C_3H_9N in the liquid phase, $x_{C_3H_9N}$

			T/K		
$x_{C_3H_9N}$	223.15	233.15	253.15	273.15	293.15
0	1.8	3.7	14.1	45.7	121.0
0.0508	4.7	9.6	30.8	81.4	180.2
0.1048	8.6	15.9	46.9	117.2	260.3
0.131	10.2	18.7	54.7	134.7	293.9
0.157	12.5	22.7	64.0	154.7	330.9
0.188	13.5	24.4	69.9	168.7	360.3
0.200	15.4	27.1	76.8	182.5	383.6
0.254	18.5	32.8	92.1	216.7	450.6
0.302	21.2	38.1	106.3	249.2	514.2
0.343	23.2	41.9	117.0	274.7	567.1
0.422	27.4	49.6	138.1	322.1	659.3
0.474	30.7	54.9	152.3	355.0	727.2
0.513	32.1	57.6	160.6	375.5	770.7
0.560	35.2	62.3	173.6	405.0	829.0
0.601	37.0	66.7	185.8	433.5	887.9
0.654	40.0	71.4	198.9	464.4	950.7
0.703	42.2	76.3	212.3	493.2	1007.8
0.758	45.1	80.8	224.5	525.0	1076.4

Cont.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Apparatus described previously was used (1), (2). Liquid mixtures of accurately known composition were introduced into a cell held in a thermostat controlled to ± 0.02 °C. The total vapor pressure was measured by a mercury manometer.

The authors calculated activity coefficients of each component from the vapor pressure data by a method described by Barker (3). Constants for Redlich-Kister equations (4) were evaluated and reported. The compositions of the vapor phase were also calculated by the authors.

SOURCE AND PURITY OF MATERIALS:

1. Prepared from commercial *reinst* trimethylammonium chloride; repeatedly fractionated until the first and last fractions had vapor pressures which differed by less than the limits of error of the pressure measurements.
2. Fluka "*Reinstpräparat*"; purity 99.96 mol %.

ESTIMATED ERROR:

$\delta T/K = \pm 0.02$ (estimated by authors)

REFERENCES:

1. Wolff, H.; Höpfner, A. *Z. Elektrochem.* 1962, *66*, 149.
2. Wolff, H.; Höppel, H.-E. *Ber. Bunsenges. Phys. Chem.* 1966, *70*, 874.
3. Barker, J.A. *Aust. J. Chem.* 1953, *6*, 207.
4. Redlich, O.; Kister, A.T. *Ind. Eng. Chem.* 1948, *21*, 345.

COMPONENTS:	ORIGINAL MEASUREMENTS:
1. *N,N*-Dimethylmethanamine, (trimethylamine); C_3H_9N; [75-50-3] 2. Hexane; C_6H_{14}; [110-54-3]	Wolff, H.; Würtz, R. *Ber. Bunsenges. Phys. Chem.* 1968, *72*, 101-109.

EXPERIMENTAL VALUES: Cont.

	T/K				
$x_{C_3H_9N}$	223.15	233.15	253.15	273.15	293.15
0.806	47.2	85.2	238.7	555.4	1173.6
0.886	51.1	90.6	253.0	591.6	1213.8
0.901	52.8	94.2	263.1	612.9	1259.5
1	57.4	103.9	289.2	675.8	1388.2

760 Torr = 1 atm = 1.013 x 10^5 Pa

Constants for calculation of activity coefficients from the Redlich-Kister equations given below.

T/K	A	B	C
223.15	0.257	0.060	+0.014
233.15	0.225	0.032	-0.022
243.15	0.203	0.035	-0.024
253.15	0.197	0.022	-0.001
263.15	0.173	0.027	-0.000
273.15	0.145	0.018	-0.006
283.15	0.121	0.003	-0.013
293.15	0.100	0.009	-0.013

$$\ln f_1 = A\,x_2^2 - B\,x_2^2(1 - 4\,x_1) + C\,x_2^2(1 - 8\,x_1 + 12\,x_1^2)$$

$$\ln f_2 = A\,x_1^2 + B\,x_1^2(1 - 4\,x_2) + C\,x_1^2(1 - 8\,x_2 + 12\,x_2^2)$$

where f_1 = activity coefficient of trimethylamine
f_2 = activity coefficient of hexane
x_1 = mole fraction of trimethylamine in the liquid phase
x_2 = mole fraction of hexane in the liquid phase

COMPONENTS:

1. *N,N*-Dimethylmethanamine, (Trimethylamine); C_3H_9N; [75-50-3]
2. Heptane; C_7H_{16}; [142-82-5]
3. Cyclohexanone; $C_6H_{10}O$; [108-94-1]
   Cyclopentanone; C_5H_8O; [120-92-3]
   3-Pentanone; $C_5H_{10}O$; [96-22-0]
   2-Butanone; C_4H_8O; [78-93-3]

ORIGINAL MEASUREMENTS:

Wheeler, O.H.; Levy, E.M.
Can. J. Chem.
1959, *37*, 1727-1732

PREPARED BY:

P. G. T. Fogg

EXPERIMENTAL VALUES:

	Conc.of component 3 /mol dm^{-3}	T/K	Henry's law constant H / (mmHg / $x_{C_3H_9N}$)
Heptane	-	233.2	148
		273.2	864
Heptane + cyclohexanone	1.0	233.2	111
		273.2	814
Heptane + cyclopentanone	1.0	233.2	123
		273.2	884
Heptane + 3-pentanone	1.0	233.2	133
		273.2	908
Heptane + 2-butanone	1.0	233.2	138
		273.2	944

760 mmHg = 1 atm = 1.013×10^5 Pa

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The absorption vessel of known volume was connected by narrow bore tubing to a mercury manometer and by a tap to a storage vessel connected to a second manometer. The whole was attached to a high-vacuum line. 10 cm^3 of liquid were introduced into the absorption vessel and repeatedly frozen and pumped to remove air. Trimethylamine was distilled into the storage vessel and from there small samples transferred to the absorption vessel. The liquid was stirred by a magnetic stirrer and the final pressure in the absorption vessel measured. The quantity of trimethylamine admitted to the absorption vessel was calculated from the volume of the storage vessel and the change of pressure in this vessel. Allowance was made for the trimethylamine in the gas phase in the absorption vessel when the quantity dissolved was calculated.

SOURCE AND PURITY OF MATERIALS:

1. Eastman-Kodak white-label grade; dried over CaH_2; non-condensible gases removed.
2. From Matheson, Coleman, & Bell; distilled over Na; b.p.98.3°C; n_D(20°C) 1.3884.
3. Eastman-Kodak white label grade; dried over $CaSO_4$ and distilled.

$C_6H_{10}O$: b.p. 155.7°C; n_D(20°C) 1.4506
C_5H_8O : b.p. 129.5°C; n_D(20°C) 1.4369
$C_5H_{10}O$: b.p. 101.6°C; n_D(20°C) 1.3929
C_4H_8O : b.p. 79.5°C; n_D(20°C) 1.3786

REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
1. *N,N*-Dimethylmethanamine, (Trimethylamine); C_3H_9N; [75-50-3] 2. Heptane; C_7H_{16}; [142-82-5] 3. Cyclohexanone; $C_6H_{10}O$; [108-94-1] Cyclopentanone; C_5H_8O; [120-92-3] 3-Pentanone; $C_5H_{10}O$; [96-22-0] 2-Butanone; C_4H_8O; [78-93-3]	Wheeler, O.H.; Levy, E.M. *Can. J. Chem.* 1959, *37*, 1727-1732.

EXPERIMENTAL VALUES:

The authors gave two small scale graphs showing linear variations of $x_{C_3H_9N}$ with $p_{C_3H_9N}$ for all the systems. Experimental points were not marked on these graphs. The authors stated that measurements were made over a pressure range to $p_{C_3H_9N}$ = 160 mmHg. The lines drawn on the graphs show a variation of pressure from a few mmHg to about 140 mmHg for all measurements at 0°C, from a few mmHg to about 70 mmHg for solutions in pure heptane at -40°C and from a few mmHg to about 50 mmHg for other solutions at -40°C.

The authors also gave a table of values of $x_{C_3H_9N}$ for various values of $p_{C_3H_9N}$ for the cyclohexanone-heptane mixture at 0°C, apparently to a maximum $p_{C_3H_9N}$ of 17 mmHg. This data is inconsistent with other data in the paper and the compiler considers that the authors have confused mmHg with cmHg and that this has led to errors by a factor of 10.

COMPONENTS:	ORIGINAL MEASUREMENTS:
1. *N,N*-Dimethylmethanamine (trimethylamine); C_3H_9N; [75-50-3] 2. Decane; $C_{10}H_{22}$; [124-18-5]	Gerrard, W. *Solubility of Gases and Liquids, Plenum,* 1976, Chapter 10.
VARIABLES:	**PREPARED BY:**
Pressure	C. L. Young

EXPERIMENTAL VALUES:

T/K	*P*/mmHg	*P*/10^5Pa	Mole fraction of trimethylamine in liquid, $x_{(CH_3)_3N}$
283.15	100	0.133	0.108
	200	0.267	0.211
	300	0.400	0.313
	400	0.533	0.416
	500	0.667	0.517
	600	0.800	0.624
	700	0.933	0.728
	760	1.013	0.786

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Amine 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:

1. British Drug Houses or Cambrian Gases sample.

2. Purified and attested 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* 623-650.

2. Gerrard, W.
Solubility of Gases and Liquids. Plenum Press, New York. 1976.
Chapter 1.

COMPONENTS:

1. N,N-Dimethylmethanamine, (Trimethylamine); C_3H_9N; [75-50-3]
2. Benzene; C_6H_6; [71-43-2]

ORIGINAL MEASUREMENTS:

Halban, H.

Z. Phys. Chem.

1913, *84*, 129-159.

VARIABLES:

Concentration

PREPARED BY:

P. G. T. Fogg

EXPERIMENTAL VALUES:

T/K	Concentration of C_3H_9N in solution/ mol dm^{-3}	$p_{C_3H_9N}$/mmHg	Concentration of C_3H_9N in solution/ concentration in gas phase	Mole fraction in solution* $x_{C_3H_9N}$
298.2	0.1621	27.8	108	0.0143
	0.1692	28.5	110	0.0149
	0.1901	32.9	108	0.0167
	0.1928	33.1	108	0.0169

* Calculated by the compiler, using the density of the solvent given in ref. (1), on the assumption that dissolution of gas caused negligible change of volume of the liquid phase.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The partial pressures of trimethylamine above solutions of concentrations determined by titration, were measured by a dynamic method (refs. (2) & (3)). Mixtures of hydrogen and oxygen, produced by electrolysis of sodium hydroxide solution, were passed through each solution of trimethylamine. The trimethylamine in the gas stream was absorbed in hydrochloric acid and estimated from changes in electrical conductivity due to partial neutralisation of the acid. The volumes of hydrogen/oxygen gas mixture produced by electrolysis were found from the barometric pressure and changes in a copper voltameter in series with the cell for producing the gas. The partial pressures of trimethylamine were calculated on the assumption that equilibrium was established between trimethylamine in solution and that in the gas phase, during passage of hydrogen/oxygen mixture through the solution.

SOURCE AND PURITY OF MATERIALS:

1. Hydrated chloride from Kahlbaum; reacted with KOH; gas dried with NaOH.
2. From Kahlbaum; contained no thiophene; distilled over Na.

ESTIMATED ERROR:

REFERENCES:

1. Dreisbach, R.R. *Physical Properties of Chemical Compounds*, Vol. 1, A.C.S. Washington. 1955.
2. Gaus, *Z. Anorg. Chem.* 1900, *25*, 236.
3. Abegg, R.; Riesenfeld, H. *Z. Phys. Chem.* 1902, *40*, 84.

COMPONENTS:	ORIGINAL MEASUREMENTS:
1. *N,N*-Dimethylmethanamine (trimethylamine); C_3H_9N; [75-50-3] 2. Aromatic hydrocarbons	Gerrard, W. *Solubility of Gases and Liquids, Plenum,* 1976, Chapter 10.

VARIABLES:	PREPARED BY:
Pressure	C. L. Young

EXPERIMENTAL VALUES:

T/K	P/mmHg	$P/10^5$Pa	Mole fraction of trimethylamine in liquid, $x_{(CH_3)_3N}$
		Benzene; C_6H_6; [71-43-2]	
283.15	700	0.933	0.69
	760	1.013	0.74
		Methylbenzene (toluene); C_7H_8; [108-88-3]	
283.15	700	0.933	0.718
	760	1.013	0.768
		1,3-Dimethylbenzene (*m*-xylene); C_8H_{10}; [108-38-3]	
283.15	700	0.933	0.716
	760	1.013	0.768
		1,3,5-Trimethylbenzene (mesitylene); C_9H_{12}; [108-67-8]	
283.15	100	0.133	0.096
	200	0.267	0.192
	300	0.400	0.284
	400	0.533	0.382
	500	0.667	0.488
	600	0.800	0.600
	700	0.933	0.700
	760	1.013	0.756

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Amine 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:

1. British Drug Houses or Cambrian Gases sample.

2. Purified and attested 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, 22 623-650.

2. Gerrard, W.
Solubility of Gases and Liquids. Plenum Press, New York. 1976. Chapter 1.

COMPONENTS:	ORIGINAL MEASUREMENTS:
1. *N,N*-Dimethylmethanamine, (Trimethylamine); C_3H_9N; [75-50-3] 2. Methanol; CH_4O; [67-56-1]	Halban, H. *Z. Phys. Chem.* 1913, *84*, 129-159.

VARIABLES:	PREPARED BY:
Concentration	P. G. T. Fogg

EXPERIMENTAL VALUES:

T/K	Concentration of C_3H_9N in solution/ mol dm^{-3}	$p_{C_3H_9N}$/mmHg	Concentration of C_3H_9N in solution/ concentration in gas phase	Mole fraction in solution* $x_{C_3H_9N}$
298.2	0.368	9.63	712	0.0148
	0.510	13.2	718	0.0204
	0.511	13.5	704	0.0204

* Calculated by the compiler, on the assumption that dissolution of gas caused negligible change of volume of the liquid phase, using the density of methanol given in ref. (1).

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The partial pressures of trimethylamine above solutions of concentrations determined by titration, were measured by a dynamic method (refs. (2) & (3)). Mixtures of hydrogen and oxygen, produced by electrolysis of sodium hydroxide solution, were passed through each solution of trimethylamine. The trimethylamine in the gas stream was absorbed in hydrochloric acid and estimated from changes in electrical conductivity due to partial neutralisation of the acid. The volumes of hydrogen/ oxygen gas mixture produced by electrolysis were found from the barometric pressure and changes in a copper voltameter in series with the cell for producing the gas. The partial pressures of trimethylamine were calculated on the assumption that equilibrium was established between trimethylamine in solution and that in the gas phase, during passage of hydrogen/oxygen mixture through the solution.

SOURCE AND PURITY OF MATERIALS:

1. Hydrated chloride from Kahlbaum reacted with KOH; gas dried with NaOH.
2. Kahlbaum *methylalkohol I* distilled from CaO. b.p. 64.3-65.3°C (752 mmHg).

ESTIMATED ERROR:

REFERENCES:

1. Timmermans, J. *Physico-Chemical Constants of Pure Organic Compounds* Vol. 2, Elsevier, Amsterdam. 1965
2. Gaus, *Z. Anorg. Chem.* 1900, *25*, 236.
3. Abegg, R.; Riesenfeld, H. *Z. Phys. Chem.* 1902, *40*, 84.

COMPONENTS:

1. *N,N*-Dimethylmethanamine, (Trimethylamine); C_3H_9N; [75-50-3]
2. Ethanol; C_2H_6O; [557-75-5]

ORIGINAL MEASUREMENTS:

Halban, H.

Z. Phys. Chem.

1913, *84*, 129-159.

VARIABLES:

Concentration

PREPARED BY:

P. G. T. Fogg

EXPERIMENTAL VALUES:

T/K	Concentration of C_3H_9N in solution/ mol dm^{-3}	$p_{C_3H_9N}$/mmHg	Concentration of C_3H_9N in solution/ concentration in gas phase	Mole fraction in solution* $x_{C_3H_9N}$
298.2	0.1914	7.62	467	0.0111
	0.299	11.8	472	0.0172
	0.299	11.7	474	0.0172

* Calculated by the compiler using the density of the solvent given in ref. (1), on the assumption that dissolution of gas caused negligible change of volume of the liquid phase.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The partial pressures of trimethylamine above solutions of concentrations determined by titration, were measured by a dynamic method (refs. (2) & (3)). Mixtures of hydrogen and oxygen, produced by electrolysis of sodium hydroxide solution, were passed through each solution of trimethylamine. The trimethylamine in the gas stream was absorbed in hydrochloric acid and estimated from changes in electrical conductivity due to partial neutralisation of the acid. The volumes of hydrogen/ oxygen gas mixture produced by electrolysis were found from the barometric pressure and changes in a copper voltameter in series with the cell for producing the gas. The partial pressures of trimethylamine were calculated on the assumption that equilibrium was established between trimethylamine in solution and that in the gas phase, during passage of hydrogen/oxygen mixture through the solution.

SOURCE AND PURITY OF MATERIALS:

1. Hydrated chloride from Kahlbaum reacted with KOH; gas dried with NaOH.
2. Dried over CaO and distilled; b.p. 78.1°C (760 mmHg).

ESTIMATED ERROR:

REFERENCES:

1. Timmermans, J. *Physico-Chemical Constants of Pure Organic Compounds* Vol. 2, Elsevier, Amsterdam. 1965
2. Gaus. *Z. Anorg. Chem.* 1900, *25*, 236.
3. Abegg, R; Riesenfeld, H. *Z. Phys. Chem.* 1902, *40*, 84.

COMPONENTS:	ORIGINAL MEASUREMENTS:
1. *N,N*-Dimethylmethanamine, (Trimethylamine); C_3H_9N; [75-50-3] 2. 1-Propanol; C_3H_8O; [71-23-8]	Halban, H. *Z. Phys. Chem.* 1913, *84*, 129-159.
VARIABLES:	PREPARED BY:
Concentration	P. G. T. Fogg

EXPERIMENTAL VALUES:

T/K	Concentration of C_3H_9N in solution/ mol dm^{-3}	$p_{C_3H_9N}$/mmHg	Concentration of C_3H_9N in solution/ concentration in gas phase	Mole fraction in solution* $x_{C_3H_9N}$
298.2	0.219	8.55	482	0.0162
	0.329	13.1	467	0.0241
	0.330	13.2	467	0.0242

* Calculated by the compiler, using the density of the solvent given in ref. (1), on the assumption that dissolution of gas caused negligible change of volume of the liquid phase.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The partial pressures of trimethylamine above solutions of concentrations determined by titration, were measured by a dynamic method (refs. (2) & (3)). Mixtures of hydrogen and oxygen, produced by electrolysis of sodium hydroxide solution, were passed through each solution of trimethylamine. The trimethylamine in the gas stream was absorbed in hydrochloric acid and estimated from changes in electrical conductivity due to partial neutralisation of the acid. The volumes of hydrogen/oxygen gas mixture produced by electrolysis were found from the barometric pressure and changes in a copper voltameter in series with the cell for producing the gas. The partial pressures of trimethylamine were calculated on the assumption that equilibrium was established between trimethylamine in solution and that in the gas phase, during passage of hydrogen/oxygen mixture through the solution.

SOURCE AND PURITY OF MATERIALS:

1. Hydrated chloride from Kahlbaum; reacted with KOH; gas dried with NaOH.
2. Dried over KOH and distilled; b.p. 96.8-97.1°C (754 mmHg).

ESTIMATED ERROR:

REFERENCES:

1. Timmermans, J. *Physico-Chemical Constants of Pure Organic Compound* Vol. 2, Elsevier, Amsterdam. 1965
2. Gaus, *Z. Anorg. Chem.* 1900, *25*, 236.
3. Abegg, R.; Riesenfeld, H. *Z. Phys. Chem.* 1902, *40*, 84.

COMPONENTS:	ORIGINAL MEASUREMENTS:
1. *N,N*-Dimethylmethanamine (trimethylamine); C_3H_9N; [75-50-3] 2. 1-Butanol; $C_4H_{10}O$; [71-36-3]	Gerrard, W. *Solubility of Gases and Liquids*, *Plenum* 1976, Chapter 10.
VARIABLES: Temperature, pressure	PREPARED BY: C. L. Young

EXPERIMENTAL VALUES:

T/K	P/mmHg	$P/10^5$Pa	Mole fraction of trimethylamine in liquid, $x_{(CH_3)_3N}$
293.15	760	1.013	0.571
298.15	700	0.933	0.488
	760	1.013	0.510

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Amine 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:

1. British Drug Houses or Cambrian Gases sample.

2. Purified and attested 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* 623-650.

2. Gerrard, W.
Solubility of Gases and Liquids. Plenum Press, New York. 1976. Chapter 1.

COMPONENTS:	ORIGINAL MEASUREMENTS:
1. *N,N*-Dimethylmethanamine, (Trimethylamine); C_3H_9N; [75-50-3] 2. 3-Methyl-1-Butanol; $C_5H_{12}O$; [123-51-3]	Halban, H. *Z. Phys. Chem.* 1913, *84*, 129-159.
VARIABLES:	**PREPARED BY:**
Concentration	P. G. T. Fogg

EXPERIMENTAL VALUES:

T/K	Concentration of C_3H_9N in solution/ mol dm^{-3}	$p_{C_3H_9N}$/mmHg	Concentration of C_3H_9N in solution/ concentration in gas phase	Mole fraction in solution* $x_{C_3H_9N}$
298.2	0.342	16.3	390	0.0358
	0.346	16.9	382	0.0362
	0.347	16.9	383	0.0363

* Calculated by the compiler, using the density of the solvent given in ref. (1), on the assumption that dissolution of gas caused negligible change of volume of the liquid phase.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The partial pressures of trimethylamine above solutions of concentrations determined by titration, were measured by a dynamic method (refs. (2) & (3)). Mixtures of hydrogen and oxygen, produced by electrolysis of sodium hydroxide solution, were passed through each solution of trimethylamine. The trimethylamine in the gas stream was absorbed in hydrochloric acid and estimated from changes in electrical conductivity due to partial neutralisation of the acid. The volumes of hydrogen/oxygen gas mixture produced by electrolysis were found from the barometric pressure and changes in a copper voltameter in series with the cell for producing the gas. The partial pressures of trimethylamine were calculated on the assumption that equilibrium was established between trimethylamine in solution and that in the gas phase, during passage of hydrogen/oxygen mixture through the solution.

SOURCE AND PURITY OF MATERIALS:

1. Hydrated chloride from Kahlbaum; reacted with KOH; gas dried with NaOH.
2. Kahlbaum *Amylalkohol frei von Pyridin*

   distilled twice from Na; fraction distilling 130.6-131.0°C (752 mmHg) was collected.

ESTIMATED ERROR:

REFERENCES:

1. *Lange's Handbook of Chemistry* (12th edition), McGraw-Hill, New York. 1979.
2. Gaus, *Z. Anorg. Chem.* 1900, *25*, 236.
3. Abegg, R.; Riesenfeld, H. *Z. Phys. Chem.* 1902, *40*, 84.

COMPONENTS:	ORIGINAL MEASUREMENTS:
1. *N,N*-Dimethylmethanamine, (Trimethylamine); C_3H_9N; [75-50-3] 2. 1-Octanol; $C_8H_{18}O$; [111-87-5]	Gerrard, W. *Solubility of Gases and Liquids,* *Plenum* 1976, Chapter 10.
VARIABLES: Temperature, pressure	PREPARED BY: C. L. Young

EXPERIMENTAL VALUES:

T/K	P/mmHg	$P/10^5$Pa	Mole fraction of trimethylamine in liquid, $x_{(CH_3)_3N}$
278.15	100	0.133	0.263
	200	0.267	0.401
	300	0.400	0.510
	400	0.533	0.607
	500	0.667	0.691
	600	0.800	0.790
	700	0.933	0.882
	760	1.013	0.936
283.15	100	0.133	0.240
	200	0.267	0.392
	300	0.400	0.472
	400	0.533	0.538
	500	0.667	0.602
	600	0.800	0.675
	700	0.933	0.752
	760	1.013	0.800
293.15	760	1.013	0.636
298.15	100	0.133	0.157
	200	0.267	0.251
	300	0.400	0.320
	400	0.533	0.382
	500	0.667	0.436
	600	0.800	0.486
	700	0.933	0.538
	760	1.013	0.568

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Amine 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:

1. British Drug Houses or Cambrian Gases sample.

2. Purified and attested 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* 623-650.
2. Gerrard, W.
Solubility of Gases and Liquids. Plenum Press, New York. 1976. Chapter 1.

COMPONENTS:

1. *N,N*-Dimethylmethanamine, (Trimethylamine); C_3H_9N; [75-50-3]
2. Benzenemethanol (benzyl alcohol); C_7H_8O; [100-51-6]

ORIGINAL MEASUREMENTS:

Halban, H.
Z. Phys. Chem.
1913, *84*, 129-159.

VARIABLES:

Concentration

PREPARED BY:

P. G. T. Fogg

EXPERIMENTAL VALUES:

T/K	Concentration of C_3H_9N in solution/ mol dm^{-3}	$p_{C_3H_9N}$/mmHg	Concentration of C_3H_9N in solution/ concentration in gas phase	Mole fraction in solution* $x_{C_3H_9N}$
298.2	0.0950	1.35	1308	0.0098
	0.247	3.57	1282	0.0250
	0.447	7.39	1127	0.0443
	0.486	8.37	1081	0.0480
	0.763	14.6	973	0.0734
	0.769	14.7	968	0.0739
	1.040	25.0	775	0.0975

* Calculated by the compiler, using the density of the solvent given in ref. (1), on the assumption that dissolution of gas caused negligible change of volume of the liquid phase.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The partial pressures of trimethylamine above solutions of concentrations determined by titration, were measured by a dynamic method (refs. (2) & (3)). Mixtures of hydrogen and oxygen, produced by electrolysis of sodium hydroxide solution, were passed through each solution of trimethylamine. The trimethylamine in the gas stream was absorbed in hydrochloric acid and estimated from changes in electrical conductivity due to partial neutralisation of the acid. The volumes of hydrogen/oxygen gas mixture produced by electrolysis were found from the barometric pressure and changes in a copper voltameter in series with the cell for producing the gas. The partial pressures of trimethylamine were calculated on the assumption that equilibrium was established between trimethylamine in solution and that in the gas phase, during passage of hydrogen/oxygen mixture through the solution.

SOURCE AND PURITY OF MATERIALS:

1. Hydrated chloride from Kahlbaum; reacted with KOH; gas dried with NaOH.
2. From Schmitz, Düsseldorf; b.p. 204.8-205.2°C.

ESTIMATED ERROR:

REFERENCES:

1. Dreisbach, R.R. *Physical Properties of Chemical Compounds*, Vol. 1, A.C.S. Washington. 1955.
2. Gaus, *Z. Anorg. Chem.* 1900, *25*, 236.
3. Abegg, R.; Riesenfeld, H. *Z. Phys. Chem.* 1902, *40*, 84.

COMPONENTS:

1. *N,N*-Dimethylmethanamine (trimethylamine); C_3H_9N; [75-50-3]
2. Benzenemethanol (Benzyl alcohol); C_7H_8O; [100-51-6]

ORIGINAL MEASUREMENTS:

Gerrard, W.

Solubility of Gases and Liquids,

Plenum 1976, Chapter 10.

VARIABLES:

Temperature, pressure

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	P/mmHg	$P/10^5$Pa	Mole fraction of trimethylamine in liquid, $x_{(CH_3)_3N}$
278.15	100	0.133	0.315
	200	0.267	0.407
	300	0.400	0.484
	400	0.533	0.557
	500	0.667	0.644
	600	0.800	0.742
	700	0.933	0.866
	760	1.013	0.925
283.15	100	0.133	0.293
	200	0.267	0.372
	300	0.400	0.448
	400	0.533	0.508
	500	0.667	0.574
	600	0.800	0.644
	700	0.933	0.725
	760	1.013	0.776
293.15	760	1.013	0.585
298.15	100	0.133	0.224
	200	0.267	0.301
	300	0.400	0.353
	400	0.533	0.395
	500	0.667	0.436
	600	0.800	0.475
	700	0.933	0.516
	760	1.013	0.541

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Amine 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:

1. British Drug Houses or Cambrian Gases sample.

2. Purified and attested by conventional procedures.

ESTIMATED ERROR:

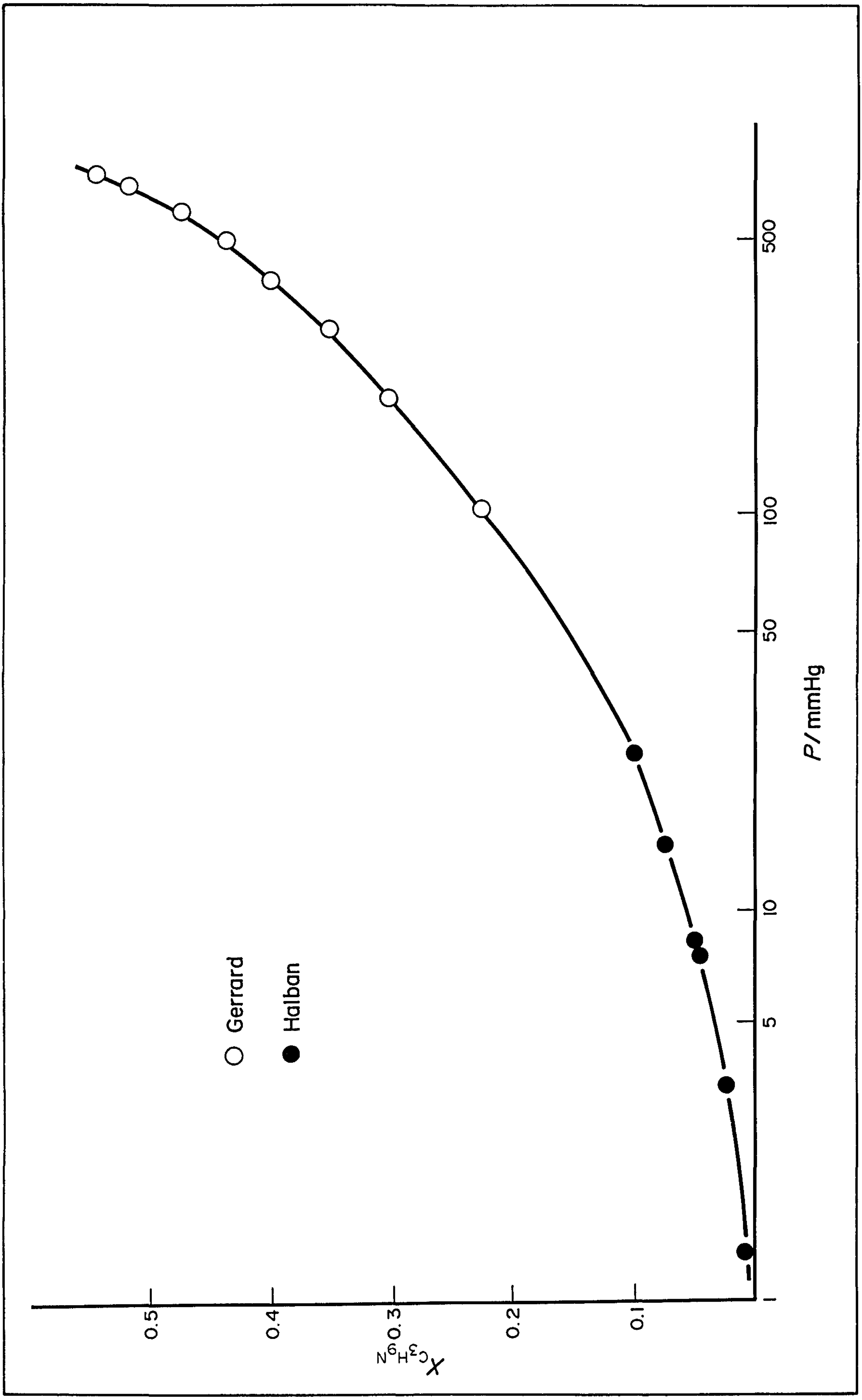
$\delta T/K = \pm 0.1$; $\delta x/x = \pm 3\%$

(estimated by compiler)

REFERENCES:

1. Gerrard, W.
J. Appl. Chem. Biotechnol. 1972, 22 523-650.

2. Gerrard, W.
Solubility of Gases and Liquids. Plenum Press, New York. 1976.
Chapter 1.


Gerrard
Halban
P/mmHg
1
5
10
50
100
500
$x_{C_3H_9N}$
0.1
0.2
0.3
0.4
0.5

COMPONENTS:

1. *N,N*-Dimethylmethanamine (trimethylamine); C_3H_9N; [75-50-3]
2. 1,2-Ethanediol (Ethylene glycol); $C_2H_6O_2$; [107-21-1]

ORIGINAL MEASUREMENTS:

Gerrard, W.

Solubility of Gases and Liquids,

Plenum 1976, Chapter 10.

VARIABLES:

Temperature, pressure

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	P/mmHg	$P/10^5$Pa	Mole fraction of trimethylamine in liquid, $x_{(CH_3)_2N}$
283.15	100	0.133	0.116
	200	0.267	0.216
	300	0.400	0.304
	400	0.533	0.384
	500	0.667	0.455
	600	0.800	0.531
	700	0.933	0.616
	760	1.013	0.672
298.15	100	0.133	0.058
	200	0.267	0.120
	300	0.400	0.180
	400	0.533	0.232
	500	0.667	0.285
	600	0.800	0.331
	700	0.933	0.378
	760	1.013	0.396

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Amine 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 abd procedure are described by Gerrard [1,2].

SOURCE AND PURITY OF MATERIALS:

1. British Drug Houses or Cambrian Gases sample.

2. Purified and attested 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* 623-650.
2. Gerrard, W.
Solubility of Gases and Liquids. Plenum Press, New York. 1976.
Chapter 1.

COMPONENTS:

1. *N,N*-Dimethylmethanamine, (Trimethylamine); C_3H_9N; [75-50-3]
2. 2-Propanone, (acetone); C_3H_6O; [67-64-1]

ORIGINAL MEASUREMENTS:

Halban, H.

Z. Phys. Chem.

1913, *84*, 129-159.

VARIABLES:

Concentration

PREPARED BY:

P. G. T. Fogg

EXPERIMENTAL VALUES:

T/K	Concentration of C_3H_9N in solution/ mol dm^{-3}	$p_{C_3H_9N}$/mmHg	Concentration of C_3H_9N in solution/ concentration in gas phase	Mole fraction in solution* $x_{C_3H_9N}$
298.2	0.212	51.8	76.2	0.0153
	0.237	57.8	76.7	0.0171
	0.281	68.5	76.2	0.0202
	0.325	77.6	77.7	0.0233

* Calculated by the compiler, using the density of the solvent given in ref. (1), on the assumption that dissolution of gas caused negligible change of volume of the liquid phase.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The partial pressures of trimethylamine above solutions of concentrations determined by titration, were measured by a dynamic method (refs. (2) & (3)). Mixtures of hydrogen and oxygen, produced by electrolysis of sodium hydroxide solution, were passed through each solution of trimethylamine. The trimethylamine in the gas stream was absorbed in hydrochloric acid and estimated from changes in electrical conductivity due to partial neutralisation of the acid. The volumes of hydrogen/oxygen gas mixture produced by electrolysis were found from the barometric pressure and changes in a copper voltameter in series with the cell for producing the gas. The partial pressures of trimethylamine were calculated on the assumption that equilibrium was established between trimethylamine in solution and that in the gas phase, during passage of hydrogen/oxygen mixture through the solution.

SOURCE AND PURITY OF MATERIALS:

1. Hydrated chloride from Kahlbaum; reacted with KOH; gas dried with NaOH.
2. Kahlbaum *aus der Bisulfitverbindung*; dried over anhydrous $CuSO_4$; b.p. 56.4 °C (769 mmHg).

ESTIMATED ERROR:

REFERENCES:

1. *Lange's Handbook of Chemistry* (12th edition), McGraw-Hill, New York, 1979.
2. Gaus, *Z. Anorg. Chem.* 1900, *25*, 236.
3. Abegg, R.; Riesenfeld, H. *Z. Phys. Chem.* 1902, *40*, 84.

COMPONENTS:

1. *N,N*-Dimethylmethanamine (trimethylamine); C_3H_9N; [75-50-3]

2. 1,2,3-Propanetriol (Glycerol); $C_3H_8O_3$; [56-81-5]

ORIGINAL MEASUREMENTS:

Gerrard, W.

Solubility of Gases and Liquids,

Plenum 1976, Chapter 10.

VARIABLES:

Temperature, pressure

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	P/mmHg	$P/10^5$Pa	Mole fraction of trimethylamine in liquid, $x_{(CH_3)_3N}$
283.15	100	0.133	0.134
	200	0.267	0.238
	300	0.400	0.316
	400	0.533	0.395
	500	0.667	0.464
	600	0.800	0.530
	700	0.933	0.604
	760	1.013	0.657
298.15	100	0.133	0.075
	200	0.267	0.129
	300	0.400	0.177
	400	0.533	0.224
	500	0.667	0.272
	600	0.800	0.322
	700	0.933	0.376
	760	1.013	0.408

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Amine 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:

1. British Drug Houses or Cambrian Gases sample.

2. Purified and attested 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* 623-650.

2. Gerrard, W.
Solubility of Gases and Liquids. Plenum Press, New York. 1976.
Chapter 1.

COMPONENTS:	ORIGINAL MEASUREMENTS:
1. *N,N*-Dimethylmethanamine (trimethylamine); C_3H_9N; [75-50-3] 2. 1,4-Dioxane; $C_4H_8O_2$; [123-91-1]	Gerrard, W. *Solubility of Gases and Liquids*, *Plenum* 1976, Chapter 10.
VARIABLES:	PREPARED BY: C. L. Young

EXPERIMENTAL VALUES:

T/K	*P*/mmHg	*P*/10⁵Pa	Mole fraction of trimethylamine in liquid, $x_{(CH_3)_3N}$
283.15	760	1.013	0.680

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Amine 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:

1. British Drug Houses or Cambrian Gases sample.

2. Purified and attested 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* 623-650.

2. Gerrard, W.
Solubility of Gases and Liquids. Plenum Press, New York. 1976. Chapter 1.

COMPONENTS:	ORIGINAL MEASUREMENTS:
1. *N,N*-Dimethylmethanamine, (Trimethylamine); C_3H_9N; [75-50-3] 2. Acetic acid, ethyl ester (ethyl acetate); $C_4H_8O_2$; [141-78-6]	Halban, H. *Z. Phys. Chem.* 1913, *84*, 129-159.
VARIABLES:	**PREPARED BY:**
Concentration	P. G. T. Fogg

EXPERIMENTAL VALUES:

T/K	Concentration of C_3H_9N in solution/ mol dm^{-3}	$p_{C_3H_9N}$/mmHg	Concentration of C_3H_9N in solution/ concentration in gas phase	Mole fraction in solution* $x_{C_3H_9N}$
298.2	0.213	46.7	84.9	0.0205
	0.250	54.7	85.0	0.0240
	0.267	59.0	84.1	0.0256

* Calculated by the compiler, using the density of the solvent given in ref. (1), on the assumption that dissolution of gas caused negligible change of volume of the liquid phase.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The partial pressures of trimethylamine above solutions of concentrations determined by titration, were measured by a dynamic method (refs. (2) & (3)). Mixtures of hydrogen and oxygen, produced by electrolysis of sodium hydroxide solution, were passed through each solution of trimethylamine. The trimethylamine in the gas stream was absorbed in hydrochloric acid and estimated from changes in electrical conductivity due to partial neutralisation of the acid. The volumes of hydrogen/oxygen gas mixture produced by electrolysis were found from the barometric pressure and changes in a copper voltameter in series with the cell for producing the gas. The partial pressures of trimethylamine were calculated on the assumption that equilibrium was established between trimethylamine in solution and that in the gas phase, during passage of hydrogen/oxygen mixture through the solution.

SOURCE AND PURITY OF MATERIALS:

1. Hydrated chloride from Kahlbaum; reacted with KOH; gas dried with NaOH.
2. Purified as indicated in ref.(4); distilled over phosphorus pentoxide; b.p. 76.2-77.1°C.

ESTIMATED ERROR:

REFERENCES:

1. Timmermans, J. *Physico-Chemical Constants of Pure Organic Compounds* Vol. 2, Elsevier, Amsterdam. 1965
2. Gaus, *Z. Anorg. Chem.* 1900, *25*, 236.
3. Abegg, R.; Riesenfeld, H. *Z. Phys. Chem.* 1902, *40*, 84.
4. Beckmann, E. *Z. Phys. Chem.* 1913 *82*, 338.

COMPONENTS:

1. *N,N*-Dimethylmethanamine, (Trimethylamine); C_3H_9N; [75-50-3]
2. 1,1'-Oxybis-ethane, (ethyl ether) $C_4H_{10}O$; [60-29-7]

ORIGINAL MEASUREMENTS:

Halban, H.

Z. Phys. Chem.

1913, *84*, 129-159.

VARIABLES:

Concentration

PREPARED BY:

P. G. T. Fogg

EXPERIMENTAL VALUES:

T/K	Concentration of C_3H_9N in solution/ mol dm^{-3}	$p_{C_3H_9N}$/mmHg	Concentration of C_3H_9N in solution/ concentration in gas phase	Mole fraction in solution* $x_{C_3H_9N}$
298.2	0.0868	29.5	54.7	0.0089
	0.1270	44.3	53.3	0.0130
	0.1310	46.9	51.9	0.0134

* Calculated by the compiler, using the density of the solvent given in ref. (1), on the assumption that dissolution of gas caused negligible change of volume of the liquid phase.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The partial pressures of trimethylamine above solutions of concentrations determined by titration, were measured by a dynamic method (refs. (2) & (3)). Mixtures of hydrogen and oxygen, produced by electrolysis of sodium hydroxide solution, were passed through each solution of trimethylamine. The trimethylamine in the gas stream was absorbed in hydrochloric acid and estimated from changes in electrical conductivity due to partial neutralisation of the acid. The volumes of hydrogen/oxygen gas mixture produced by electrolysis were found from the barometric pressure and changes in a copper voltameter in series with the cell for producing the gas. The partial pressures of trimethylamine were calculated on the assumption that equilibrium was ' established between trimethylamine in solution and that in the gas phase, during passage of hydrogen/oxygen mixture through the solution.

SOURCE AND PURITY OF MATERIALS:

1. Hydrated chloride from Kahlbaum; reacted with KOH; gas dried with NaOH.
2. Free from alcohol.

ESTIMATED ERROR:

REFERENCES:

1. Marsden, C. *Solvent Guide*, Cleaver-Hume, London, 1963.
2. Gaus, *Z. Anorg. Chem.* 1900, *25*, 236.
3. Abegg, R.; Riesenfeld, H. *Z. Phys. Chem.* 1902, *40*, 84.

COMPONENTS:

1. *N,N*-Dimethylmethanamine, (Trimethylamine); C_3H_9N; [75-50-3]
2. 1-Phenyl-ethanone, (acetophenone); C_8H_8O; [98-86-2]

ORIGINAL MEASUREMENTS:

Halban, H.
Z. Phys. Chem.
1913, *84*, 129-159.

VARIABLES:

Concentration

PREPARED BY:

P. G. T. Fogg

EXPERIMENTAL VALUES:

T/K	Concentration of C_3H_9N in solution/ mol dm^{-3}	$p_{C_3H_9N}$/mmHg	Concentration of C_3H_9N in solution/ concentration in gas phase	Mole fraction in solution* $x_{C_3H_9N}$
298.2	0.212	68.5	57.6	0.0243
	0.379	120.7	58.1	0.0426

* Calculated by the compiler, using the density of the solvent given in ref. (1), on the assumption that dissolution of gas caused negligible change of volume of the liquid phase.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The partial pressures of trimethylamine above solutions of concentrations determined by titration, were measured by a dynamic method (refs. (2) & (3). Mixtures of hydrogen and oxygen, produced by electrolysis of sodium hydroxide solution, were passed through each solution of trimethylamine. The trimethylamine in the gas stream was absorbed in hydrochloric acid and estimated from changes in electrical conductivity due to partial neutralisation of the acid. The volumes of hydrogen/oxygen gas mixture produced by electrolysis were found from the barometric pressure and changes in a copper voltameter in series with the cell for producing the gas. The partial pressures of trimethylamine were calculated on the assumption that equilibrium was established between trimethylamine in solution and that in the gas phase, during passage of hydrogen/oxygen mixture through the solution.

SOURCE AND PURITY OF MATERIALS:

1. Hydrated chloride from Kahlbaum; reacted with KOH; gas dried with NaOH.
2. Kahlbaum; purified by freezing.

ESTIMATED ERROR:

REFERENCES:

1. Dreisbach, R.R. *Physical Properties of Chemical Compounds*, Vol. 1, A.C.S. Washington, 1955.
2. Gaus, *Z. Anorg. Chem.* 1900, *25*, 236.
3. Abegg, R.; Riesenfeld, H. *Z. Phys. Chem.* 1902, *40*, 84.

COMPONENTS:

1. *N,N*-Dimethylmethanamine (trimethylamine); C_3H_9N; [75-50-3]
2. 1-Phenylethanone (methyl phenyl ketone); C_8H_8O; [98-86-2]

ORIGINAL MEASUREMENTS:

Gerrard, W.

Solubility of Gases and Liquids, *Plenum* 1976, Chapter 10.

VARIABLES:

Pressure

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	P/mmHg	$P/10^5$Pa	Mole fraction of trimethylamine in liquid, $x_{(CH_3)_3N}$
298.15	100	0.133	0.039
	200	0.267	0.080
	300	0.400	0.117
	400	0.533	0.157
	500	0.667	0.202
	600	0.800	0.252
	700	0.933	0.310
	760	1.013	0.353

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Amine 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:

1. British Drug Houses or Cambrian Gases sample.
2. Purified and attested 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* 623-650.
2. Gerrard, W.
Solubility of Gases and Liquids. Plenum Press, New York. 1976. Chapter 1.

COMPONENTS:

1. *N,N*-Dimethylmethanamine (trimethylamine); C_3H_9N; [75-50-3]
2. Ethoxybenzene (ethyl phenyl ether); $C_8H_{10}O$; [103-73-1]

ORIGINAL MEASUREMENTS:

Gerrard, W.

Solubility of Gases and Liquids, *Plenum* 1976, Chapter 10.

VARIABLES:

Pressure

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	*P*/mmHg	*P*/10^5Pa	Mole fraction of trimethylamine in liquid, $(CH_3)_3N$
283.15	100	0.133	0.076
	200	0.267	0.160
	300	0.400	0.255
	400	0.533	0.354
	500	0.667	0.460
	600	0.800	0.566
	700	0.933	0.680
	760	1.013	0.750

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Amine 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:

1. British Drug Houses or Cambrian Gases sample.

2. Purified and attested 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*, 623-650.

2. Gerrard, W. *Solubility of Gases and Liquids. Plenum Press, New York.* 1976, Chapter. 1.

COMPONENTS:	ORIGINAL MEASUREMENTS:
1. *N,N*-Dimethylmethanamine, (Trimethylamine); C_3H_9N; [75-50-3] 2. Benzoic acid, ethyl ester (ethyl benzoate) $C_9H_{10}O_2$; [93-89-0]	Halban, H. *Z. Phys. Chem.* 1913, *84*, 129-159.
VARIABLES:	**PREPARED BY:**
Concentration	P. G. T. Fogg

EXPERIMENTAL VALUES:

T/K	Concentration of C_3H_9N in solution/ mol dm^{-3}	$p_{C_3H_9N}$/mmHg	Concentration of C_3H_9N in solution/ concentration in gas phase	Mole fraction in solution* $x_{C_3H_9N}$
298.2	0.1561	38.1	76.2	0.0220
	0.1622	39.6	76.2	0.0228

* Calculated by the compiler, using the density of the solvent given in ref. (1), on the assumption that dissolution of gas caused negligible change of volume of the liquid phase.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The partial pressures of trimethylamine above solutions of concentrations determined by titration, were measured by a dynamic method (refs. (2) & (3)). Mixtures of hydrogen and oxygen, produced by electrolysis of sodium hydroxide solution, were passed through each solution of trimethylamine. The trimethylamine in the gas stream was absorbed in hydrochloric acid and estimated from changes in electrical conductivity due to partial neutralisation of the acid. The volumes of hydrogen/oxygen gas mixture produced by electrolysis were found from the barometric pressure and changes in a copper voltameter in series with the cell for producing the gas. The partial pressures of trimethylamine were calculated on the assumption that equilibrium was established between trimethylamine in solution and that in the gas phase, during passage of hydrogen/oxygen mixture through the solution.

SOURCE AND PURITY OF MATERIALS:

1. Hydrated chloride from Kahlbaum; reacted with KOH; gas dried with NaOH.
2. Kahlbaum; b.p. 212.4-212.9°C (764 mmHg).

ESTIMATED ERROR:

REFERENCES:

1. Timmermans, J. *Physico-Chemical Constants of Pure Organic Compound* Vol. 2, Elsevier, Amsterdam, 1965.
2. Gaus, *Z. Anorg. Chem.* 1900, *25*, 236.
3. Abegg, R.; Riesenfeld, H. *Z. Phys. Chem.* 1902, *40*, 84.

COMPONENTS:

1. *N,N*-Dimethylmethanamine (trimethylamine); C_3H_9N; [75-50-3]
2. Benzoic acid, ethyl ester (ethyl benzoate); $C_9H_{10}O_2$; [93-89-0]

ORIGINAL MEASUREMENTS:

Gerrard, W.

Solubility of Gases and Liquids,

Plenum 1976, Chapter 10.

VARIABLES:

Temperature, pressure

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	P/mmHg	$P/10^5$Pa	Mole fraction of trimethylamine in liquid, $x_{(CH_3)_3N}$
293.15	760	1.013	0.506
298.15	100	0.133	0.051
	200	0.267	0.103
	300	0.400	0.152
	400	0.533	0.205
	500	0.667	0.256
	600	0.800	0.292
	700	0.933	0.376
	760	1.013	0.423

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Amine 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:

1. British Drug Houses or Cambrian Gases sample.

2. Purified and attested 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* 623-650.

2. Gerrard, W.
Solubility of Gases and Liquids. Plenum Press, New York. 1976. Chapter 1.

COMPONENTS:	ORIGINAL MEASUREMENTS:
1. *N,N*-Dimethylmethanamine (trimethylamine); C_3H_9N; [75-50-3] 2. 1,1'-Oxybisoctane (dioctyl ether); $C_{16}H_{34}O$; [629-82-3]	Gerrard, W. *Solubility of Gases and Liquids,* *Plenum* 1976, Chapter 10.
VARIABLES:	PREPARED BY:
Temperature, pressure	C. L. Young

EXPERIMENTAL VALUES:

T/K	P/mmHg	$P/10^5$Pa	Mole fraction of trimethylamine in liquid, $x_{(CH_3)_3N}$
293.15	400	0.533	0.376
	500	0.667	0.452
	600	0.800	0.524
	700	0.933	0.595
	760	1.013	0.630
298.15	100	0.133	0.148
	200	0.267	0.232
	300	0.400	0.302
	400	0.533	0.366
	500	0.667	0.426
	600	0.800	0.482
	700	0.933	0.536
	760	1.013	0.567

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Amine 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:

1. British Drug Houses or Cambrian Gases sample.

2. Purified and attested 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* 623-650.
2. Gerrard, W.
Solubility of Gases and Liquids. Plenum Press, New York. 1976. Chapter 1.

COMPONENTS:

1. *N,N*-Dimethylmethanamine, (Trimethylamine); C_3H_9N; [75-50-3]
2. Acetonitrile; C_2H_3N; [75-05-8]

ORIGINAL MEASUREMENTS:

Halban, H.

Z. Phys. Chem.

1913, *84*, 129-159.

VARIABLES:

Concentration

PREPARED BY:

P. G. T. Fogg

EXPERIMENTAL VALUES:

T/K	Concentration of C_3H_9N in solution/ mol dm^{-3}	$p_{C_3H_9N}$/mmHg	Concentration of C_3H_9N in solution/ concentration in gas phase	Mole fraction in solution* $x_{C_3H_9N}$
298.2	0.1200	35.3	63.2	0.0063
	0.1260	37.0	63.2	0.0066
	0.1620	46.7	64.3	0.0085

* Calculated by the compiler, using the density of the solvent given in ref. (1), on the assumption that dissolution of gas caused negligible change of volume of the liquid phase.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The partial pressures of trimethylamine above solutions of concentrations determined by titration, were measured by a dynamic method (refs. (2) & (3)). Mixtures of hydrogen and oxygen, produced by electrolysis of sodium hydroxide solution, were passed through each solution of trimethylamine. The trimethylamine in the gas stream was absorbed in hydrochloric acid and estimated from changes in electrical conductivity due to partial neutralisation of the acid. The volumes of hydrogen/oxygen gas mixture produced by electrolysis were found from the barometric pressure and changes in a copper voltameter in series with the cell for producing the gas. The partial pressures of trimethylamine were calculated on the assumption that equilibrium was established between trimethylamine in solution and that in the gas phase, during passage of hydrogen/oxygen mixture through the solution.

SOURCE AND PURITY OF MATERIALS:

1. Hydrated chloride from Kahlbaum; reacted with KOH; gas dried with NaOH.
2. Kahlbaum; dried over K_2SO_4; b.p. 81.0-81.2 °C.

ESTIMATED ERROR:

REFERENCES:

1. Dreisbach, R.R. *Physical Properties of Chemical Compounds*, Vol. 3, A.C.S., Washington. 1961.
2. Gaus, *Z. Anorg. Chem.* 1900, *25*, 236.
3. Abegg, R.; Riesenfeld, H. *Z. Phys. Chem.* 1902, *40*, 84.

COMPONENTS:

1. *N,N*-Dimethylmethanamine, (Trimethylamine); C_3H_9N; [75-50-3]
2. Nitromethane ; CH_3NO_2; [75-52-5]

ORIGINAL MEASUREMENTS:

Halban, H.

Z. Phys. Chem.

1913, *84*, 129-159.

VARIABLES:

Concentration

PREPARED BY:

P. G. T. Fogg

EXPERIMENTAL VALUES:

T/K	Concentration of C_3H_9N in solution/ mol dm^{-3}	$p_{C_3H_9N}$/mmHg	Concentration of C_3H_9N in solution/ concentration in gas phase	Mole fraction in solution* $x_{C_3H_9N}$
298.2	0.1070	35.4	56.0	0.0057
	0.1272	42.1	56.0	0.0068
	0.1419	46.8	56.5	0.0076
	0.1741	56.4	57.5	0.0093

* Calculated by the compiler, using the density of the solvent given in ref. (1), on the assumption that dissolution of gas caused negligible change of volume of the liquid phase.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The partial pressures of trimethylamine above solutions of concentrations determined by titration, were measured by a dynamic method (refs. (2) & (3)). Mixtures of hydrogen and oxygen, produced by electrolysis of sodium hydroxide solution, were passed through each solution of trimethylamine. The trimethylamine in the gas stream was absorbed in hydrochloric acid and estimated from changes in electrical conductivity due to partial neutralisation of the acid. The volumes of hydrogen/oxygen gas mixture produced by electrolysis were found from the barometric pressure and changes in a copper voltameter in series with the cell for producing the gas. The partial pressures of trimethylamine were calculated on the assumption that equilibrium was established between trimethylamine in solution and that in the gas phase, during passage of hydrogen/oxygen mixture through the solution.

SOURCE AND PURITY OF MATERIALS:

1. Hydrated chloride from Kahlbaum; reacted with KOH; gas dried with NaOH.
2. Prepared according to ref. (4); dried over potassium carbonate; b.p. 100.6°C (751 mmHg).

REFERENCES:

1. Timmermans, J. *Physico-Chemical Constants of Pure Organic Compounds* Vol. 2, Elsevier, Amsterdam. 1965
2. Gaus *Z. Anorg. Chem.* 1900, *25*, 236.
3. Abegg, R.; Riesenfeld, H. *Z. Phys. Chem.* 1902, *40*, 84.
4. Steinkopf, W.; Kirchhoff, G. *Ber. Dtsch. Chem. Ges.* 1909, *42*, 3438.

COMPONENTS:	ORIGINAL MEASUREMENTS:
1. *N,N*-Dimethylmethanamine (trimethylamine); C_3H_9N; [75-50-3] 2. *N,N*-Dimethylformamide; C_3H_7NO; [68-12-2]	Gerrard, W. *Solubility of Gases and Liquids, Plenum* 1976, Chapter 10.
VARIABLES:	PREPARED BY:
Temperature, pressure	C. L. Young

EXPERIMENTAL VALUES:

T/K	*P*/mmHg	*P*/10^5Pa	Mole fraction of trimethylamine in liquid, $x_{(CH_3)_3N}$
278.15	100	0.133	0.028
	200	0.267	0.072
	300	0.400	0.128
	400	0.533	0.202
	500	0.667	0.305
	600	0.800	0.442
	700	0.933	0.700
	760	1.013	0.880
283.15	100	0.133	0.024
	200	0.267	0.060
	300	0.400	0.098
	400	0.533	0.145
	500	0.667	0.205
	600	0.800	0.288
	700	0.933	0.410
	760	1.013	0.511
298.15	100	0.133	0.017
	200	0.267	0.037
	300	0.400	0.060
	400	0.533	0.084
	500	0.667	0.106
	600	0.800	0.132
	700	0.933	0.165
	760	1.013	0.191

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Amine 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 abosrbed 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:

1. British Drug Houses or Cambrian Gases sample.

2. Purified and attested 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* 623-650.

2. Gerrard, W.
Solubility of Gases and Liquids. Plenum Press, New York. 1976.
Chapter 1.

COMPONENTS:

1. *N,N*-Dimethylmethanamine (trimethylamine); C_3H_9N; [75-50-3]
2. Pyridine; C_5H_5N; [110-86-1]
   or
   Quinoline; C_9H_7N; [91-22-5]

ORIGINAL MEASUREMENTS:

Gerrard, W.

Solubility of Gases and Liquids,

Plenum 1976, Chapter 10.

VARIABLES:

Pressure

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	P/mmHg	$P/10^5$Pa	Mole fraction of trimethylamine in liquid, $x_{(CH_3)_3N}$
		Pyridine; C_5H_5N; [110-86-1]	
283.15	700	0.933	0.65
	760	1.013	0.70
		Quinoline; C_9H_7N; [91-22-5]	
283.15	100	0.133	0.051
	200	0.267	0.112
	300	0.400	0.179
	400	0.533	0.248
	500	0.667	0.321
	600	0.800	0.413
	700	0.933	0.545
	760	1.013	0.648

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Amine 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:

1. British Drug Houses or Cambrian Gases sample.

2. Purified and attested 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* 623-650.

2. Gerrard, W.
Solubility of Gases and Liquids. Plenum Press, New York. 1976.
Chapter 1.

COMPONENTS:

1. *N*,*N*-Methylmethanamine (trimethylamine); C_3H_9N; [75-50-3]
2. Nitrobenzene; $C_6H_5NO_2$; [98-95-3]

ORIGINAL MEASUREMENTS:

Gerrard, W.

Solubility of Gases and Liquids,

Plenum 1976, Chapter 10.

VARIABLES:

Temperature, pressure

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	P/mmHg	$P/10^5$Pa	Mole fraction of trimethylamine in liquid, $x_{(CH_3)_3N}$
283.15	100	0.133	0.060
	200	0.267	0.119
	300	0.400	0.184
	400	0.533	0.260
	500	0.667	0.356
	600	0.800	0.464
	700	0.933	0.595
	760	1.013	0.694
298.15	100	0.133	0.032
	200	0.267	0.070
	300	0.400	0.110
	400	0.533	0.151
	500	0.667	0.196
	600	0.800	0.243
	700	0.933	0.293
	760	1.013	0.326

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Amine 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 abosrbed 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:

1. British Drug Houses or Cambrian Gases sample.

2. Purified and attested 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* 623-650.
2. Gerrard, W.
Solubility of Gases and Liquids. Plenum Press, New York. 1976. Chapter 1.

COMPONENTS:

1. *N,N*-Dimethylmethanamine, (Trimethylamine); C_3H_9N; [75-50-3]
2. Nitrobenzene ; $C_6H_5NO_2$; [98-95-3]

ORIGINAL MEASUREMENTS:

Halban, H.

Z. Phys. Chem.

1913, *84*, 129-159.

VARIABLES:

Concentration

PREPARED BY:

P. G. T. Fogg

EXPERIMENTAL VALUES:

T/K	Concentration of C_3H_9N in solution/ mol dm	$p_{C_3H_9N}$/mmHg	Concentration of C_3H_9N in solution/ concentration in gas phase	Mole fraction in solution* $x_{C_3H_9N}$
298.2	0.180	63.3	52.8	0.0182
	0.236	81.7	53.7	0.0237
	0.268	94.5	52.7	0.0268

* Calculated by the compiler, using the density of the solvent given in ref. (1), on the assumption that dissolution of gas caused negligible change of volume of the liquid phase.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The partial pressures of trimethylamine above solutions of concentrations determined by titration, were measured by a dynamic method (refs. (2) & (3)). Mixtures of hydrogen and oxygen, produced by electrolysis of sodium hydroxide solution, were passed through each solution of trimethylamine. The trimethylamine in the gas stream was absorbed in hydrochloric acid and estimated from changes in electrical conductivity due to partial neutralisation of the acid. The volumes of hydrogen/ oxygen gas mixture produced by electrolysis were found from the barometric pressure and changes in a copper voltameter in series with the cell for producing the gas. The partial pressures of trimethylamine were calculated on the assumption that equilibrium was established between trimethylamine in solution and that in the gas phase, during passage of hydrogen/oxygen mixture through the solution.

SOURCE AND PURITY OF MATERIALS:

1. Hydrated chloride from Kahlbaum; reacted with KOH; gas dried with NaOH.
2. Kahlbaum *aus krist. Benzol*; dried before use.

ESTIMATED ERROR:

REFERENCES:

1. Dreisbach, R.R. *Physical Properties of Chemical Compounds*, Vol. 1, A.C.S. Washington. 1955.
2. Gaus, *Z. Anorg. Chem.* 1900, *25*, 236.
3. Abegg, R.; Riesenfeld, H. *Z. Phys. Chem.* 1902, *40*, 84.

COMPONENTS:	ORIGINAL MEASUREMENTS:
1. *N,N*-Dimethylmethanamine (trimethylamine); C_3H_9N; [75-50-3] 2. Benzenamine (Aniline); C_6H_7N; [62-53-3]	Gerrard, W. *Solubility of Gases and Liquids*, *Plenum* 1976, Chapter 10.
VARIABLES:	PREPARED BY:
Pressure	C. L. Young

EXPERIMENTAL VALUES:

T/K	P/mmHg	$P/10^5$Pa	Mole fraction of trimethylamine in liquid, $x_{(CH_3)_3N}$
283.15	100	0.133	0.111
	200	0.267	0.217
	300	0.400	0.327
	400	0.533	0.432
	500	0.667	0.531
	600	0.800	0.626
	700	0.933	0.720
	760	1.013	0.775

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Amine 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:

1. British Drug Houses or Cambrian Gases sample.

2. Purified and attested 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* 623-650.

2. Gerrard, W.
Solubility of Gases and Liquids. Plenum Press, New York. 1976. Chapter 1.

COMPONENTS:	ORIGINAL MEASUREMENTS:
1. *N,N*-Dimethylmethanamine (trimethylamine); C_3H_9N; [75-50-3] 2. *N*-Methylbenzenamine; C_7H_9N; [100-61-8]	Gerrard, W. *Solubility of Gases and Liquids, Plenum*, 1976, Chapter 10.
VARIABLES:	PREPARED BY:
Pressure	C. L. Young

EXPERIMENTAL VALUES:

T/K	*P*/mmHg	$P/10^5$Pa	Mole fraction of *N,N*-dimethylmethanamine in liquid, $x_{C_3H_9N}$
283.15	100	0.133	0.060
	200	0.267	0.128
	300	0.400	0.203
	400	0.533	0.284
	500	0.667	0.380
	600	0.800	0.492
	700	0.933	0.640
	760	1.013	0.732

AUXILIARY INFORMATION

METHOD APPARATUS/PROCEDURE:

Amine 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:

1. British Drug Houses or Cambrian Gases sample.
2. Purified and attested 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*, 623-650.
2. Gerrard, W. *Solubility of Gases and Liquids, Plenum Press, New York.* 1976, Chapter 1.

COMPONENTS:

1. *N,N*-Dimethylmethanamine, (trimethylamine); C_3H_9N; [75-50-3]
2. Benzonitrile; C_7H_5N; [100-47-0]

ORIGINAL MEASUREMENTS:

Gerrard, W.

Solubility of Gases and Liquids, *Plenum* 1976, Chapter 10.

VARIABLES:

Pressure

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	P/mmHg	$P/10^5$Pa	Mole fraction of trimethylamine in liquid, $x_{(CH_3)_3N}$
283.15	100	0.133	0.067
	200	0.267	0.140
	300	0.400	0.217
	400	0.533	0.302
	500	0.667	0.400
	600	0.800	0.507
	700	0.933	0.640
	760	1.013	0.720

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Amine 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:

1. British Drug Houses or Cambrian Gases sample.

2. Purified and attested 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* 623-650.

2. Gerrard, W.
Solubility of Gases and Liquids. Plenum Press, New York. 1976. Chapter 1.

COMPONENTS:

1. *N,N*-Dimethylmethanamine, (Trimethylamine); C_3H_9N; [75-50-3]
2. 1-Methyl-2-nitrobenzene; $C_7H_7NO_2$; [88-72-2]

ORIGINAL MEASUREMENTS:

Halban, H.
Z. Phys. Chem.
1913, *84*, 129-159.

VARIABLES:

Concentration

PREPARED BY:

P. G. T. Fogg

EXPERIMENTAL VALUES:

T/K	Concentration of C_3H_9N in solution/ mol dm^{-3}	$p_{C_3H_9N}$/mmHg	Concentration of C_3H_9N in solution/ concentration in gas phase	Mole fraction in solution* $x_{C_3H_9N}$
298.2	0.250	86.6	53.7	0.0286
	0.256	85.2	55.8	0.0293

* Calculated by the compiler, using the density of the solvent given in ref. (1), on the assumption that dissolution of gas caused negligible change of volume of the liquid phase.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The partial pressures of trimethylamine above solutions of concentrations determined by titration, were measured by a dynamic method (refs. (2) & (3)). Mixtures of hydrogen and oxygen, produced by electrolysis of sodium hydroxide solution, were passed through each solution of trimethylamine. The trimethylamine in the gas stream was absorbed in hydrochloric acid and estimated from changes in electrical conductivity due to partial neutralisation of the acid. The volumes of hydrogen/ oxygen gas mixture produced by electrolysis were found from the barometric pressure and changes in a copper voltameter in series with the cell for producing the gas. The partial pressures of trimethylamine were calculated on the assumption that equilibrium was established between trimethylamine in solution and that in the gas phase, during passage of hydrogen/oxygen mixture through the solution.

SOURCE AND PURITY OF MATERIALS:

1. Hydrated chloride from Kahlbaum; reacted with KOH; gas dried with NaOH.
2. Supplied by Kahlbaum; purified by method given in ref. (4); dried over calcium chloride.

ESTIMATED ERROR:

REFERENCES:

1. *Lange's Handbook of Chem.* (12th ed McGraw-Hill, New York, 1979.
2. Gaus, *Z. Anorg. Chem.* 1900 *25*, 236.
3. Abegg, R.; Riesenfeld, H. *Z. Phys. Chem.* 1902, *40*, 84.
4. Lösner, H. *J. Prakt. Chem.* 1895, *50*, 563.

COMPONENTS:	ORIGINAL MEASUREMENTS:
1. *N,N*-Dimethylmethanamine (trimethylamine); C_3H_9N; [75-50-3] 2. 1-Methyl-2-nitrobenzene (*o*-nitrotoluene); $C_7H_7NO_2$; [88-72-2]	Gerrard, W. *Solubility of Gases and Liquids, Plenum* 1976, Chapter 10.
VARIABLES:	PREPARED BY:
Temperature, pressure	C. L. Young

EXPERIMENTAL VALUES:

T/K	P/mmHg	$P/10^5$Pa	Mole fraction of trimethylamine in liquid, $x_{(CH_3)_3N}$
278.15	100	0.133	0.071
	200	0.267	0.146
	300	0.400	0.238
	400	0.533	0.351
	500	0.667	0.482
	600	0.800	0.647
	700	0.933	0.828
	760	1.013	0.920
283.15	100	0.133	0.064
	200	0.267	0.132
	300	0.400	0.202
	400	0.533	0.284
	500	0.667	0.380
	600	0.800	0.486
	700	0.933	0.605
	760	1.013	0.676
293.15	760	1.013	0.406
298.15	100	0.133	0.040
	200	0.267	0.080
	300	0.400	0.118
	400	0.533	0.160
	500	0.667	0.204
	600	0.800	0.250
	700	0.933	0.301
	760	1.013	0.331

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Amine 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:

1. British Drug Houses or Cambrian Gases sample.

2. Purified and attested 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* 623-650.

2. Gerrard, W.
Solubility of Gases and Liquids. Plenum Press, New York. 1976.
Chapter 1.

COMPONENTS:	ORIGINAL MEASUREMENTS:
1. *N,N*-Dimethylmethanamine, (trimethylamine); C_3H_9N; [75-50-3] 2. Benzenemethanamine, (Benzylamine); C_7H_9N; [100-46-9]	Gerrard, W. *Solubility of Gases and Liquids*, *Plenum*, 1976, Chapter 10.
VARIABLES:	**PREPARED BY:**
Pressure	C. L. Young

EXPERIMENTAL VALUES:

T/K	*P*/mmHg	$P/10^5$Pa	Mole fraction of trimethylamine in liquid, $x_{(CH_3)_3N}$
283.15	100	0.133	0.060
	200	0.267	0.128
	300	0.400	0.203
	400	0.533	0.284
	500	0.667	0.380
	600	0.800	0.492
	700	0.933	0.640
	760	1.013	0.732

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Amine 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:

1. British Drug Houses or Cambrian Gases sample.

2. Purified and attested 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, 22 623-650.

2. Gerrard, W.
Solubility of Gases and Liquids. Plenum Press, New York. 1976.
Chapter 1.

COMPONENTS:

1. *N,N*-Dimethylmethanamine (trimethylamine); C_3H_9N; [75-50-3]
2. *N*-Ethylbenzenamine (*N*-ethylaniline); $C_8H_{11}N$; [103-69-5]

ORIGINAL MEASUREMENTS:

Gerrard, W.

Solubility of Gases and Liquids,

Plenum 1976, Chapter 10.

VARIABLES:

Pressure

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	P/mmHg	$P/10^5$Pa	Mole fraction of trimethylamine in liquid, $x_{(CH_3)_3N}$
283.15	100	0.133	0.124
	200	0.267	0.233
	300	0.400	0.335
	400	0.533	0.432
	500	0.667	0.526
	600	0.800	0.612
	700	0.933	0.712
	760	1.013	0.771

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Amine 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:

1. British Drug Houses or Cambrian Gases sample.

2. Purified and attested 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* 623-650.

2. Gerrard, W.
Solubility of Gases and Liquids. Plenum Press, New York. 1976.
Chapter 1.

COMPONENTS:

1. *N,N*-Dimethylmethanamine, (trimethylamine); C_3H_9N; [75-50-3]
2. 1-Octanamine (octylamine); $C_8H_{19}N$; [111-86-4]

ORIGINAL MEASUREMENTS:

Gerrard, W.

Solubility of Gases and Liquids,

Plenum 1976, Chapter 10.

VARIABLES:

Temperature, pressure

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	P/mmHg	$P/10^5$Pa	Mole fraction of trimethylamine in liquid, $x_{(CH_3)_3N}$
278.15	100	0.133	0.141
	200	0.267	0.265
	300	0.400	0.387
	400	0.533	0.507
	500	0.667	0.628
	600	0.800	0.750
	700	0.933	0.866
	760	1.013	0.930
283.15	100	0.133	0.106
	200	0.267	0.213
	300	0.400	0.317
	400	0.533	0.418
	500	0.667	0.516
	600	0.800	0.617
	700	0.933	0.717
	760	1.013	0.776
293.15	760	1.013	0.585
298.15	100	0.133	0.075
	200	0.267	0.141
	300	0.400	0.210
	400	0.533	0.277
	500	0.667	0.340
	600	0.800	0.400
	700	0.933	0.463
	760	1.013	0.500

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Amine 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:

1. British Drug Houses or Cambrian Gases sample.

2. Purified and attested 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* 623-650.

2. Gerrard, W.
Solubility of Gases and Liquids. Plenum Press, New York. 1976. Chapter 1.

COMPONENTS:

1. *N,N*-Dimethylmethanamine (trimethylamine); C_3H_9N; [75-50-3]

2. *N,N*-Dimethylbenzenamine (*N,N*-dimethylaniline); $C_8H_{11}N$; [121-69-7]

ORIGINAL MEASUREMENTS:

Gerrard, W.

Solubility of Gases and Liquids, *Plenum* 1976, Chapter 10.

VARIABLES:

Pressure

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	P/mmHg	$P/10^5$Pa	Mole fraction of trimethylamine in liquid, $x_{(CH_3)_3N}$
283.15	100	0.133	0.071
	200	0.267	0.149
	300	0.400	0.235
	400	0.533	0.328
	500	0.667	0.422
	600	0.800	0.535
	700	0.933	0.660
	760	1.013	0.744

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Amine 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:

1. British Drug Houses or Cambrian Gases sample.

2. Purified and attested 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* 623-650.

2. Gerrard, W.
Solubility of Gases and Liquids. Plenum Press, New York. 1976. Chapter 1.

COMPONENTS:

1. *N*,*N*-Methylmethanamine (trimethylamine); C_3H_9N; [75-50-3]

2. *N*,*N*-Diethylbenzenamine (*N*,*N*-diethylaniline); $C_{10}H_{15}N$; [91-66-7]

ORIGINAL MEASUREMENTS:

Gerrard, W.

Solubility of Gases and Liquids, *Plenum* 1976, Chapter 10.

VARIABLES:

Pressure

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	P/mmHg	$P/10^5$Pa	Mole fraction of trimethylamine in liquid, $x_{(CH_3)_3N}$
283.15	100	0.133	0.083
	200	0.267	0.165
	300	0.400	0.255
	400	0.533	0.352
	500	0.667	0.454
	600	0.800	0.560
	700	0.933	0.673
	760	1.013	0.750

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Amine 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:

1. British Drug Houses or Cambrian Gases sample.

2. Purified and attested 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* 623-650.

2. Gerrard, W.
Solubility of Gases and Liquids. Plenum Press, New York. 1976.
Chapter 1.

COMPONENTS:	ORIGINAL MEASUREMENTS:
1. *N,N*-Dimethylmethanamine, (Trimethylamine); C_3H_9N; [75-50-3] 2. Trichloromethane, (chloroform); $CHCl_3$; [67-66-3]	Halban, H. *Z. Phys. Chem.* 1913, *84*, 129-159.
VARIABLES:	PREPARED BY:
Concentration	P. G. T. Fogg

EXPERIMENTAL VALUES:

T/K	Concentration of C_3H_9N in solution/ mol dm^{-3}	$p_{C_3H_9N}$/mmHg	Concentration of C_3H_9N in solution/ concentration in gas phase	Mole fraction in solution* $x_{C_3H_9N}$
298.2	0.1552	4.82	598	0.0124
	0.1995	6.14	593	0.0158
	0.276	8.84	580	0.0218

* Calculated by the compiler, using the density of the solvent given in ref. (1), on the assumption that dissolution of gas caused negligible change of volume of the liquid phase.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The partial pressures of trimethylamine above solutions of concentrations determined by titration, were measured by a dynamic method (refs. (2) & (3)). Mixtures of hydrogen and oxygen, produced by electrolysis of sodium hydroxide solution, were passed through each solution of trimethylamine. The trimethylamine in the gas stream was absorbed in hydrochloric acid and estimated from changes in electrical conductivity due to partial neutralisation of the acid. The volumes of hydrogen/oxygen gas mixture produced by electrolysis were found from the barometric pressure and changes in a copper voltameter in series with the cell for producing the gas. The partial pressures of trimethylamine were calculated on the assumption that equilibrium was established between trimethylamine in solution and that in the gas phase, during passage of hydrogen/oxygen mixture through the solution.

SOURCE AND PURITY OF MATERIALS:

1. Hydrated chloride from Kahlbaum; reacted with KOH; gas dried with NaOH.
2. From Kahlbaum; dried over $CaCl_2$ and distilled.

ESTIMATED ERROR:

REFERENCES:

1. Dreisbach, R.R. *Physical Properties of Chemical Compounds*, Vol. 2, A.C.S., Washington, 1959.
2. Gaus, *Z. Anorg. Chem.* 1900, *25*, 236.
3. Abegg, R.; Riesenfeld, H. *Z. Phys. Chem.* 1902, *40*, 84.

COMPONENTS:	ORIGINAL MEASUREMENTS:
1. *N*,*N*-Dimethylmethanamine (trimethylamine); C_3H_9N; [75-50-3] 2. Trichloromethane; $CHCl_3$; [67-66-3]	Gerrard, W. *Solubility of Gases and Liquids*, *Plenum*, 1976, Chapter 10.
VARIABLES:	PREPARED BY: C. L. Young

EXPERIMENTAL VALUES:

T/K	P/mmHg	$P/10^5$Pa	Mole fraction of *N*,*N*-dimethylmethanamine in liquid, $x_{C_3H_9N}$
298.15	760	1.013	0.554

AUXILIARY INFORMATION

METHOD APPARATUS/PROCEDURE:

Amine 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:

1. British Drug Houses or Cambrian Gases sample.
2. Purified and attested 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*, 623-650.
2. Gerrard, W. *Solubility of Gases and Liquids*, *Plenum Press*, *New York*. 1976, Chapter 1.

COMPONENTS:

1. *N,N*-Dimethylmethanamine, (trimethylamine); C_3H_9N; [75-50-3]
2. Tetrachloromethane (carbon tetrachloride); CCl_4; [56-23-5]

ORIGINAL MEASUREMENTS:

Wolff, H.; Würtz, R.
Ber. Bunsenges. Phys. Chem.
1968, *72*, 101-109.

VARIABLES:

Composition, temperature

PREPARED BY:

P. G. T. Fogg

EXPERIMENTAL VALUES:

Variation of the total vapor pressure/Torr with variation of temperature and of mole fraction of C_3H_9N in the liquid phase, $x_{C_3H_9N}$

		T/K	
$x_{C_3H_9N}$	253.15	273.15	293.15
0	10.0	33.0	90.5
0.0502	17.7	51.0	130.4
0.1029	21.5	73.6	177.1
0.152	31.6	90.6	218.6
0.202	41.7	114.8	269.8
0.254	51.6	139.8	322.6
0.304	62.3	166.1	378.7
0.351	73.5	190.9	425.0
0.396	85.5	221.5	491.9
0.403	87.5	227.2	501.7
0.453	101.4	259.5	564.4
0.507	117.7	296.5	639.8
0.553	133.6	330.1	700.6
0.604	152.8	372.0	787.1
0.655	176.0	414.0	855.9
0.701	186.3	445.6	924.2

Cont.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Apparatus described previously was used (1), (2). Liquid mixtures of accurately known composition were introduced into a cell held in a thermostat controlled to ± 0.02°C. The total vapor pressure was measured by a mercury manometer but contact between vapor and mercury was avoided by using a sensitive quartz spiral manometer as a null instrument with pressure of vapor balanced against that of carbon dioxide. Metal taps were used so as to avoid contact between vapor and tap grease.

The authors calculated activity coefficients of each component from the vapor pressure data by a method described by Barker (3). Constants for Redlich-Kister equations (4) were evaluated and reported. The compositions of the vapor phase were also calculated by the authors.

SOURCE AND PURITY OF MATERIALS:

1. Prepared from commercial *reinst* trimethylammonium chloride; repeatedly fractionated until the first and last fractions had vapor pressures which differed by less than the limits of error of the pressure measurements (1).
2. Merck "*Uvasol*"

ESTIMATED ERROR:

$\delta T/K = \pm 0.02$ (estimated by authors)

REFERENCES:

1. Wolff, H.; Höpfner, A. *Z. Elektrochem.* 1962, *66*, 149.
2. Wolff, H.; Höppel, H.-E. *Ber. Bunsenges. Phys. Chem.* 1966, *70*, 874.
3. Barker, J.A. *Aust. J. Chem* 1953, *6*, 207.
4. Redlich, O.; Kister, A.T. *Ind. Eng. Chem.* 1948, *21*, 345.

COMPONENTS:	ORIGINAL MEASUREMENTS:
1. *N,N*-Dimethylmethanamine, (trimethylamine); C_3H_9N; [75-50-3] 2. Tetrachloromethane (carbon tetrachloride); CCl_4; [56-23-5]	Wolff, H.; Würtz, R. *Ber. Bunsenges. Phys. Chem.* 1968, *72*, 101-109.

EXPERIMENTAL VALUES: Cont.

$x_{C_3H_9N}$	T/K		
	253.15	273.15	293.15
0.753	206.7	488.2	1006.8
0.801	223.9	527.8	1088.6
0.824	231.8	545.9	1117.3
0.925	264.8	619.5	1269.5
1	289.2	675.8	1388.2

760 Torr = 1 atm = 1.013×10^5 Pa

Constants for calculation of activity coefficients from the Redlich-Kister equations given below

T/K	A	B	C
253.15	-0.882	-0.056	+0.077
263.15	-0.726	-0.081	+0.083
273.15	-0.640	-0.058	+0.051
283.15	-0.541	-0.064	+0.005
293.15	-0.489	-0.044	-0.011

$$\ln f_1 = A\,x_2^{\,2} - B\,x_2^{\,2}(1 - 4\,x_1) + C\,x_2^{\,2}(1 - 8\,x_1 + 12\,x_1^{\,2})$$

$$\ln f_2 = A\,x_1^{\,2} + B\,x_1^{\,2}(1 - 4\,x_2) + C\,x_1^{\,2}(1 - 8\,x_2 + 12\,x_2^{\,2})$$

where f_1 = activity coefficient of trimethylamine

f_2 = activity coefficient of carbon tetrachloride

x_1 = mole fraction of trimethylamine in the liquid phase

x_2 = mole fraction of carbon tetrachloride in the liquid phase

COMPONENTS:

1. *N,N*-Dimethylmethanamine (trimethylamine); C_3H_9N; [75-50-3]
2. 2,2,2-Trichloroethanol (1,1,1-trichloro-2-hydroxyethane); $C_2H_3Cl_3O$; [115-20-8]

ORIGINAL MEASUREMENTS:

Gerrard, W.

Solubility of Gases and Liquids,

Plenum 1976, Chapter 10.

VARIABLES:

Temperature, pressure

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	P/mmHg	$P/10^5$Pa	Mole fraction of trimethylamine in liquid, $x_{(CH_3)_3N}$
278.15	100	0.133	0.478
	200	0.267	0.545
	300	0.400	0.600
	400	0.533	0.660
	500	0.667	0.722
	600	0.800	0.800
	700	0.933	0.875
	760	1.013	0.930
283.15	100	0.133	0.454
	200	0.267	0.515
	300	0.400	0.567
	400	0.533	0.613
	500	0.667	0.660
	600	0.800	0.713
	700	0.933	0.780
	760	1.013	0.820
293.15	760	1.013	0.689
298.15	760	1.013	0.654

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Amine 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:

1. British Drug Houses or Cambrian Gases sample.

2. Purified and attested 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* 623-650.

2. Gerrard, W.
Solubility of Gases and Liquids. Plenum Press, New York. 1976. Chapter 1.

COMPONENTS:	ORIGINAL MEASUREMENTS:
1. *N*,*N*-Dimethylmethanamine (trimethylamine); C_3H_9N; [75-50-3] 2. Bromobenzene; C_6H_5Br; [108-86-1]	Gerrard, W. *Solubility of Gases and Liquids*, *Plenum*, 1976, Chapter 10.
VARIABLES:	**PREPARED BY:**
Pressure	C. L. Young

EXPERIMENTAL VALUES:

T/K	P/mmHg	$P/10^5$Pa	Mole fraction of trimethylamine in liquid, $x_{(CH_3)_3N}$
283.15	100	0.133	0.088
	200	0.267	0.182
	300	0.400	0.290
	400	0.533	0.386
	500	0.667	0.496
	600	0.800	0.600
	700	0.933	0.710
	760	1.013	0.770

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Amine 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:

1. British Drug Houses or Cambrian Gases sample.

2. Purified and attested 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, 22 623-650.
2. Gerrard, W.
Solubility of Gases and Liquids. Plenum Press, New York. 1976. Chapter 1.

COMPONENTS:

1. *N,N*-Dimethylmethanamine (trimethylamine); C_3H_9N; [75-50-3]
2. Iodobenzene; C_6H_5I; [591-50-4]

ORIGINAL MEASUREMENTS:

Gerrard, W.

Solubility of Gases and Liquids,

Plenum, 1976, Chapter 10.

VARIABLES:

Pressure

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	P/mmHg	$P/10^5$Pa	Mole fraction of trimethylamine in liquid, $x_{(CH_3)_3N}$
283.15	100	0.133	0.100
	200	0.267	0.202
	300	0.400	0.303
	400	0.533	0.398
	500	0.667	0.502
	600	0.800	0.606
	700	0.933	0.715
	760	1.013	0.780

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Amine 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 abosrbed 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:

1. British Drug Houses or Cambrian Gases sample.

2. Purified and attested 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* 623-650.

2. Gerrard, W.
Solubility of Gases and Liquids. Plenum Press, New York. 1976.
Chapter 1.

COMPONENTS:

1. *N,N*-Dimethylmethanamine (trimethylamine); C_3H_9N; [75-50-3]

2. 1-Bromo-3-methylbenzene (m-Bromotoluene); C_7H_7Br; [95-46-5]

ORIGINAL MEASUREMENTS:

Gerrard, W.

Solubility of Gases and Liquids, Plenum 1976, Chapter 10.

VARIABLES:

Pressure

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	P/mmHg	$P/10^5$Pa	Mole fraction of trimethylamine in liquid, $x_{(CH_3)_3N}$
283.15	100	0.133	0.089
	200	0.267	0.171
	300	0.400	0.261
	400	0.533	0.362
	500	0.667	0.476
	600	0.800	0.590
	700	0.933	0.704
	760	1.013	0.772

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Amine 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:

1. British Drug Houses or Cambrian Gases sample.

2. Purified and attested 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*, 623-650.
2. Gerrard, W. *Solubility of Gases and Liquids, Plenum Press, New York.* 1976, Chapter. 1.

COMPONENTS:	ORIGINAL MEASUREMENTS:
1. *N,N*-Dimethylmethanamine, (Trimethylamine); C_3H_9N; [75-50-3] 2. 1-Bromo-naphthalene; $C_{10}H_7Br$; [90-11-9]	Halban, H. *Z. Phys. Chem.* 1913, *84*, 129-159.
VARIABLES:	PREPARED BY:
Concentration	P. G. T. Fogg

EXPERIMENTAL VALUES:

T/K	Concentration of C_3H_9N in solution/ mol dm^{-3}	$p_{C_3H_9N}$/mmHg	Concentration of C_3H_9N in solution/ concentration in gas phase	Mole fraction in solution* $x_{C_3H_9N}$
298.2	0.1206	47.7	47.0	0.0166
	0.1456	60.0	45.1	0.0199
	0.201	84.0	44.4	0.0273

* Calculated by the compiler, using the density of the solvent given in ref. (1), on the assumption that dissolution of gas caused negligible change of volume of the liquid phase.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The partial pressures of trimethylamine above solutions of concentrations determined by titration, were measured by a dynamic method (refs. (2) & (3). Mixtures of hydrogen and oxygen, produced by electrolysis of sodium hydroxide solution, were passed through each solution of trimethylamine. The trimethylamine in the gas stream was absorbed in hydrochloric acid and estimated from changes in electrical conductivity due to partial neutralisation of the acid. The volumes of hydrogen/oxygen gas mixture produced by electrolysis were found from the barometric pressure and changes in a copper voltameter in series with the cell for producing the gas. The partial pressures of trimethylamine were calculated on the assumption that equilibrium was established between trimethylamine in solution and that in the gas phase, during passage of hydrogen/oxygen mixture through the solution.

SOURCE AND PURITY OF MATERIALS:

1. Hydrated chloride from Kahlbaum; reacted with KOH; gas dried with NaOH.
2. From Kahlbaum; distilled under vacuum; b.p. 145-146°C (16 mmHg).

ESTIMATED ERROR:

REFERENCES:

1. *Lange's Handbook of Chemistry*, (12th edition), McGraw-Hill, New York, 1979.
2. Gaus, *Z. Anorg. Chem.* 1900, *25*, 236.
3. Abegg, R.; Riesenfeld, H. *Z. Phys. Chem.* 1902, *40*, 84.

COMPONENTS:

1. *N,N*-Dimethylmethanamine (trimethylamine); C_3H_9N; [75-50-3]
2. 1-Bromonaphthalene; $C_{10}H_7Br$; [90-11-9]

ORIGINAL MEASUREMENTS:

Gerrard, W.

Solubility of Gases and Liquids,

Plenum 1976, Chapter 10.

VARIABLES:

Pressure

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	*P*/mmHg	$P/10^5$Pa	Mole fraction of trimethylamine in liquid, $x_{(CH_3)_3N}$
298.15	100	0.133	0.050
	200	0.267	0.096
	300	0.400	0.141
	400	0.533	0.192
	500	0.667	0.240
	600	0.800	0.293
	700	0.933	0.345
	760	1.013	0.380

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Amine 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:

1. British Drug Houses or Cambrian Gases sample.

2. Purified and attested 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* 623-650

2. Gerrard, W.
Solubility of Gases and Liquids. Plenum Press, New York. 1976.
Chapter 1.

COMPONENTS: 1. *N,N*-Dimethylmethanamine (trimethylamine); C_3H_9N; [75-50-3] 2. 1-Chloronaphthalene; $C_{10}H_7Cl$; [90-13-1]	ORIGINAL MEASUREMENTS: Gerrard, W. *Solubility of Gases and Liquids, Plenum*, 1976, Chapter 10.
VARIABLES: Pressure	PREPARED BY: C. L. Young

EXPERIMENTAL VALUES:

T/K	*P*/mmHg	$P/10^5$Pa	Mole fraction of trimethylamine in liquid, $x_{(CH_3)_3N}$
293.15	100	0.133	0.043
	200	0.267	0.090
	300	0.400	0.132
	400	0.533	0.178
	500	0.667	0.228
	600	0.800	0.278
	700	0.933	0.332
	760	1.013	0.365

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Amine 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 abosrbed 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:

1. British Drug Houses or Cambrian Gases sample.

2. Purified and attested 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* 623-650.

2. Gerrard, W.
Solubility of Gases and Liquids. Plenum Press, New York. 1976. Chapter 1.

COMPONENTS:

1. Methan-d_3-amine; CH_3D_2N; [5581-55-5]
   Methanamine-d_2; CH_3D_2N; [2614-35-9]
   Methanamine-d_5; CD_5N; [3767-37-1]
   Ethanamine-d_2; $C_2H_5D_2N$; [5852-45-0]
   N-Methylmethanamine-d; C_2H_6DN; [917-72-6]
   N-(Methyl-d_3)-methan-d_3-amine;
   C_2HD_6N; [14802-36-9]
   N-(Methyl-d_3)-methan-d_3-amine-d;
   C_2D_7N; [22024-52-8]
   1-Propanamine-d_2; $C_3H_7ND_2$; [25837-80-3]
   2-Propanamine-d_2; $C_3H_7ND_2$; [7395-10-0]
2. Organic liquids

EVALUATOR:

P. G. T. Fogg,
School of Chemistry,
Polytechnic of North London,
Holloway,
London N7 8DB,
United Kingdom.

October 1983

CRITICAL EVALUATION:

The variation of total vapor pressure with variation of concentration has been measured by Wolff *et al.* (1-6) for solutions of deuterated methanamines, propanamines, *N*-deuterated ethanamine and deuterated *N*-methylmethanamines in hexane. In addition measurements have been made on *N*-deuterated ethanamine in butane and on *N*-deuterated methanamine in *N*,*N*-dimethylmethanamine. In each case the variation of partial pressure of either component with variation of composition may be calculated and compared with values for the system containing the corresponding non-deuterated amine, also studied by Wolff *et al.*

The relative solubilities of a deuterated and a corresponding non-deuterated amine in the same solvent depent upon the temperature and the partial pressure. Differences may be up to about 10%. Differences have been discussed by Wolff *et al.* in terms of relative partial pressures at the same mole fraction concentration.

On the basis of the systems which have been studied it appears that, at all concentrations, amines which have deuterium atoms substituted into methyl groups are more volatile than the corresponding unsubstituted amines under the same conditions. At low concentrations most of the amines studied which have deuterium atoms substituted on the nitrogen atom are also more volatile than the corresponding amines containing =NH or $-NH_2$ groups. However this does not hold for the 1- and 2-propanamines. It follows that, at the same partial pressure and temperature, the deuterated compound may be less soluble than the corresponding non-deuterated compound. Wolff *et al.* showed that differences may be due to changes in vibrational frequencies causing changes in partition functions governing the distribution between condensed and gaseous state.

Increase in concentration causes the partial pressure of a *N*-deuterated amine to decrease relative to that of the corresponding *N*-hydrogen compound. The effect is more marked the lower the temperature and may lead to the *N*-deuterated compound having the greater solubility at the same partial pressure and temperature. Wolff *et al.* considered that this was due to *N*-deuterated amines having a greater tendency to associate in the liquid phase than the corresponding *N*-hydrogen compounds because bonding by deuterium atoms is stronger than hydrogen bonding. It was pointed out that effects due to association are likely to be enhanced with decrease in temperature and increase in concentration.

There appears to be no investigations of phase equilibria in deuterated amine systems by other workers for comparison with the work of Wolff *et al.* However, in the opinion of the evaluator, this work is self-consistent and of high standard and should be accepted as reliable.

References

1. Wolff, H.; Höpfner, A.
   Ber. Bunsenges. Phys. Chem. 1965, *69*, 710-716.
2. Wolff, H.; Höpfner, A.
   Ber. Bunsenges. Phys. Chem. 1967, *71*, 461-466.
3. Wolff, H.; Hoppel, H.-E.
   Ber. Bunsenges. Phys. Chem. 1966, *70*, 874-883.
4. Wolff, H.; Würtz, R.
   Ber. Bunsenges. Phys. Chem. 1968, *72*, 101-109.
5. Wolff, H.; Würtz, R.
   Z. Phys. Chem. (Frankfurt am Main) 1969, *67*, 115-121.
6. Wolff, H.; Shadiakhy, A.
   Fluid Phase Equilibria 1983, *11*, 267-287.

COMPONENTS:

1. Methan-d_3-amine; CH_2D_3N; [5581-55-5]
2. Hexane; C_6H_{14}; [110-54-3]

ORIGINAL MEASUREMENTS:

Wolff, H.; Höpfner, A.
Ber. Bunsenges. Phys. Chem.
<u>1967</u>, *71*, 461-466.

VARIABLES:

Composition, temperature

PREPARED BY:

P. G. T. Fogg

EXPERIMENTAL VALUES:

Variation of the total vapor pressure/Torr with variation of temperature and of mole fraction of CH_2D_3N in the liquid phase, $x_{CH_2D_3N}$

	T/K				
$x_{CH_2D_3N}$	218.15	233.15	253.15	273.15	293.15
0	1.4	3.8	14.1	45.2	120.8
0.00905	7.9	16.0	39.1	90.1	192.8
0.0187	13.8	27.7	64.5	135.3	267.1
0.0392	23.5	48.6	110.7	223.3	414.7
0.0725	32.2	71.3	170.2	343.9	627.5
0.1023	37.0	85.0	209.4	433.3	793.7
0.128	39.5	93.2	235.8	497.0	919.0
0.145	40.6	97.3	250.6	532.6	990.2
0.185	42.1	104.4	278.6	607.6	1150.9
0.216	43.2	108.3	294.6	653.3	1253.2
0.263	44.2	112.5	313.1	704.8	1372.2
0.305	45.0	115.2	324.4	746.4	1464.5
0.340	45.1	116.9	333.8	774.4	1538.8
0.379	45.2	118.1	341.4	800.6	1611.6
0.419	45.5	119.5	347.5	824.3	1677.2
0.455	45.7	120.2	352.5	841.7	1728.6
0.488	45.9	120.7	356.5	856.7	1771.3
0.517	45.9	121.4	358.9	868.0	1804.9

Cont.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Apparatus described previously was used (1). Liquid mixtures of accurately known composition were introduced into a cell held in a thermostat controlled to ± 0.02°C. The total pressure was measured by a mercury manometer.

The authors calculated activity coefficients of each component by a method described by Barker (2). Constants for Redlich-Kister (3) equations for activity coefficients were evaluated and reported.

SOURCE AND PURITY OF MATERIALS:

1. CD_3NH_3Cl from Merck was treated with KOH and gave CD_3NH_2 which was purified by repeated fractionation as for CH_3ND_2 (4).
2. Supplied by Fluka; purity 99.96 mol %.

ESTIMATED ERROR:

$\delta T/K = \pm 0.02$ (estimated by authors)

REFERENCES:

1. Wolff, H; Höpfner, A. *Z. Elektrochem.* <u>1962</u>, *66*, 149.
2. Barker, J.A. *Aust. J. Chem.* <u>1953</u>, *6*, 207.
3. Redlich, O.; Kister, A.T. *Ind. Eng Chem.* <u>1948</u>, *21*, 345.
4. Wolff, H.; Höpfner, A. *Ber. Bunsenges. Phys. Chem.* <u>1965</u>, *69*, 710.

COMPONENTS:

1. Methan-d_3-amine; CH_2D_3N; [5581-55-5]

2. Hexane; C_6H_{14}; [110-54-3]

ORIGINAL MEASUREMENTS:

Wolff, H.; Höpfner, A.

Ber. Bunsenges. Phys. Chem.

1967, *71*, 461-466.

VARIABLES:

Composition, temperature

PREPARED BY:

P. G. T. Fogg

EXPERIMENTAL VALUES: Cont.

$x_{CH_2D_3N}$	218.15	233.15	253.15	273.15	293.15
0.540	46.2	121.6	360.9	876.8	1829.2
0.571	45.6	121.6	363.6	887.1	1861.6
0.601	45.9	121.9	366.4	896.1	1889.5
0.623	45.7	122.4	367.7	902.7	1909.6
0.641	45.7	122.5	368.5	906.3	1917.8
0.709	45.9	123.4	373.5	925.8	1979.0
0.715	45.8	122.9	373.8	927.9	1986.5
0.785	45.7	124.4	379.3	946.4	2039.6
0.853	46.0	125.3	384.8	966.8	2095.0
0.897	46.1	126.4	389.4	982.0	2132.4
0.946	47.0	128.4	396.2	1003.0	2186.5
1	48.0	131.5	407.4	1033.3	2256.4

COMPONENTS:	ORIGINAL MEASUREMENTS:
1. Methan-d_3-amine; CH_2D_3N; [5581-55-5] 2. Hexane; C_6H_{14}; [110-54-3]	Wolff, H.; Höpfner, A. *Ber. Bunsenges. Phys. Chem.* 1967, *71*, 461-466.

EXPERIMENTAL VALUES:

Constants for calculation of activity coefficients from the Redlich-Kister equations given below

T/K	A	B	C	D	E
218.15	2.385	0.094	0.421	-0.012	0.106
223.15	2.338	0.107	0.413	+0.072	0.136
233.15	2.208	0.121	0.351	+0.074	0.080
243.15	2.087	0.147	0.301	+0.093	0.069
253.15	1.959	0.165	0.268	+0.094	0.043
263.15	1.832	0.179	0.231	+0.090	0.027
273.15	1.708	0.191	0.206	+0.080	0.006
283.15	1.585	0.200	0.188	+0.074	-0.006
293.15	1.467	0.203	0.179	+0.067	-0.022

$$\begin{aligned}\ln f_1 &= A\,x_2^2 - B\,x_2^2(1 - 4\,x_1) + C\,x_2^2(1 - 8\,x_1 + 12\,x_1^2)\\ &\quad - D\,x_2^2(1 - 12\,x_1 + 36\,x_1^2 - 32\,x_1^3)\\ &\quad + E\,x_2^2(1 - 16\,x_1 + 72\,x_1^2 - 128\,x_1^3 + 80\,x_1^4)\end{aligned}$$

$$\begin{aligned}\ln f_2 &= A\,x_1^2 + B\,x_1^2(1 - 4\,x_2) + C\,x_1^2(1 - 8\,x_2 + 12\,x_2^2)\\ &\quad + D\,x_1^2(1 - 12\,x_2 + 36\,x_2^2 - 32\,x_2^3)\\ &\quad + E\,x_1^2(1 - 16\,x_2 + 72\,x_2^2 - 128\,x_2^3 + 80\,x_2^4)\end{aligned}$$

where f_1 = activity coefficient of methan-d_3-amine
f_2 = activity coefficient of hexane
x_1 = mole fraction of methan-d_3-amine in the liquid phase
x_2 = mole fraction of hexane in the liquid phase

COMPONENTS:

1. Methanamine-d_2; CH_3D_2N; [2614-35-9]
2. Hexane; C_6H_{14}; [110-54-3]

ORIGINAL MEASUREMENTS:

Wolff, H.; Höpfner, A.

Ber. Bunsenges. Phys. Chem. 1965, *69*, 710-716.

VARIABLES:

Composition, temperature

PREPARED BY:

P. G. T. Fogg

EXPERIMENTAL VALUES:

Variation of the total vapor pressure/Torr with variation of temperature and of mole fraction of CH_3D_2N in the liquid phase, $x_{CH_3D_2N}$

	T/K				
$x_{CH_3D_2N}$	218.15	233.15	253.15	273.15	293.15
0	1.0	3.7	14.3	45.4	121.0
0.0107	8.7	17.8	43.1	96.9	204.0
0.0202	14.2	28.9	66.8	140.3	275.1
0.0364	21.1	44.1	102.2	207.5	388.6
0.0465	24.3	52.4	122.4	247.2	458.0
0.0600	27.3	60.8	144.7	294.1	540.7
0.0706	29.6	66.7	161.3	330.6	606.3
0.0926	32.6	75.9	189.8	393.3	724.7
0.1134	34.3	82.4	211.7	447.7	830.1
0.145	36.3	89.3	237.3	513.2	965.9
0.176	37.6	94.4	257.1	568.6	1086.2
0.214	38.6	98.6	274.2	620.5	1204.7
0.248	38.8	100.6	286.2	657.8	1292.0
0.301	39.2	103.5	300.3	704.7	1411.9
0.338	39.7	104.6	307.5	729.2	1474.9
0.390	39.8	105.9	315.9	758.9	1558.6
0.434	39.8	106.7	320.7	778.8	1613.6
0.472	39.9	107.5	324.8	794.5	1660.8

Cont.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Apparatus described previously was used (1). Liquid mixtures of accurately known composition were introduced into a cell held in a thermostat controlled to ± 0.02°C. The total vapor pressure was measured by a mercury manometer.

The authors calculated activity coefficients of each component by a method described by Barker (2). Constants for Redlich-Kister equations for activity coefficients were evaluated and reported.

SOURCE AND PURITY OF MATERIALS:

1. Prepared from CH_3NH_2 and D_2O; repeatedly fractionated until first and last fractions had vapor pressures which differed by less than 0.5 Torr at 20°C. Spectroscopic measurements indicated that the product was 98-99% pure.
2. Material of high purity; dried over P_2O_5; distilled and repeatedly fractionated until first and last fractions had the same vapor pressures as indicated by a manometer (1).

ESTIMATED ERROR:

$\delta T/K = \pm 0.02$ (estimated by authors)

REFERENCES:

1. Wolff, H; Höpfner, A. *Z. Elektrochem.* 1962, *66*, 149.
2. Barker, J.A. *Aust. J. Chem.* 1953, *6*, 207.
3. Redlich, O.; Kister, A.T. *Ind. Eng. Chem.* 1948, *21*, 345.

COMPONENTS:

1. Methanamine-d_2; CH_3D_2N; [2614-35-9]
2. Hexane; C_6H_{14}; [110-54-3]

ORIGINAL MEASUREMENTS:

Wolff, H.; Höpfner, A.
Ber. Bunsenges. Phys. Chem.
1965, *69*, 710-716.

VARIABLES:

Composition, temperature

PREPARED BY:

P. G. T. Fogg

EXPERIMENTAL VALUES: Cont.

	T/K				
$x_{CH_3D_2N}$	218.15	233.15	253.15	273.15	293.15
0.535	40.0	108.3	329.9	815.6	1727.1
0.567	39.9	108.5	331.8	824.1	1753.0
0.629	40.3	109.1	336.0	840.7	1805.6
0.680	40.2	109.4	339.0	853.3	1842.6
0.730	40.0	110.4	341.2	864.5	1876.5
0.802	40.3	110.6	346.3	881.6	1928.3
0.872	40.1	111.4	351.0	899.7	1980.7
0.918	40.4	112.5	355.9	915.2	2021.5
0.957	41.1	114.0	361.0	930.7	2059.4
0.972	41.2	114.5	363.5	937.6	2074.8
1	41.4	116.1	368.7	950.2	2107.7

Constants for calculation of activity coefficients from the Redlich-Kister equations given below

T/K	A	B	C
218.15	2.460	0.141	0.601
223.15	2.377	0.110	0.508
228.15	2.320	0.124	0.458
233.15	2.252	0.122	0.405
243.15	2.135	0.148	0.325
253.15	2.008	0.166	0.269
263.15	1.884	0.185	0.221
273.15	1.764	0.201	0.190
283.15	1.640	0.207	0.163
293.15	1.519	0.211	0.142

$$\ln f_1 = A\,x_2^{\,2} - B\,x_2^{\,2}(1 - 4\,x_1) + C\,x_2^{\,2}(1 - 8\,x_1 + 12\,x_1^{\,2})$$
$$\ln f_2 = A\,x_1^{\,2} + B\,x_1^{\,2}(1 - 4\,x_2) + C\,x_1^{\,2}(1 - 8\,x_2 + 12\,x_2^{\,2})$$

where f_1 = activity coefficient of methanamine-d_2
f_2 = activity coefficient of hexane
x_1 = mole fraction of methanamine-d_2 in the liquid phase
x_2 = mole fraction of hexane in the liquid phase

COMPONENTS:

1. Methanamine-d_5; CD_5N; [3767-37-1]
2. Hexane; C_6H_{14}; [110-54-3]

ORIGINAL MEASUREMENTS:

Wolff, H.; Höpfner, A.
Ber. Bunsenges. Phys. Chem.
1967, *71*, 461-466.

VARIABLES:

Composition, temperature

PREPARED BY:

P. G. T. Fogg

EXPERIMENTAL VALUES:

Variation of the total vapor pressure/Torr with variation of temperature and of mole fraction of CD_5N in the liquid phase.

x_{CD_5N}	T/K 218.15	233.15	253.15	273.15	293.15
0	1.0	3.7	14.3	45.4	121.0
0.0112	9.4	19.2	45.8	101.7	211.1
0.0221	15.7	32.1	73.6	152.7	295.4
0.0329	20.6	42.8	98.5	199.7	373.6
0.0434	24.3	51.9	119.8	242.2	447.3
0.0538	27.2	59.2	139.5	281.7	516.3
0.0639	29.8	65.6	156.2	317.3	579.6
0.0737	31.4	70.7	171.4	350.1	638.8
0.0878	33.7	77.1	190.4	392.7	719.5
0.1016	35.0	82.2	206.9	431.1	792.6
0.114	36.3	86.2	219.4	462.1	854.2
0.154	38.6	94.9	252.2	547.7	1032.0
0.191	40.0	100.3	274.1	609.4	1167.6
0.238	40.9	105.0	294.4	668.8	1306.7
0.239	40.9	105.1	294.7	670.1	1311.2
0.274	41.0	107.2	304.7	702.5	1386.7
0.308	41.6	108.5	313.0	732.5	1463.7
0.336	41.2	109.2	318.8	753.3	1519.0
0.393	41.6	110.7	327.5	785.4	1609.9

Cont.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Apparatus described previously was used (1). Liquid mixtures of accurately known composition were introduced into a cell held in a thermostat controlled to ± 0.02°C. The total vapor pressure was measured by a mercury manometer.

The authors calculated activity coefficients of each component by a method described by Barker (2). Constants for Redlich-Kister(3) equations for activity coefficients were evaluated and reported.

SOURCE AND PURITY OF MATERIALS:

1. CD_3NH_3Cl from Merck was treated with KOH to give CD_3NH_2 which was then allowed to react with D_2O to give CD_3ND_2. Purification by repeated fractionation as for CH_3ND_2 (4).
2. Supplied by FLUKA A.G.;purity 99.96 mol %.

ESTIMATED ERROR:

$\delta T/K = \pm\ 0.02$ (authors' estimate)

REFERENCES:

1. Wolff, H.; Höpfner, A. *Z. Elektrochem.* 1962, *66*, 149.
2. Barker, J.A. *Aust. J. Chem.* 1953, *6*, 207.
3. Redlich, O.; Kister, A.T. *Ind. Eng. Chem.* 1948, *21*, 345.
4. Wolff, H.; Höpfner, A. *Ber. Bunsenges. Phys. Chem.* 1965, *69*, 710.

COMPONENTS:

1. Methanamine-d_5; CD_5N; [3767-37-1]
2. Hexane; C_6H_{14}; [110-54-3]

ORIGINAL MEASUREMENTS:

Wolff, H; Höpfner, A.
Ber. Bunsenges. Phys. Chem.
1967, *71*, 461-466.

VARIABLES:

Composition, temperature

PREPARED BY:

P. G. T. Fogg

EXPERIMENTAL VALUES: Cont.

	T/K				
x_{CD_5N}	218.15	233.15	253.15	273.15	293.15
0.436	41.0	111.0	332.8	806.1	1666.0
0.452	41.6	111.8	334.5	812.5	1684.9
0.479	41.2	111.8	337.3	823.0	1717.0
0.522	41.2	112.5	341.4	838.3	1764.6
0.561	41.5	112.7	343.7	849.7	1801.6
0.613	41.6	113.0	346.7	863.7	1841.6
0.663	41.7	113.5	349.3	877.0	1885.4
0.717	41.7	114.3	353.0	889.3	1922.0
0.786	41.8	114.4	357.0	905.4	1973.4
0.838	41.6	115.0	360.6	919.0	2011.6
0.910	42.3	116.5	367.3	942.4	2075.1
0.942	42.6	118.0	371.6	954.3	2105.5
0.979	42.9	119.4	377.5	972.0	2146.3
1	43.2	120.2	380.4	981.6	2170.4

760 Torr = 1 atm = 1.013×10^5 Pa.

Constants for calculation of activity coefficients from the Redlich-Kister equations given below.

T/K	A	B	C	D	E
218.15	2.456	0.050	0.445	0.140	0.275
223.15	2.399	0.089	0.436	0.087	0.177
233.15	2.272	0.106	0.372	0.100	0.123
243.15	2.141	0.134	0.329	0.092	0.071
253.15	2.018	0.157	0.290	0.107	0.054
263.15	1.886	0.170	0.245	0.099	0.030
273.15	1.763	0.184	0.212	0.096	0.024
283.15	1.639	0.196	0.192	0.093	0.010
293.15	1.519	0.195	0.163	0.091	0.011

$$\begin{aligned}\ln f_1 &= A x_2^2 - B x_2^2(1 - 4x_1) + C x_2^2(1 - 8x_1 + 12x_1^2)\\ &\quad - D x_2^2(1 - 12x_1 + 36x_1^2 - 32x_1^3)\\ &\quad + E x_2^2(1 - 16x_1 + 72x_1^2 - 128x_1^3 + 80x_1^4)\end{aligned}$$

$$\begin{aligned}\ln f_2 &= A x_1^2 + B x_1^2(1 - 4x_2) + C x_1^2(1 - 8x_2 + 12x_2^2)\\ &\quad + D x_1^2(1 - 12x_2 + 36x_2^2 - 32x_2^3)\\ &\quad + E x_1^2(1 - 16x_2 + 72x_2^2 - 128x_2^3 + 80x_2^4)\end{aligned}$$

where f_1 = activity coefficient of methanamine-d_5
f_2 = activity coefficient of hexane
x_1 = mole fraction of methanamine-d_5 in the liquid phase
x_2 = mole fraction of hexane in the liquid phase.

COMPONENTS:

1. Ethanamine-d_2; $C_2H_5D_2N$; [5852-45-9]
2. Hexane; C_6H_{14}; [110-54-3]

ORIGINAL MEASUREMENTS:

Wolff, H.; Höpfner, A.

Ber. Bunsenges. Phys. Chem. 1965, *69*, 710-716.

VARIABLES:

Composition, Temperature

PREPARED BY:

P. G. T. Fogg

EXPERIMENTAL VALUES:

Variation of the total vapor pressure/Torr with variation of temperature and of mole fraction of $C_2H_5D_2N$ in the liquid phase, $x_{C_2H_5D_2N}$

	T/K			
$x_{C_2H_5D_2N}$	233.15	253.15	273.15	293.15
0	3.9	14.6	45.9	121.1
0.0176	8.0	25.0	67.9	162.4
0.0329	11.0	33.0	85.5	196.0
0.0452	12.9	38.9	98.6	221.4
0.0891	18.2	55.1	138.3	301.9
0.1165	20.0	62.7	158.2	344.7
0.2095	24.6	79.4	207.2	458.1
0.239	25.0	83.4	218.2	486.3
0.305	26.7	88.9	239.9	540.6
0.339	28.1	93.4	249.7	564.6
0.362	27.6	94.0	254.6	577.3
0.409	28.3	97.2	264.1	604.9
0.455	28.9	99.7	273.5	629.3
0.468	29.2	100.5	275.8	636.4
0.517	29.6	102.9	284.1	659.5
0.582	30.1	105.9	294.0	686.2
0.617	30.7	107.5	299.7	701.3
0.683	31.0	110.1	307.5	725.8
0.723	31.7	112.1	314.1	741.8

Cont.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Apparatus described previously was used (1). Liquid mixtures of accurately known composition were introduced into a cell held in a thermostat controlled to ± 0.02°C. The total vapor pressure was measured by a mercury manometer.

The authors calculated activity coefficients of each component by a method described by Barker (2). Constants for Redlich-Kister equations for activity coefficients were evaluated and reported.

SOURCE AND PURITY OF MATERIALS:

1. Prepared from $C_2H_5NH_2$ and D_2O; repeatedly fractionated until first and last fractions had vapor pressures which differed by 0.4 Torr at 20°C. Spectroscopic measurements indicated that the product was at least 99% pure.
2. Material of high purity; dried over P_2O_5; distilled and repeatedly fractionated until first and last fractions had the same vapor pressures as indicated by a manometer (1).

ESTIMATED ERROR:

$\delta T/K = \pm 0.02$ (estimated by authors)

REFERENCES:

1. Wolff, H.; Höpfner, A. *Z. Elektrochem.* 1962, *66*, 149.
2. Barker, J.A. *Aust. J. Chem.* 1953, *6*, 207.
3. Redlich, O.; Kister, A.T. *Ind. Eng. Chem.* 1948, *21*, 345.

COMPONENTS:	ORIGINAL MEASUREMENTS:
1. Ethanamine-d_2; $C_2H_5D_2N$; [5852-45-9] 2. Hexane; C_6H_{14}; [110-54-3]	Wolff, H.; Höpfner, A. *Ber. Bunsenges. Phys. Chem.* 1965, *69*, 710-716.
VARIABLES: Composition, Temperature	PREPARED BY: P. G. T. Fogg

EXPERIMENTAL VALUES: Cont.

$x_{C_2H_5D_2N}$	T/K			
	233.15	253.15	273.15	293.15
0.793	32.1	114.7	323.9	767.0
0.832	32.5	116.5	329.6	782.8
0.898	33.7	119.6	339.2	806.9
0.987	34.9	123.9	352.2	841.3
1	34.8	124.5	354.7	847.2

760 Torr = 1 atm = 1.013×10^5 Pa

Constants for calculation of activity coefficients from the Redlich-Kister equations given below

T/K	A	B	C
233.15	1.728	-0.078	0.191
243.15	1.630	-0.036	0.174
253.15	1.535	+0.001	0.148
263.15	1.434	+0.017	0.109
273.15	1.332	+0.037	0.087
283.15	1.237	+0.048	0.066
293.15	1.145	+0.061	0.063

$$\ln f_1 = A x_2^2 - B x_2^2(1 - 4 x_1) + C x_2^2(1 - 8 x_1 + 12 x_1^2)$$

$$\ln f_2 = A x_1^2 + B x_1^2(1 - 4 x_2) + C x_1^2(1 - 8 x_2 + 12 x_2^2)$$

where f_1 = activity coefficient of ethanamine -d_2

f_2 = activity coefficient of hexane

x_1 = mole fraction of ethanamine-d_2 in the liquid phase

x_2 = mole fraction of hexane in the liquid phase.

COMPONENTS:

1. *N*-Methyl-methanamine-d; C_2H_6DN; [917-72-6]
2. Hexane; C_6H_{14}; [110-54-3]

ORIGINAL MEASUREMENTS:

Wolff, H.; Würtz, R.
J. Phys. Chem.
1970, *74*, 1600-1606.

VARIABLES:

Composition, temperature

PREPARED BY:

P. G. T. Fogg

EXPERIMENTAL VALUES:

Variation of the total vapor pressure/Torr with variation of temperature and of mole fraction of C_2H_6DN in the liquid phase, $x_{C_2H_6DN}$

	T/K							
$x_{C_2H_6DN}$	223.15	233.15	243.15	253.15	263.15	273.15	283.15	293.15
0	2.2	3.8	7.7	14.3	26.7	45.5	75.6	121.1
0.0048	2.5	5.0	9.4	17.3	30.8	52.4	85.2	133.4
0.0075	3.0	5.7	10.8	19.7	33.8	56.6	91.0	141.3
0.0207	4.9	9.0	15.3	27.9	45.3	74.1	114.8	173.2
0.0254	5.6	10.0	18.0	30.5	50.4	79.9	122.7	183.6
0.0484	8.2	15.2	26.6	44.3	70.6	108.9	163.2	238.6
0.0705	10.2	18.9	33.3	55.0	87.4	133.6	198.3	286.4
0.0922	11.8	22.5	39.1	64.7	102.3	156.3	231.1	331.8
0.1541	15.2	28.9	51.7	86.6	137.5	209.8	307.9	437.8
0.2535	18.3	35.7	64.9	111.3	178.2	276.6	409.5	584.6
0.3053	19.1	37.7	69.6	119.8	194.5	301.9	448.8	642.3
0.3526	20.1	40.1	73.9	128.3	209.5	327.1	484.9	706.3
0.4109	20.9	41.8	78.2	135.5	223.0	350.7	527.6	765.1
0.4494	21.5	43.2	80.2	140.4	231.1	364.3	549.6	798.5
0.5077	22.2	44.6	83.6	147.1	243.4	384.6	582.0	846.3
0.6055	23.1	47.3	88.8	157.3	262.1	417.3	635.5	932.2
0.6554	23.8	48.4	91.6	162.0	268.6	432.1	659.8	970.1
0.7038	24.6	49.7	94.0	167.3	279.5	447.4	685.0	1009.4
0.7538	25.0	50.9	96.7	172.2	288.2	461.5	708.6	1046.4

Cont.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Apparatus described previously was used (1). Liquid mixtures of accurately known composition were introduced into a cell held in a thermostat controlled to ± 0.02°C. The total vapor pressure was measured by a mercury manometer.

The authors calculated activity coefficients of each component from the vapor pressure data by a method described by Barker (2). Constants for Redlich-Kister equations for activity coefficients were evaluated and reported.

SOURCE AND PURITY OF MATERIALS:

1. Prepared from dimethylammonium chloride; repeatedly fractionated until first and last fractions had vapor pressures within 0.2 Torr.
2. Research grade (Phillips Petroleum Co., Bartlesville, Oklahoma).

ESTIMATED ERROR:

$\delta T/K = \pm 0.02$ (estimated by authors)

REFERENCES:

1. Wolff, H.; Höpfner, A. *Z. Elektrochem.* 1962, *66*, 149.
2. Barker, J.A. *Aust. J. Chem.* 1953 *6*, 207.
3. Redlich, O.; Kister, A.T. *Ind. Eng Chem.* 1948, *21*, 345.

COMPONENTS:	ORIGINAL MEASUREMENTS:
1. *N*-Methyl-methanamine-d; C_2H_6DN; [917-72-6] 2. Hexane; C_6H_{14}; [110-54-3]	Wolff, H.; Würtz, R. *J. Phys. Chem.* 1970, *74*, 1600-1606.
VARIABLES:	PREPARED BY:
Composition, temperature	P. G. T. Fogg

EXPERIMENTAL VALUES: Cont.

	T/K							
$x_{C_2H_6DN}$	223.15	233.15	243.15	253.15	263.15	273.15	283.15	293.15
0.8037	25.7	52.5	100.5	177.3	297.6	477.2	734.1	1086.1
0.8545	26.6	54.2	102.4	182.6	307.2	493.1	759.0	1125.1
0.9021	27.3	55.6	105.7	188.3	316.8	509.3	784.9	1164.8
1	28.8	58.9	112.2	201.0	338.4	545.1	841.1	1249.2

760 Torr = 1 atm = 1.013 x 10^5 Pa.

Constants for calculation of activity coefficients from the Redlich-Kister equations given below.

T/K	A	B	C
223.15	1.482	-0.081	0.119
233.15	1.431	-0.029	0.139
243.15	1.326	+0.002	0.111
253.15	1.225	+0.016	0.090
263.15	1.113	+0.033	0.066
273.15	1.021	+0.047	0.066
283.15	0.920	+0.053	0.068
293.15	0.828	+0.057	0.061

$$\ln f_1 = A\,x_2^{\,2} - B\,x_2^{\,2}(1 - 4\,x_1) + C\,x_2^{\,2}(1 - 8\,x_1 + 12\,x_1^{\,2})$$

$$\ln f_2 = A\,x_1^{\,2} + B\,x_1^{\,2}(1 - 4\,x_2) + C\,x_1^{\,2}(1 - 8\,x_2 + 12\,x_2^{\,2})$$

where f_1 = activity coefficient of the amine
f_2 = activity coefficient of hexane
x_1 = mole fraction of the amine in the liquid phase
x_2 = mole fraction of hexane in the liquid phase

COMPONENTS:

1. *N*-(methyl-d_3)-methan-d_3-amine; C_2HD_6N; [14802-36-9]
2. Hexane; C_6H_{14}; [110-54-3]

ORIGINAL MEASUREMENTS:

Wolff, H.; Würtz, R.
J. Phys. Chem.
1970, *74*, 1600-1606.

VARIABLES:

Composition, temperature

PREPARED BY:

P. G. T. Fogg

EXPERIMENTAL VALUES:

Variation of the total vapor pressure/Torr with variation of temperature and of mole fraction of C_2HD_6N in the liquid phase, $x_{C_2HD_6N}$

	T/K							
$x_{C_2HD_6N}$	223.15	233.15	243.15	253.15	263.15	273.15	283.15	293.15
0	2.2	3.8	7.7	14.3	26.7	45.5	75.6	121.1
0.0103	3.5	6.7	12.1	21.6	36.7	60.4	96.0	148.5
0.0254	5.8	10.5	18.6	31.4	51.2	81.9	124.7	185.9
0.0509	8.9	16.4	28.2	46.4	73.9	113.6	169.9	247.1
0.0763	11.5	20.9	36.4	59.8	94.4	143.9	212.1	304.1
0.1016	13.6	25.1	43.3	71.7	112.3	170.9	250.9	357.6
0.1504	16.2	30.6	54.0	90.3	141.8	214.7	312.9	442.5
0.2525	20.1	38.8	70.1	118.8	190.2	291.1	428.5	609.1
0.2685	20.3	39.8	72.2	122.0	195.3	299.3	441.2	626.0
0.2778	20.8	40.2	73.0	123.8	198.7	305.5	449.7	638.5
0.3539	22.6	44.1	80.7	138.5	223.8	347.5	516.1	739.9
0.4063	23.4	46.1	84.5	146.0	237.7	370.4	553.2	795.8
0.4258	23.7	46.8	86.5	149.4	243.9	380.2	569.3	819.9
0.5014	24.8	49.5	91.5	159.5	260.9	409.4	615.2	891.3
0.5529	25.4	50.9	94.8	167.3	272.1	428.2	646.3	938.3
0.6053	26.9	52.3	97.8	172.2	283.4	447.9	677.9	987.1
0.6531	27.0	53.9	100.9	177.1	292.8	463.9	703.8	1029.4
0.7044	28.5	55.3	103.8	182.5	303.3	480.9	732.0	1072.5

Cont.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Apparatus described previously was used (1). Liquid mixtures of accurately known composition were introduced into a cell held in a thermostat controlled to ± 0.02 °C. The total vapor pressure was measured by a mercury manometer.

The authors calculated activity coefficients of each component from the vapor pressure data by a method described by Barker (2). Constants for Redlich-Kister equations for activity coefficients were evaluated and reported.

SOURCE AND PURITY OF MATERIALS:

1. Prepared from $(CD_3)_2NH_2Cl$ (Merck, Darmstadt); purified by repeated fractionation until first and last fractions differed in vapor pressures by less than 0.2 Torr.
2. Research grade (Phillips Petroleum Co., Bartlesville, Oklahoma.)

ESTIMATED ERROR:

$\delta T/K = \pm 0.02$ (estimated by authors)

REFERENCES:

1. Wolff, H.; Höpfner, A. *Z. Elektrochem.* 1962, *66*, 149.
2. Barker, J.A. *Aust. J. Chem.* 1953, *6*, 207.
3. Redlich, O.; Kister, A.T. *Ind. Eng. Chem.* 1948, *21*, 345.

COMPONENTS:

1. *N*-(methyl-d_3)-methan-d_3-amine; C_2HD_6N; [14802-36-9]

2. Hexane; C_6H_{14}; [110-54-3]

ORIGINAL MEASUREMENTS:

Wolff, H.; Würtz, R.

J. Phys. Chem.

1970, *74*, 1600-1606.

VARIABLES:

Composition, temperature

PREPARED BY:

P. G. T. Fogg

EXPERIMENTAL VALUES: Cont.

	T/K							
$x_{C_2HD_6N}$	223.15	233.15	243.15	253.15	263.15	273.15	283.15	293.15
0.7546	28.6	56.9	106.8	188.1	312.9	497.9	759.1	1114.5
0.8024	29.3	58.2	109.7	193.9	322.7	514.4	785.0	1156.3
0.8529	29.9	60.1	113.1	200.1	333.5	531.8	813.5	1198.5
0.9218	31.2	63.0	118.4	209.2	349.8	558.7	855.0	1262.2
1	32.8	66.0	124.8	221.1	369.8	591.5	906.6	1339.4

760 Torr = 1 atm = 1.013×10^5 Pa

Constants for calculation of activity coefficients from the Redlich-Kister equations given below

T/K	A	B	C
223.15	1.452	-0.029	0.168
233.15	1.396	-0.010	0.121
243.15	1.287	+0.014	0.086
253.15	1.189	+0.033	0.076
263.15	1.078	+0.047	0.056
273.15	0.984	+0.054	0.054
283.15	0.888	+0.061	0.049
293.15	0.792	+0.063	0.049

$$\ln f_1 = A x_2^2 - B x_2^2(1 - 4 x_1) + C x_2^2(1 - 8 x_1 + 12 x_1^2)$$

$$\ln f_2 = A x_1^2 + B x_1^2(1 - 4 x_2) + C x_1^2(1 - 8 x_2 + 12 x_2^2)$$

where f_1 = activity coefficient of the amine

f_2 = activity coefficient of hexane

x_1 = mole fraction of the amine in the liquid phase

x_2 = mole fraction of hexane in the liquid phase

COMPONENTS:

1. *N*-(methyl-d_3)-methan-d_3-amine-d; C_2D_7N; [22024-52-8]
2. Hexane; C_6H_{14}; [110-54-3]

ORIGINAL MEASUREMENTS:

Wolff, H.; Würtz, R.
J. Phys. Chem.
1970, *74*, 1600-1606.

VARIABLES:

Composition, temperature

PREPARED BY:

P. G. T. Fogg

EXPERIMENTAL VALUES:

Variation of the total vapor pressure/Torr with variation of temperature and of mole fraction of C_2D_7N in the liquid phase, $x_{C_2D_7N}$

	T/K							
$x_{C_2D_7N}$	223.15	233.15	243.15	253.15	263.15	273.15	283.15	293.15
0	2.2	3.8	7.7	14.3	26.7	45.5	75.6	121.1
0.0103	3.1	6.5	12.7	21.6	36.9	60.7	96.5	148.6
0.0256	5.9	10.4	18.7	31.8	51.9	82.1	125.7	187.6
0.0503	8.9	16.1	28.0	46.6	73.9	114.1	170.5	247.5
0.0761	11.6	21.1	36.2	60.0	94.6	144.3	212.7	305.8
0.1012	13.0	24.4	42.9	71.4	112.5	171.3	251.8	359.7
0.1516	15.9	30.4	53.9	90.3	142.9	218.0	320.3	456.3
0.2028	18.4	34.9	62.3	104.7	166.7	254.9	374.0	528.9
0.2538	19.8	37.9	68.7	117.0	187.6	288.6	426.0	605.5
0.3003	20.1	39.9	73.2	125.6	203.4	314.5	466.8	666.6
0.3512	21.4	42.2	77.8	133.7	218.0	339.6	506.8	727.3
0.4005	22.2	43.8	81.7	141.9	232.0	363.0	544.4	785.2
0.4504	22.9	45.7	84.8	148.1	242.9	381.6	572.8	827.7
0.5019	23.2	47.2	88.1	153.8	253.3	398.9	602.3	873.4
0.5485	24.1	48.5	91.1	159.8	264.6	418.1	633.7	924.4
0.6022	25.1	50.0	93.9	165.5	274.3	435.5	661.0	966.9
0.6533	25.5	51.2	96.8	171.3	284.9	453.2	690.7	1012.9
0.7011	26.0	52.8	99.6	176.0	293.4	468.0	714.2	1050.0

Cont.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Apparatus described previously was used (1). Liquid mixtures of accurately known composition were introduced into a cell held in a thermostat controlled to ± 0.02°C. The total vapor pressure was measured by a mercury manometer.

The authors calculated activity coefficients of each component from the vapor pressure data by a method described by Barker (2). Constants for Redlich-Kister equations (3) for activity coefficients were evaluated and reported.

SOURCE AND PURITY OF MATERIALS:

1. $(CD_3)_2NH_2Cl$ (Merck, Darmstadt) was used to prepare $(CD_3)_2NH$ which was then converted to $(CD_3)_2ND$ by the action of D_2O. Purification was by repeated fractionation until first and last fractions had vapor pressures within 0.2 Torr (1), (4).
2. Research grade (Phillips Petroleum Co., Bartlesville, Oklahoma.)

ESTIMATED ERROR:

$\delta T/K = \pm 0.02$ (estimated by authors)

REFERENCES:

1. Wolff, H.; Höpfner, A. *Z. Elektrochem.* 1962, *66*, 149.
2. Barker, J.A. *Aust. J. Chem.* 1953, *6*, 207.
3. Redlich, O.; Kister, A.T. *Ind. Eng Chem.* 1948, *21*, 345.
4. Wolff, H.; Höpfner, A. *Ber. Bunsenges. Phys. Chem.* 1965, *69*, 710.

COMPONENTS:

1. *N*-(methyl-d_3)-methan-d_3-amine-d; C_2D_7N; [22024-52-8]
2. Hexane; C_6H_{14}; [110-54-3]

ORIGINAL MEASUREMENTS:

Wolff, H.; Würtz, R.
J. Phys. Chem.
1970, *74*, 1600-1606.

VARIABLES:

Composition, temperature

PREPARED BY:

P. G. T. Fogg

EXPERIMENTAL VALUES: Cont.

$x_{C_2D_7N}$	T/K							
	223.15	233.15	243.15	253.15	263.15	273.15	283.15	293.15
0.7533	26.8	54.3	102.5	181.7	303.6	484.9	741.7	1092.5
0.8003	27.4	55.6	105.5	186.7	312.5	499.7	766.3	1130.4
0.8519	28.7	57.6	108.6	192.8	323.2	517.9	795.7	1175.8
0.9012	29.4	59.3	112.0	199.0	333.4	535.5	823.0	1219.0
1	30.8	62.4	119.0	212.3	356.5	572.9	882.1	1309.7

760 Torr = 1 atm = 1.013×10^5 Pa

Constants for calculation of activity coefficients from the Redlich-Kister equations given below

T/K	A	B	C
223.15	1.495	-0.078	0.137
233.15	1.441	-0.016	0.151
243.15	1.328	+0.006	0.109
253.15	1.228	+0.021	0.097
263.15	1.117	+0.038	0.077
273.15	1.023	+0.045	0.073
283.15	0.925	+0.050	0.067
293.15	0.824	+0.046	0.063

$$\ln f_1 = A x_2^2 - B x_2^2(1 - 4 x_1) + C x_2^2(1 - 8 x_1 + 12 x_1^2)$$

$$\ln f_2 = A x_1^2 + B x_1^2(1 - 4 x_2) + C x_1^2(1 - 8 x_2 + 12 x_2^2)$$

where f_1 = activity coefficient of the amine
f_2 = activity coefficient of hexane
x_1 = mole fraction of the amine in the liquid phase
x_2 = mole fraction of hexane in the liquid phase

COMPONENTS:

1. Methanamine-d_2; CH_3D_2N; [2614-35-9]
2. *N,N*-Dimethylmethanamine, (trimethylamine); C_3H_9N; [75-50-3]

ORIGINAL MEASUREMENTS:

Wolff, H; Würtz, R.

Z. Phys. Chem. (Frankfurt am Main) 1969, *67*, 115-121

VARIABLES:

Composition, temperature

PREPARED BY:

P. G. T. Fogg

EXPERIMENTAL VALUES:

Variation of the total vapor pressure/Torr with variation of temperature and of mole fraction of CH_3D_2N in the liquid phase, $x_{CH_3D_2N}$

$x_{CH_3D_2N}$	T/K 223.15	233.15	253.15	273.15	293.15
0	56.4	102.3	288.3	676.9	1387.0
0.0105	57.8	105.0	293.2	687.1	1411.9
0.0301	59.7	107.8	302.0	708.1	1454.3
0.0505	60.4	109.6	310.6	727.6	1495.2
0.0689	61.8	111.7	316.7	744.3	1530.6
0.0901	63.0	115.3	327.1	769.7	1582.1
0.0994	63.3	115.5	327.0	770.9	1589.0
0.1502	65.0	119.2	341.0	807.3	1665.7
0.1973	66.7	122.8	352.7	838.8	1737.0
0.2475	68.0	125.2	362.6	864.6	1798.3
0.2981	68.7	127.3	371.3	892.2	1862.5
0.3664	69.5	129.3	379.1	920.4	1928.1
0.4076	69.8	130.3	383.8	931.9	1960.1
0.4481	69.5	130.9	388.2	944.1	1991.0
0.4980	70.0	131.9	391.5	956.8	2029.8
0.5401	70.4	132.4	394.6	968.7	2053.0
0.6020	69.3	131.5	396.5	976.9	2084.1
0.6446	69.5	131.5	398.1	983.0	2107.0

Cont.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Apparatus described previously was used (1). Liquid mixtures of accurately known composition were introduced into a cell held in a thermostat controlled to ± 0.02 °C. The total vapor pressure was measured by a mercury manometer.

The authors calculated activity coefficients of each component by a method described by Barker (2). Constants for Redlich-Kister equations (3) for activity coefficients were evaluated and reported.

SOURCE AND PURITY OF MATERIALS:

1. Prepared from CH_3NH_2 and D_2O; repeatedly fractionated until the first and last fractions had vapor pressures which differed by less than 0.5 torr at 20 °C (4).
2. Prepared from trimethylammonium hydrochloride and purified as 1 (5).

ESTIMATED ERROR:

$\delta T/K = \pm 0.02$ (estimated by authors)

REFERENCES:

1. Wolff, H.; Höpfner, A. *Z. Elektrochem.* 1962, *66*, 149.
2. Barker, J.A. *Aust. J. Chem.* 1953, *6*, 207.
3. Redlich, O.; Kister, A.T. *Ind. Eng. Chem.* 1948, *21*, 345.
4. Wolff, H.; Höpfner, A. *Ber. Bunsenges. Phys. Chem.* 1965, *69*, 710
5. Wolff, H.; Würtz, R. *Ber. Bunsenges. Phys. Chem.* 1968, *72*, 101.

COMPONENTS: 1. Methanamine-d$_2$; CH_3D_2N; [2614-35-9] 2. *N,N*-Dimethylmethanamine, (trimethylamine); C_3H_9N; [75-50-3]	ORIGINAL MEASUREMENTS: Wolff, H; Würtz, R. *Z. Phys. Chem. (Frankfurt am Main)* 1969, *67*, 115-121.
VARIABLES: Composition, temperature	PREPARED BY: P. G. T. Fogg

EXPERIMENTAL VALUES: Cont.

	T/K				
$x_{CH_3D_2N}$	223.15	233.15	253.15	273.15	293.15
0.7466	68.7	129.6	396.7	989.2	2137.6
0.8485	66.1	126.3	390.5	984.9	2145.6
0.8965	64.3	123.7	385.5	978.8	2143.5
0.9487	61.7	120.3	378.4	966.0	2128.3
1	59.1	115.6	367.4	947.8	2105.4

760 Torr = 1 atm = 1.013×10^5 Pa

Constants for calculation of activity coefficients from the Redlich-Kister equations given below

T/K	A	B	C
223.15	0.767	-0.075	0.139
233.15	0.749	-0.059	0.071
243.15	0.719	-0.013	0.036
253.15	0.692	0.000	0.052
263.15	0.659	+0.019	0.056
273.15	0.621	+0.028	0.028
283.15	0.578	+0.038	0.037
293.15	0.539	+0.031	0.040

$$\ln f_1 = A\,x_2^2 - B\,x_2^2(1 - 4\,x_1) + C\,x_2^2(1 - 8\,x_1 + 12\,x_1^2)$$

$$\ln f_2 = A\,x_1^2 + B\,x_1^2(1 - 4\,x_2) + C\,x_1^2(1 - 8\,x_2 + 12\,x_2^2)$$

where f_1 = activity coefficient of methanamine-d$_2$
f_2 = activity coefficient of trimethylamine
x_1 = mole fraction of methanamine-d$_2$
x_2 = mole fraction of trimethylamine.

COMPONENTS:	EVALUATOR:
1. Other amines. 2. Organic liquids.	P. G. T. Fogg, School of Chemistry, Polytechnic of North London, Holloway, London N7 8DB, United Kingdom. August 1983

CRITICAL EVALUATION:

The measurements by Wolff *et al.* (1-6) of the vapor pressure of various systems containing ethanamine, propanamine or deuterated amines are of high standard and may be accepted as reliable.

The solubility of propanamine in several alcohols was measured by Copley *et al.* (7) at 305.4 K and a pressure of propanamine of 106 mmHg, said to be its vapor pressure at 277.7 K. This value of the vapor pressure may be compared with the interpolated value of 119 mmHg from measurements by Wolff which are likely to be the more accurate. However, values published by Copley *et al.* are of the magnitude expected for solubilities in hydroxy-compounds, by analogy with the behaviour of other amines. The possibility of error in the reported pressure should be borne in mind.

Copley *et al.* also reported solubilities of 2-propanamine, 2-methyl-1-propanamine, 1-butanamine and 2-butanamine. These are of the expected order of magnitude for the solvents investigated and should be accepted on a tentative basis until comparisons with other measurements of solubilities of these amines can be made.

References:

1. Wolff, H.; Höpfner, A.; Höpfner, H.-M.
Ber. Bunsenges. Phys. Chem. 1964, *68*, 410.

2. Wolff, H.; Höpfner, A.
Ber. Bunsenges. Phys. Chem. 1965, *69*, 710.

3. Wolff, H.; Höpfner, A.
Ber. Bunsenges. Phys. Chem. 1967, *71*, 461.

4. Wolff, H.; Würtz, R.
Z. Phys. Chem (Frankfurt am Main) 1969, *67*, 115.

5. Wolff, H.; Würtz, R.
J. Phys. Chem. 1970, *74*, 1600.

6. Wolff, H.; Shadiakhy, A.
Fluid Phase Equilibria 1983, *11*, 267-287.

7. Copley, M. J.; Ginsberg, E.; Zellhoefer, G. F.; Marvel, C. S.
J. Amer. Chem. Soc. 1941, *63*, 254.

COMPONENTS:

1. Ethanamine, (ethylamine); C_2H_7N; [75-04-7]
2. Butane; C_4H_{10}; [106-97-8]

ORIGINAL MEASUREMENTS:

Wolff, H.; Höpfner, A.; Höpfner, H.-M.
Ber. Bunsenges. Phys. Chem.
1964, *68*, 410-417.

VARIABLES:

Composition, temperature

PREPARED BY:

P. G. T. Fogg

EXPERIMENTAL VALUES:

Variation of the total vapor pressure/Torr with variation of temperature and of mole fraction of C_2H_7N in the liquid phase, $x_{C_2H_7N}$

	T/K				
$x_{C_2H_7N}$	218.15	233.15	253.15	273.15	293.15
0	52.1	125.0	338.5	772.7	1552.6
0.0141	53.1	127.0	343.3	782.6	1571.1
0.0353	53.7	129.2	349.2	794.1	1594.2
0.0544	54.2	130.8	352.9	802.9	1612.2
0.0887	54.5	131.7	357.5	814.7	1635.8
0.1265	54.3	132.1	360.0	821.6	1655.4
0.1446	54.6	132.3	360.7	824.1	1660.7
0.168	54.3	132.1	360.3	826.5	1667.4
0.195	54.2	132.1	360.0	827.7	1670.5
0.281	53.9	130.5	358.3	824.4	1672.4
0.348	53.1	129.3	354.3	818.5	1663.1
0.359	54.0	129.5	353.5	816.4	1659.6
0.400	52.9	128.0	350.5	809.9	1649.9
0.423	52.3	127.4	348.0	806.2	1642.9
0.575	50.1	121.4	332.5	770.5	1575.5
0.577	50.1	121.5	331.7	768.4	1571.6
0.646	48.3	116.8	320.3	743.7	1524.6
0.651	48.6	116.6	319.8	743.5	1522.7

Cont.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Apparatus described previously was used (1). Liquid mixtures of accurately known composition were introduced into a cell held in a thermostat controlled to ± 0.02 °C. The total vapor pressures were measured by a mercury manometer.

The authors calculated activity coefficients of each component from the vapor pressure data by a method described by Barker (2). Constants for Redlich-Kister equations (3) for activity coefficients were evaluated and reported.

SOURCE AND PURITY OF MATERIALS:

1. From commercial *reinst* ethylammonium chloride by reaction with KOH; gas dried with KOH and Na; liquified gas treated with Li and repeatedly fractionated until the first and last fractions had consistent vapor pressures as described for methylamine (1).
2. Commercial product; dried with P_2O_5 repeatedly fractionated until first and last fractions had consistent vapor pressures as described for hexane (1).

ESTIMATED ERROR:

$\delta T/K = \pm 0.02$ (estimated by authors)

REFERENCES:

1. Wolff, H.; Höpfner, A. *Z. Elektrochem.* 1962, *66*, 149.
2. Barker, J.A. *Aust. J. Chem.* 1953, *6*, 207.
3. Redlich, O.; Kister, A.T. *Ind. Eng. Chem.* 1948, *21*, 345.

COMPONENTS:	ORIGINAL MEASUREMENTS:
1. Ethanamine, (ethylamine); C_2H_7N; [75-04-7] 2. Butane; C_4H_{10}; [106-97-8]	Wolff, H.; Höpfner, A.; Höpfner,H.-M. *Ber. Bunsenges. Phys. Chem.* 1964, *68*, 410-417.
VARIABLES:	PREPARED BY:
Composition, temperature	P. G. T. Fogg

EXPERIMENTAL VALUES: Cont.

	T/K				
$x_{C_2H_7N}$	218.15	233.15	253.15	273.15	293.15
0.772	43.2	104.6	288.3	675.5	1396.9
0.838	38.6	94.0	262.7	622.1	1300.9
0.861	36.4	89.2	250.5	598.5	1259.2
0.900	32.4	79.8	227.8	553.1	1178.0
0.935	26.7	67.3	199.0	496.2	1082.1
0.940	25.8	66.3	197.0	492.7	1076.6
0.962	21.8	56.5	174.7	450.1	1006.7
1	12.1	37.3	131.6	369.2	872.9

760 Torr = 1 atm = 1.013×10^5 Pa

Constants for calculation of activity coefficients from the Redlich-Kister equations given below.

T/K	A	B	C
218.15	1.772	-0.212	0.237
223.15	1.718	-0.201	0.213
228.15	1.671	-0.179	0.205
233.15	1.630	-0.173	0.184
243.15	1.528	-0.128	0.142
253.15	1.439	-0.100	0.123
263.15	1.348	-0.070	0.098
273.15	1.259	-0.041	0.072
283.15	1.176	-0.024	0.062
293.15	1.091	-0.011	0.048

$$\ln f_1 = A\,x_2^2 - B\,x_2^2(1 - 4\,x_1) + C\,x_2^2(1 - 8\,x_1 + 12\,x_1^2)$$

$$\ln f_2 = A\,x_1^2 + B\,x_1^2(1 - 4\,x_2) + C\,x_1^2(1 - 8\,x_2 + 12\,x_2^2)$$

where f_1 = activity coefficient of ethylamine
f_2 = activity coefficient of butane
x_1 = mole fraction of ethylamine in the liquid phase
x_2 = mole fraction of butane in the liquid phase

COMPONENTS:

1. Ethanamine, (ethylamine); C_2H_7N; [75-04-7]
2. Hexane; C_6H_{14}; [110-54-3]

ORIGINAL MEASUREMENTS:

Wolff, H.; Höpfner, A.; Höpfner,H.-M
Ber. Bunsenges. Phys. Chem.
1964, *68*, 410-417.

VARIABLES:

Composition, temperature

PREPARED BY:

P. G. T. Fogg

EXPERIMENTAL VALUES:

Variation of the total vapor pressure/Torr with variation of temperature and of mole fraction of C_2H_7N in the liquid phase, $x_{C_2H_7N}$

	T/K			
$x_{C_2H_7N}$	233.15	253.15	273.15	293.15
0	3.7	14.3	45.4	121.0
0.0105	6.3	20.4	59.1	145.5
0.0266	9.7	29.6	77.8	180.3
0.0359	11.5	34.6	88.3	201.1
0.0598	15.0	43.0	110.9	244.6
0.0824	17.6	52.0	130.5	287.1
0.0921	18.7	56.4	140.1	304.9
0.0956	19.2	56.8	141.4	306.5
0.1244	21.5	64.7	162.4	350.7
0.1591	23.5	72.7	184.4	401.8
0.1744	23.6	75.4	191.8	417.5
0.227	25.7	83.4	215.7	473.3
0.319	28.2	93.3	247.2	552.8
0.400	28.9	100.1	268.1	607.2
0.436	29.9	102.4	276.4	629.2
0.441	29.9	102.2	276.8	632.0
0.558	31.6	109.0	298.5	689.1
0.622	33.0	111.3	307.7	716.2
0.631	32.2	112.6	309.4	722.0

Cont.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Apparatus described previously was used (1). Liquid mixtures of accurately known composition were introduced into a cell held in a thermostat controlled to ± 0.02°C. The total vapor pressure was measured by a mercury manometer.

The authors calculated activity coefficients of each component from the vapor pressure data by a method described by Barker (2). Constants for Redlich-Kister equations (3) for activity coefficients were evaluated and reported.

SOURCE AND PURITY OF MATERIALS:

1. From commercial *reinst* ethylammonium chloride by reaction with KOH; gas dried with KOH and Na; liquified gas treated with Li and repeatedly fractionated as described for preparation of methylamine (1).
2. Material of high purity; dried over P_2O_5, distilled and repeatedly fractionated until first and last fractions had the same vapor pressures as measured by the manometer (1).

ESTIMATED ERROR:

$\delta T/K = \pm 0.02$ (estimated by authors)

REFERENCES:

1. Wolff, H.; Höpfner, A. *Z. Elektrochem.* 1962, *66*, 149.
2. Barker, J.A. *Aust. J. Chem.* 1953, *6*, 207.
3. Redlich, O.; Kister, A.T. *Ind. Eng. Chem.* 1948, *21*, 345.

COMPONENTS:	ORIGINAL MEASUREMENTS:
1. Ethanamine, (ethylamine); C_2H_7N; [75-04-7] 2. Hexane; C_6H_{14}; [110-54-3]	Wolff, H.; Höpfner, A.; Höpfner, H.-M *Ber. Bunsenges. Phys. Chem.* 1964, *68*, 410-417.
VARIABLES:	PREPARED BY:
Composition, temperature	P. G. T. Fogg

EXPERIMENTAL VALUES: Cont.

	T/K			
$x_{C_2H_7N}$	233.15	253.15	273.15	293.15
0.687	32.8	115.0	318.8	744.2
0.761	35.1	118.5	330.5	774.3
0.831	35.0	122.5	341.4	801.9
0.846	35.4	123.3	344.1	808.1
0.928	35.6	127.5	357.3	843.0
0.951	36.6	128.4	360.8	851.5
1	37.6	132.1	369.5	872.8

760 Torr = 1 atm = 1.013×10^5 Pa

Constants for calculation of activity coefficients from the Redlich-Kister equations given below

T/K	A	B	C
233.15	1.665	-0.082	0.232
243.15	1.581	-0.015	0.169
253.15	1.477	-0.004	0.107
263.15	1.376	+0.024	0.096
273.15	1.285	+0.046	0.081
283.15	1.190	+0.061	0.067
293.15	1.097	+0.077	0.061

$$\ln f_1 = A x_2^2 - B x_2^2(1 - 4 x_1) + C x_2^2(1 - 8 x_1 + 12 x_1^2)$$

$$\ln f_2 = A x_1^2 + B x_1^2(1 - 4 x_2) + C x_1^2(1 - 8 x_2 + 12 x_2^2)$$

where f_1 = activity coefficient of ethylamine
f_2 = activity coefficient of hexane
x_1 = mole fraction of ethylamine in the liquid phase
x_2 = mole fraction of hexane in the liquid phase.

COMPONENTS:

1. Ethanamine-d_2; $C_2H_5D_2N$; [5852-45-9]
2. Butane; C_4H_{10}; [106-97-8]

ORIGINAL MEASUREMENTS:

Wolff, H.; Höpfner, A.
Ber. Bunsenges. Phys. Chem.
1965, *69*, 710-716.

VARIABLES:

Composition, Temperature

PREPARED BY:

P. G. T. Fogg

EXPERIMENTAL VALUES:

Variation of the total vapor pressure/Torr with variation of temperature and of mole fraction of $C_2H_5D_2N$ in the liquid phase, $x_{C_2H_5D_2N}$

	T/K				
$x_{C_2H_5D_2N}$	218.15	233.15	253.15	273.15	293.15
0	52.1	125.0	338.5	772.7	1552.6
0.0102	52.9	126.5	341.7	780.0	1566.5
0.0242	53.6	128.4	346.0	788.8	1583.5
0.0463	53.7	130.1	351.0	800.5	1606.6
0.0646	54.1	131.2	354.9	808.0	1621.4
0.0925	54.7	131.6	357.6	816.9	1640.5
0.146	54.2	131.9	359.9	825.6	1662.0
0.171	54.3	131.8	360.0	827.4	1668.6
0.212	54.0	131.3	359.1	827.2	1673.6
0.235	53.7	130.6	358.9	826.9	1674.2
0.268	53.3	130.4	357.1	825.0	1671.8
0.343	53.3	128.9	353.6	816.7	1661.3
0.425	52.0	126.7	347.2	804.2	1638.3
0.483	52.2	125.1	341.7	792.1	1614.9
0.579	49.7	120.6	329.9	765.0	1565.1
0.631	48.6	116.9	321.3	744.9	1525.7
0.651	48.0	115.7	317.0	737.6	1512.0
0.677	46.8	113.6	311.6	725.4	1490.6
0.687	46.9	113.5	310.1	721.5	1482.5

Cont.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Apparatus described previously was used (1). Liquid mixtures of accurately known composition were introduced into a cell held in a thermostat controlled to ± 0.02°C. The total vapor pressure was measured by a mercury manometer.

The authors calculated activity coefficients of each component by a method described by Barker (2). Constants for Redlich-Kister equations for activity coefficients were evaluated and reported.

SOURCE AND PURITY OF MATERIALS:

1. Prepared from $C_2H_5NH_2$ and D_2O; repeatedly fractionated until 1st and last fractions had vapor pressures which differed by 0.4 Torr at 20°C. Spectroscopic measurements indicated that the product was at least 99% pure.
2. Commercial product; dried over P_2O_5; distilled and repeatedly fractionated until first and last fractions had consistent vapor pressures, as described for hexane (1)

ESTIMATED ERROR:

$\delta T/K = \pm 0.02$ (estimated by authors)

REFERENCES:

1. Wolff, H.; Höpfner, A. *Z. Elektrochem.* 1962, *66*, 149.
2. Barker, J. A. *Aust. J. Chem.* 1953, *6*, 207.
3. Redlich, O.; Kister, A.T. *Ind. Eng. Chem.* 1948, *21*, 345.

COMPONENTS:

1. Ethanamine-d_2; $C_2H_5D_2N$; [5852-45-9]
2. Butane; C_4H_{10}; [106-97-8]

ORIGINAL MEASUREMENTS:

Wolff, H.; Höpfner, A.

Ber. Bunsenges. Phys. Chem.

1965, *69*, 710-716.

EXPERIMENTAL VALUES: Cont.

	T/K				
$x_{C_2H_5D_2N}$	218.15	233.15	253.15	273.15	293.15
0.754	43.8	105.7	291.5	681.8	1410.7
0.803	40.6	99.2	274.5	645.2	1342.0
0.869	35.3	85.9	242.0	579.4	1222.7
0.890	32.4	80.5	227.6	551.8	1176.3
0.930	27.1	67.9	198.9	494.1	1078.8
0.955	22.5	57.9	175.7	450.5	1003.6
1	11.3	34.8	124.5	354.7	847.2

760 Torr = 1 atm = 1.013 x 10^5 Pa

Constants for calculation of activity coefficients from the Redlich-Kister equations given below

T/K	A	B	C
218.15	1.789	-0.233	0.253
223.15	1.762	-0.219	0.233
228.15	1.699	-0.199	0.210
233.15	1.660	-0.194	0.206
243.15	1.558	-0.151	0.150
253.15	1,470	-0.125	0.132
263.15	1.376	-0.095	0.106
273.15	1.286	-0.071	0.083
283.15	1.199	-0.050	0.064
293.15	1.115	-0.032	0.049

$$\ln f_1 = A\,x_2^2 - B\,x_2^2(1 - 4x_1) + C\,x_2^2(1 - 8\,x_1 + 12\,x_1^2)$$

$$\ln f_2 = A\,x_1^2 + B\,x_1^2(1 - 4x_2) + C\,x_1^2(1 - 8\,x_2 + 12\,x_2^2)$$

where f_1 = activity coefficient of ethanamine-d_2

f_2 = activity coefficient of butane

x_1 = mole fraction of ethanamine-d_2 in the liquid phase

x_2 = mole fraction of butane in the liquid phase

COMPONENTS:

1. 1-Propanamine, (propylamine); C_3H_9N; [107-10-8]
2. Hexane; C_6H_{14}; [110-54-3]

ORIGINAL MEASUREMENTS:

Wolff, H.; Höpfner, A.; Höpfner,H.-M.
Ber. Bunsenges. Phys. Chem.
1964, *68*, 410-417.

VARIABLES:

Composition, temperature

PREPARED BY:

P. G. T. Fogg

EXPERIMENTAL VALUES:

Variation of the total vapor pressure/Torr with variation of temperature and of mole fraction of C_3H_9N in the liquid phase, $x_{C_3H_9N}$

	T/K		
$x_{C_3H_9N}$	253.15	273.15	293.15
0	14.4	46.0	121.7
0.0055	14.9	46.9	124.3
0.0114	15.5	48.3	127.6
0.0321	17.4	53.0	137.3
0.0679	19.9	60.0	153.3
0.0880	21.0	63.5	161.0
0.1503	23.9	71.7	181.1
0.1715	24.5	74.0	186.9
0.210	25.5	77.8	196.6
0.229	26.0	79.3	200.8
0.277	26.7	82.4	209.4
0.296	27.1	83.6	212.5
0.360	28.2	87.0	222.3
0.402	28.6	88.7	227.5
0.451	29.3	90.9	233.7
0.527	29.8	93.1	240.7
0.608	30.4	95.2	247.1
0.628	30.2	95.5	248.0

Cont.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Apparatus described previously was used (1). Liquid mixtures of accurately known composition were introduced into a cell held in a thermostat controlled to ± 0.02°C. The total vapor pressures were measured by a mercury manometer.

The authors calculated activity coefficients of each component from the vapor pressure data by a method described by Barker (2). Constants for Redlich-Kister equations (3) for activity coefficients were evaluated and reported.

SOURCE AND PURITY OF MATERIALS:

1. From commercial propylammonium chloride by reaction with KOH; dried with KOH and with Li; repeatedly fractionated until the first and last fractions had the same vapor pressure as measured by manometer. (See ref. 1.)
2. Commercial product; dried with P_2O_5; repeatedly fractionated until first and last fractions had the same vapor pressure as measured by the manometer (1).

ESTIMATED ERROR:

$\delta T/K = \pm 0.02$ (estimated by authors)

REFERENCES:

1. Wolff, H.; Höpfner, A. *Z. Elektrochem.* 1962, *66*, 149.
2. Barker, J.A. *Aust. J. Chem.* 1953, *6*, 207.
3. Redlich, O.; Kister, A.T. *Ind. Eng. Chem.* 1948, *21*, 345.

COMPONENTS:	ORIGINAL MEASUREMENTS:
1. 1-Propanamine, (propylamine); C_3H_9N; [107-10-8] 2. Hexane; C_6H_{14}; [110-54-3]	Wolff, H.; Höpfner, A.; Höpfner, H.-M *Ber. Bunsenges. Phys. Chem.* 1964, *68*, 410-417.
VARIABLES:	**PREPARED BY:**
Composition, temperature	P. G. T. Fogg

EXPERIMENTAL VALUES: Cont.

$x_{C_3H_9N}$	T/K 253.15	 273.15	 293.15
0.680	30.6	96.4	250.0
0.725	30.8	97.1	253.5
0.796	30.7	98.0	255.5
0.910	30.2	97.1	255.8
0.971	29.6	95.5	253.3
1	29.0	94.2	252.6

760 Torr = 1 atm = 1.013×10^5 Pa.

Constants for calculation of activity coefficients from the Redlich-Kister equations given below

T/K	A	B	C
253.15	1.253	-0.070	0.090
263.15	1.165	-0.034	0.059
273.15	1.099	-0.002	0.041
283.15	1.024	0.002	0.042
293.15	0.947	0.008	0.015

$$\ln f_1 = A\,x_2^2 - B\,x_2^2(1 - 4\,x_1) + C\,x_2^2(1 - 8\,x_1 + 12\,x_1^2)$$

$$\ln f_2 = A\,x_1^2 + B\,x_1^2(1 - 4\,x_2) + C\,x_1^2(1 - 8\,x_2 + 12\,x_2^2)$$

where f_1 = activity coefficient of propylamine
f_2 = activity coefficient of hexane
x_1 = mole fraction of propylamine in the liquid phase
x_2 = mole fraction of hexane in the liquid phase

COMPONENTS:

1. Propanamine; C_3H_9N; [107-10-8]
2. Hexane; C_6H_{14}; [110-54-3]

ORIGINAL MEASUREMENTS:

Wolff, H.; Shadiakhy, A.

Fluid Phase Equilibria

1983, *11*, 267-287.

VARIABLES:

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	x_1	P/kPa	T/K	x_1	P/kPa
293.15	0	16.17	303.15	0	25.00
	0.048_4	19.13		0.048_4	29.28
	0.097_1	21.80		0.097_1	33.00
	0.150_0	24.12		0.149_8	36.36
	0.183_6	25.30		0.183_4	38.05
	0.234_0	26.77		0.233_8	40.32
	0.284_3	27.97		0.284_1	42.25
	0.348_0	29.42		0.347_8	44.41
	0.377_8	29.98		0.377_7	45.28
	0.429_7	30.76		0.429_5	46.56
	0.483_1	31.50		0.483_0	47.80
	0.543_1	32.29		0.543_0	49.01
	0.584_0	32.60		0.583_9	49.72
	0.659_8	33.29		0.659_7	50.68
	0.708_9	33.69		0.708_8	51.37
	0.767_2	34.04		0.767_2	52.08
	0.804_8	34.22		0.804_7	52.33
	0.877_9	34.44		0.877_5	52.65
	0.938_6	34.33		0.938_6	52.72
	0.975_6	33.93		0.975_6	52.34
	1	33.85		1	52.16

(cont.)

AUXILIARY INFORMATION

METHOD APPARATUS/PROCEDURE:

Apparatus described previously was used (1), (2). Liquid mixtures of accurately known composition were introduced into a cell held in a thermostat controlled to ±0.02 °C. The total pressure was measured using a mercury manometer. The authors calculated activity coefficients of each component by a method described by Barker (3). Constants for the Wilson equation (4) were evaluated and reported.

SOURCE AND PURITY OF MATERIALS:

1. Fluka purissima grade, fractionated, purity 99.5 mole per cent.
2. Purity 99.97 mole per cent, degassed, dried over molecular sieve.

ESTIMATED ERROR:

$\delta T/K = \pm 0.02$.

REFERENCES:

1. Wolff, H.; Höppel, H. E. *Ber. Bunsenges. Phys. Chem.* 1966, *70*, 874.
2. Wolff, H.; Shadiakhy, A. *Fluid Phase Equilibria* 1981, *7*, 309.
3. Barker, J. A. *Aust. J. Chem.* 1953, *6*, 207.
4. Wilson, G. M. *J. Am. Chem. Soc.* 1964, *86*, 127.

COMPONENTS:	ORIGINAL MEASUREMENTS:
1. Propanamime; C_3H_9N; [107-10-8] 2. Hexane; C_6H_{14}; [110-54-3]	Wolff, H.; Shadiakhy, A. *Fluid Phase Equilibria* 1983, *11*, 267-287.

EXPERIMENTAL VALUES:

T/K	x_1	P/kPa	T/K	x_1	P/kPa
313.15	0	37.26	333.15	0	76.23
	0.048_4	43.13		0.048_4	86.43
	0.097_0	48.26		0.096_9	95.58
	0.149_6	53.14		0.149_1	104.26
	0.183_2	55.54		0.182_7	108.82
	0.233_6	58.82		0.232_9	115.22
	0.283_8	61.70		0.283_2	121.02
	0.347_6	64.94		0.346_9	127.47
	0.377_4	66.22		0.376_8	130.23
	0.429_3	68.19		0.428_7	134.47
	0.482_8	70.06		0.482_2	138.43
	0.542_8	71.98		0.542_3	142.41
	0.583_8	72.99		0.583_3	144.83
	0.659_6	74.59		0.659_3	148.61
	0.708_7	75.83		0.708_4	151.07
	0.767_1	76.79		0.766_9	153.36
	0.804_7	77.23		0.804_5	154.63
	0.877_5	77.83		0.877_4	156.40
	0.938_6	78.22		0.938_6	157.53
	0.975_6	77.85		0.975_6	157.21
	1	77.52		1	157.38
323.15	0	54.02	343.15	0	105.19
	0.048_4	61.81		0.048_3	118.14
	0.097_0	68.71		0.096_9	129.86
	0.149_4	75.37		0.148_8	140.96
	0.183_0	78.70		0.182_3	147.03
	0.233_3	83.39		0.232_6	155.59
	0.283_6	87.54		0.282_8	163.45
	0.347_3	92.17		0.346_5	172.40
	0.377_1	94.09		0.376_4	176.13
	0.429_0	97.01		0.428_3	181.96
	0.482_5	99.83		0.481_9	187.52
	0.542_6	102.67		0.542_0	193.21
	0.583_6	104.15		0.583_0	196.54
	0.659_5	106.80		0.659_1	201.92
	0.708_6	108.47		0.708_3	205.60
	0.767_0	110.02		0.766_8	208.94
	0.804_6	110.82		0.804_4	210.81
	0.877_4	111.90		0.877_3	213.62
	0.938_6	112.48		0.938_6	215.26
	0.975_6	112.14		0.975_6	215.29
	1	112.10		1	215.69

Constants for calculation of activity coefficients from the Wilson equation are given below:

T/K	Λ_{12}	Λ_{21}
293.15	0.6054_8	0.5600_4
303.15	0.6545_6	0.5691_0
313.15	0.6994_6	0.5755_5
323.15	0.7412_7	0.5908_9
333.15	0.7818_9	0.6018_4
343.15	0.8349_2	0.6029_9

(cont.)

COMPONENTS:	ORIGINAL MEASUREMENTS:
1. Propanamine; C_3H_9N; [107-10-8] 2. Hexane; C_6H_{14}; [110-54-3]	Wolff, H.; Shadiakhy, A. *Fluid Phase Equilibria* 1983, *11*, 267-287.

EXPERIMENTAL VALUES:

$$\ln f_1 = -\ln(x_1 + \Lambda_{12}x_2) + x_2\left\{\frac{\Lambda_{12}}{x_1 + \Lambda_{12}x_2} - \frac{\Lambda_{21}}{x_2 + \Lambda_{21}x_1}\right\}$$

$$\ln f_2 = -\ln(x_2 + \Lambda_{21}x_1) - x_1\left\{\frac{\Lambda_{12}}{x_1 + \Lambda_{12}x_2} - \frac{\Lambda_{21}}{x_2 + \Lambda_{21}x_1}\right\}$$

where f_1 = activity coefficient of amine

f_2 = activity coefficient of hexane

x_1 = mole fraction of amine in liquid

x_2 = mole fraction of hexane in liquid.

COMPONENTS:

1. 1-Propanamine-d$_2$; $C_3H_7ND_2$; [25837-80-3]
2. Hexane; C_6H_{14}; [110-54-3]

ORIGINAL MEASUREMENTS:

Wolff, H.; Shadiakhy, A.

Fluid Phase Equilibria

1983, *11*, 267-287.

VARIABLES:

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	x_1	P/kPa	T/K	x_1	P/kPa
293.15	0	16.17	303.15	0	25.00
	0.046_6	19.08		0.046_6	29.20
	0.098_9	21.81		0.098_9	33.06
	0.150_9	24.04		0.150_7	36.26
	0.212_0	25.98		0.211_8	39.13
	0.245_2	26.94		0.245_0	40.64
	0.285_9	27.89		0.285_7	42.14
	0.348_3	29.17		0.348_1	44.05
	0.421_6	30.30		0.421_4	45.97
	0.449_7	30.73		0.449_6	46.61
	0.496_6	31.30		0.496_4	47.57
	0.555_2	31.92		0.555_1	48.61
	0.607_3	32.42		0.607_2	49.44
	0.657_4	32.82		0.657_4	50.17
	0.708_0	33.26		0.707_9	50.80
	0.752_7	33.48		0.752_7	51.22
	0.812_2	33.73		0.812_1	51.60
	0.875_0	33.77		0.875_0	51.81
	0.922_1	33.66		0.922_1	51.73
	0.969_5	33.33		0.969_5	51.46
	1	32.94		1	50.95

(cont.)

AUXILIARY INFORMATION

METHOD APPARATUS/PROCEDURE:

Apparatus described previously was used (1), (2). Liquid mixtures of accurately known composition were introduced into a cell held in a thermostat controlled to ±0.02 °C. The total pressure was measured using a mercury manometer. The authors calculated activity coefficients of each component by a method described by Barker (3). Constants for the Wilson equation (4) were evaluated and reported.

SOURCE AND PURITY OF MATERIALS:

1. Prepared *via* exchange reaction of non-deuterated amine with 99.97 mole per cent D_2O. Purity better than 99 mole per cent. Dried.
2. Purity 99.97 mole per cent, degassed, dried over molecular sieve.

ESTIMATED ERROR:

$\delta T/K = \pm 0.02$.

REFERENCES:

1. Wolff, H.; Höppel, H. E. *Ber. Bunsenges. Phys. Chem.* 1966, *70*, 874.
2. Wolff, H.; Shadiakhy, A. *Fluid Phase Equilibria* 1981, *7*, 309.
3. Barker, J. A. *Aust. J. Chem.* 1953, *6*, 207.
4. Wilson, G. M. *J. Am. Chem. Soc.* 1964, *86*, 127.

COMPONENTS:

1. 1-Propanamine-d_2; $C_3H_7ND_2$; [25837-80-3]

2. Hexane; C_6H_{14}; [110-54-3]

ORIGINAL MEASUREMENTS:

Wolff, H.; Shadiakhy, A.

Fluid Phase Equilibria

<u>1983</u>, *11*, 267-287.

EXPERIMENTAL VALUES:

T/K	x_1	P/kPa	T/K	x_1	P/kPa
313.15	0	37.26	333.15	0	76.23
	0.046_6	42.98		0.046_6	86.13
	0.098_8	48.40		0.098_7	95.59
	0.150_5	52.93		0.150_0	104.02
	0.211_6	57.10		0.211_0	111.99
	0.244_8	59.24		0.244_2	116.12
	0.285_5	61.43		0.284_8	120.63
	0.347_9	64.46		0.347_3	126.84
	0.421_2	67.42		0.420_6	133.08
	0.449_3	68.41		0.448_8	135.19
	0.496_2	69.90		0.495_7	138.51
	0.554_9	71.53		0.554_5	142.09
	0.607_0	72.90		0.606_6	145.03
	0.657_2	73.98		0.656_9	147.65
	0.707_8	75.01		0.707_6	149.83
	0.752_6	75.62		0.752_4	151.59
	0.812_1	76.39		0.812_0	153.45
	0.875_0	76.79		0.874_9	154.87
	0.922_1	76.93		0.922_1	155.45
	0.969_5	76.66		0.969_5	155.63
	1	76.18		1	155.10
323.15	0	54.02	343.15	0	105.19
	0.046_6	61.61		0.046_5	117.78
	0.098_8	68.93		0.098_7	129.99
	0.150_3	75.19		0.149_7	140.84
	0.211_3	81.03		0.210_7	151.55
	0.244_5	84.03		0.243_8	157.15
	0.285_2	87.25		0.284_4	163.21
	0.347_6	91.65		0.346_9	171.84
	0.420_9	95.97		0.420_2	180.36
	0.449_1	97.49		0.448_4	183.32
	0.496_0	99.66		0.495_3	187.96
	0.554_7	102.28		0.554_2	193.13
	0.606_9	104.19		0.606_4	197.22
	0.657_1	105.91		0.656_7	200.78
	0.707_7	107.46		0.707_4	204.12
	0.752_5	108.52		0.752_3	206.57
	0.812_0	109.71		0.811_9	209.49
	0.874_9	110.56		0.874_8	211.77
	0.922_1	110.84		0.922_0	212.92
	0.969_5	110.75		0.969_5	213.37
	1	110.27		1	213.12

Constants for calculation of activity coefficients from the Wilson equation are given below:

T/K	Λ_{12}	Λ_{21}
293.15	0.6139_8	0.5320_4
303.15	0.6595_1	0.5471_8
313.15	0.7043_1	0.5622_3
323.15	0.7504_3	0.5724_9
333.15	0.8100_5	0.5684_7
343.15	0.8484_9	0.5826_3

(cont.)

COMPONENTS:

1. 1-Propanamine-d$_2$; $C_3H_7ND_2$; [25837-80-3]
2. Hexane; C_6H_{14}; [110-54-3]

ORIGINAL MEASUREMENTS:

Wolff, H.; Shadiakhy, A.

Fluid Phase Equilibria

1983, *11*, 267-287.

EXPERIMENTAL VALUES:

$$\ln f_1 = -\ln(x_1 + \Lambda_{12}x_2) + x_2\left[\frac{\Lambda_{12}}{x_1 + \Lambda_{12}x_2} - \frac{\Lambda_{21}}{x_2 + \Lambda_{21}x_1}\right]$$

$$\ln f_2 = -\ln(x_2 + \Lambda_{21}x_1) - x_1\left[\frac{\Lambda_{12}}{x_1 + \Lambda_{12}x_2} - \frac{\Lambda_{21}}{x_2 + \Lambda_{21}x_1}\right]$$

where f_1 = activity coefficient of amine

f_2 = activity coefficient of hexane

x_1 = mole fraction of amine in liquid

x_2 = mole fraction of hexane in liquid.

COMPONENTS:	ORIGINAL MEASUREMENTS:
1. 1-Propanamine (n-Propylamine); C_3H_9N; [107-10-8] 2. Octanol, glycols and glycerol	Copley, M.J.; Ginsberg, E.; Zellhoefer, G.F.; Marvel, C.S. *J. Amer. Chem. Soc.* 1941, *63*, 254-256.
VARIABLES:	PREPARED BY: P. G. T. Fogg

EXPERIMENTAL VALUES:

Solvent	T/K	$p_{C_3H_9N}$/mmHg*	Mole fraction $x_{C_3H_9N}$
1-Octanol; $C_8H_{18}O$; [111-87-5]	305.4	106	0.408
1,2-Ethanediol (ethylene glycol); $C_2H_6O_2$; [107-21-1]	305.4	106	0.465
1,3-Butanediol (1,3-butylene glycol) $C_4H_{10}O_2$; [107-88-0]	305.4	106	0.460
1,2,3-Propanetriol (glycerol); $C_3H_8O_3$; [56-81-5]	305.4	106	0.497
2,2'-Oxybis-ethanol, (diethylene glycol); $C_4H_{10}O_3$; [111-46-6]	305.4	106	0.510
2,2'-[1,2-ethanediylbis(oxy)]bis-ethanol, (triethylene glycol); $C_6H_{14}O_4$; [112-27-6]	305.4	106	0.519

760 mmHg = 1 atm = 1.013 x 10^5 Pa.

* The pressure of propanamine was said by the authors to correspond to its vapor pressure at 4.5°C. The authors stated that they measured the vapor pressure at several temperatures and determined the value at 4.5°C from a plot of the logarithm of the vapor pressure against (K/T).

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The absorption apparatus was developed for studies of refrigeration systems (ref. (1)) and consisted of a copper drum, 4 x 12 cm, fitted with a needle valve and two-way outlet with one outlet connected to a manometer. The drum was evacuated to a pressure of 1 mmHg and about 40 cm^3 of solvent drawn into this drum which was then reweighed and immersed in a water bath at 32.2°C. The drum was agitated and propanamine vapor allowed to flow slowly into it until the final pressure corresponded to the vapor pressure of propanamine at 4.5°C. The drum and contents were weighed again to find the weight of vapor which had been absorbed.

SOURCE AND PURITY OF MATERIALS:

The authors stated that the materials used were all purified carefully by chemical means and fractional distillation where feasible.

ESTIMATED ERROR:

REFERENCES:

1. Zellhoefer, G.F. *Ind. Eng. Chem.* 1937, *29*, 548.

COMPONENTS:

1. 2-Propanamine (*iso*-propylamine); C_3H_9N; [75-31-0]
2. Hexane; C_6H_{14}; [110-54-3]

ORIGINAL MEASUREMENTS:

Wolff, H.; Shadiakhy, A.

Fluid Phase Equilibria

1983, *11*, 267-287.

VARIABLES:

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	x_1	P/kPa	T/K	x_1	P/kPa
283.15	0	10.09	293.15	0	16.17
	0.046_9	14.11		0.046_9	21.74
	0.098_3	17.72		0.098_3	27.05
	0.154_6	20.97		0.154_4	31.84
	0.189_0	22.56		0.188_7	34.22
	0.250_0	25.21		0.249_7	38.17
	0.290_6	26.61		0.290_3	40.30
	0.336_1	28.04		0.335_8	42.60
	0.369_3	29.01		0.369_0	44.14
	0.432_9	30.72		0.432_6	46.78
	0.516_0	32.61		0.515_7	49.77
	0.566_0	33.61		0.565_7	51.46
	0.601_2	34.24		0.601_0	52.62
	0.664_4	35.54		0.664_2	54.52
	0.707_0	36.37		0.706_9	55.81
	0.751_1	37.13		0.751_0	57.02
	0.820_7	38.33		0.820_6	59.00
	0.869_6	39.14		0.869_5	60.32
	0.936_8	40.24		0.936_8	62.05
	0.967_2	40.76		0.967_2	62.82
	1	41.26		1	63.61

(cont.)

AUXILIARY INFORMATION

METHOD APPARATUS/PROCEDURE:

Apparatus described previously was used (1), (2). Liquid mixtures of accurately known composition were introduced into a cell held in a thermostat controlled to ±0.02 °C. The total pressure was measured using a mercury manometer. The authors calculated activity coefficients of each component by a method described by Barker (3). Constants for the Wilson equation (4) were evaluated and reported.

SOURCE AND PURITY OF MATERIALS:

1. Fluka purissima grade, fractionated, purity 99.995 mole per cent.
2. Purity 99.97 mole per cent, degassed, dried over molecular sieve.

ESTIMATED ERROR:

$\delta T/K = \pm 0.02$.

REFERENCES:

1. Wolff, H.; Höppel, H. E. *Ber. Bunsenges. Phys. Chem.* 1966, *70*, 874.
2. Wolff, H.; Shadiakhy, A. *Fluid Phase Equilibria* 1981, *7*, 309.
3. Barker, J. A. *Aust. J. Chem.* 1953, *6*, 207.
4. Wilson, G. M. *J. Am. Chem. Soc.* 1964, *86*, 127.

COMPONENTS:	ORIGINAL MEASUREMENTS
1. 2-Propanamine (*iso*-propylamine); C_3H_9N; [75-31-0] 2. Hexane; C_6H_{14}; [110-54-3]	Wolff, H.; Shadiakhy, A. *Fluid Phase Equilibria* 1983, *11*, 267-287.

EXPERIMENTAL VALUES:

T/K	x_1	P/kPa	T/K	x_1	P/kPa
303.15	0	25.00	323.15	0	54.02
	0.046$_9$	32.58		0.046$_8$	67.26
	0.098$_2$	39.86		0.098$_1$	80.13
	0.154$_1$	46.72		0.153$_4$	92.41
	0.188$_4$	49.98		0.187$_6$	98.51
	0.249$_4$	55.77		0.248$_4$	109.62
	0.289$_9$	59.00		0.289$_0$	116.23
	0.335$_4$	62.43		0.334$_4$	123.07
	0.368$_7$	64.70		0.367$_7$	127.82
	0.432$_2$	68.70		0.431$_3$	136.10
	0.515$_4$	73.42		0.514$_5$	145.97
	0.565$_4$	75.95		0.564$_6$	151.45
	0.600$_7$	77.67		0.599$_9$	155.15
	0.664$_0$	80.67		0.663$_3$	161.49
	0.706$_7$	82.59		0.706$_1$	165.49
	0.750$_8$	84.49		0.750$_3$	169.63
	0.820$_5$	87.45		0.820$_2$	176.05
	0.869$_4$	89.50		0.869$_2$	180.29
	0.936$_8$	92.15		0.936$_7$	186.06
	0.967$_1$	93.23		0.967$_1$	188.53
	1	94.60		1	191.23
313.15	0	37.26	333.15	0	76.23
	0.046$_8$	47.46		0.046$_8$	93.03
	0.098$_2$	57.28		0.098$_1$	109.32
	0.153$_8$	66.54		0.153$_0$	125.42
	0.188$_0$	71.05		0.187$_1$	133.68
	0.248$_9$	79.23		0.247$_9$	148.24
	0.289$_5$	84.02		0.288$_4$	157.20
	0.335$_0$	88.79		0.333$_8$	166.49
	0.368$_2$	92.21		0.367$_1$	172.89
	0.431$_8$	98.02		0.430$_7$	184.25
	0.515$_0$	104.92		0.514$_0$	198.09
	0.565$_0$	108.79		0.564$_1$	205.69
	0.600$_4$	111.31		0.599$_5$	211.02
	0.663$_7$	115.68		0.662$_9$	219.66
	0.706$_4$	118.54		0.705$_8$	225.35
	0.750$_6$	121.31		0.750$_0$	231.14
	0.820$_3$	125.83		0.819$_9$	240.03
	0.869$_3$	128.76		0.869$_0$	246.11
	0.936$_7$	132.80		0.936$_6$	254.41
	0.967$_1$	134.50		0.967$_0$	257.67
	1	136.36		1	261.57

Constants for calculation of activity coefficients from the Wilson equation are given below:

T/K	Λ_{12}	Λ_{21}
283.15	0.5940$_0$	0.5896$_1$
293.15	0.6427$_2$	0.5986$_5$
303.15	0.6905$_5$	0.6114$_9$
313.15	0.7325$_5$	0.6233$_4$
323.15	0.7795$_7$	0.6310$_4$
333.15	0.8184$_2$	0.6444$_6$

(cont.)

COMPONENTS:	ORIGINAL MEASUREMENTS:
1. 2-Propanamine (*iso*-propylamine); C_3H_9N; [75-31-0] 2. Hexane; C_6H_{14}; [110-54-3]	Wolff, H.; Shadiakhy, A. *Fluid Phase Equilibria* 1983, *11*, 267-287.

EXPERIMENTAL VALUES:

$$\ln f_1 = -\ln(x_1 + \Lambda_{12}x_2) + x_2\left[\frac{\Lambda_{12}}{x_1 + \Lambda_{12}x_2} - \frac{\Lambda_{21}}{x_2 + \Lambda_{21}x_1}\right]$$

$$\ln f_2 = -\ln(x_2 + \Lambda_{21}x_1) - x_1\left[\frac{\Lambda_{12}}{x_1 + \Lambda_{12}x_2} - \frac{\Lambda_{21}}{x_2 + \Lambda_{21}x_1}\right]$$

where f_1 = activity coefficient of amine

f_2 = activity coefficient of hexane

x_1 = mole fraction of amine in liquid

x_2 = mole fraction of hexane in liquid.

COMPONENTS:

1. 2-Propanamine-d$_2$; $C_3H_7ND_2$; [7395-10-0]
2. Hexane; C_6H_{14}; [110-54-3]

ORIGINAL MEASUREMENTS:

Wolff, H.; Shadiakhy, A.

Fluid Phase Equilibria

1983, *11*, 267-287.

VARIABLES:

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	x_1	P/kPa	T/K	x_1	P/kPa
283.15	0	10.09	293.15	0	16.17
	0.052_0	14.36		0.052_0	22.24
	0.105_3	18.03		0.105_3	27.50
	0.157_3	20.88		0.157_1	31.78
	0.198_9	22.76		0.198_6	34.58
	0.233_4	24.14		0.233_1	36.66
	0.299_5	26.45		0.299_2	40.26
	0.347_4	27.92		0.347_0	42.54
	0.399_1	29.36		0.398_8	44.76
	0.453_7	30.61		0.453_5	46.89
	0.516_1	31.96		0.515_9	49.05
	0.567_4	33.00		0.567_1	50.77
	0.621_2	34.00		0.621_0	52.38
	0.673_7	34.93		0.673_5	53.88
	0.714_8	35.72		0.714_6	55.08
	0.787_7	37.02		0.787_6	57.02
	0.821_6	37.53		0.821_5	57.92
	0.880_2	38.42		0.880_1	59.42
	0.925_8	39.10		0.925_8	60.62
	0.970_5	39.81		0.970_5	61.69
	1	40.14		1	62.31

(cont.)

AUXILIARY INFORMATION

METHOD APPARATUS/PROCEDURE:

Apparatus described previously was used (1), (2). Liquid mixtures of accurately known composition were introduced into a cell held in a thermostat controlled to ±0.02 °C. The total pressure was measured using a mercury manometer. The authors calculated activity coefficients of each component by a method described by Barker (3). Constants for the Wilson equation (4) were evaluated and reported.

SOURCE AND PURITY OF MATERIALS:

1. Prepared *via* exchange reaction of non-deuterated amine with 99.7 mole per cent D_2O. Purity better than 99 mole per cent. Dried.
2. Purity 99.97 mole per cent, degassed, dried over molecular sieve.

ESTIMATED ERROR:

$\delta T/K = \pm 0.02$

REFERENCES:

1. Wolff, H.; Höppel, H. E. *Ber. Bunsenges. Phys. Chem.* 1966, *70*, 874.
2. Wolff, H.; Shadiakhy, A. *Fluid Phase Equilibria* 1981, *7*, 309.
3. Barker, J. A. *Aust. J. Chem.* 1953, *6*, 207.
4. Wilson, G. M. *J. Am. Chem. Soc.* 1964, *86*, 127.

COMPONENTS:

1. 2-Propanamine-d₂; $C_3H_7ND_2$; [7395-10-0]

2. Hexane; C_6H_{14}; [110-54-3]

ORIGINAL MEASUREMENTS:

Wolff, H.; Shadiakhy, A.

Fluid Phase Equilibria

1983, *11*, 267-287.

EXPERIMENTAL VALUES:

T/K	x_1	P/kPa	T/K	x_1	P/kPa
303.15	0	25.00	323.15	0	54.02
	0.051_9	33.28		0.051_9	68.31
	0.105_2	40.58		0.105_1	81.29
	0.156_8	46.65		0.156_1	92.43
	0.198_3	50.56		0.197_5	99.83
	0.232_7	53.74		0.231_8	105.96
	0.298_9	59.05		0.297_9	116.68
	0.346_7	62.47		0.345_7	123.67
	0.398_4	65.87		0.397_4	130.64
	0.453_1	69.07		0.452_2	137.47
	0.515_5	72.43		0.514_6	144.64
	0.566_8	75.01		0.566_0	150.08
	0.620_8	77.53		0.620_1	155.68
	0.673_3	79.90		0.672_7	160.84
	0.714_4	81.79		0.713_9	164.67
	0.787_4	84.71		0.787_0	171.21
	0.821_4	86.11		0.821_1	174.21
	0.880_1	88.45		0.879_8	179.25
	0.925_8	90.26		0.925_6	183.13
	0.970_4	91.97		0.970_4	186.72
	1	92.94		1	189.09
313.15	0	37.26	333.15	0	76.23
	0.051_9	48.33		0.051_8	94.35
	0.105_2	58.24		0.105_0	110.87
	0.156_5	66.62		0.155_7	125.44
	0.197_9	71.91		0.197_0	135.31
	0.232_3	76.46		0.231_3	143.53
	0.298_4	84.18		0.297_3	157.97
	0.346_2	89.15		0.345_1	167.52
	0.398_0	94.09		0.396_8	177.03
	0.452_7	98.81		0.451_6	186.52
	0.515_1	103.83		0.514_1	196.66
	0.566_5	107.67		0.565_5	204.30
	0.620_5	111.42		0.619_6	212.02
	0.673_0	114.92		0.672_3	219.24
	0.714_2	117.62		0.713_5	224.58
	0.787_2	122.19		0.786_8	233.83
	0.821_3	124.23		0.820_9	238.21
	0.880_0	127.79		0.879_7	245.34
	0.925_7	130.39		0.925_5	250.70
	0.970_4	132.94		0.970_4	255.87
	1	134.46		1	259.20

Constants for calculation of activity coefficients from the Wilson equation are given below:

T/K	Λ_{12}	Λ_{21}
283.15	0.5998_3	0.5755_1
293.15	0.6393_0	0.5976_6
303.15	0.6856_3	0.6131_9
313.15	0.7289_0	0.6255_0
323.15	0.7789_9	0.6331_6
333.15	0.8249_4	0.6412_1

(cont.)

COMPONENTS:

1. 2-Propanamine-d2; $C_3H_7ND_2$; [7395-10-0]
2. Hexane; C_6H_{14}; [110-54-3]

ORIGINAL MEASUREMENTS:

Wolff, H.; Shadiakhy, A.

Fluid Phase Equilibria

1983, *11*, 267-287.

EXPERIMENTAL VALUES:

$$\ln f_1 = -\ln(x_1 + \Lambda_{12}x_2) + x_2\left[\frac{\Lambda_{12}}{x_1 + \Lambda_{12}x_2} - \frac{\Lambda_{21}}{x_2 + \Lambda_{21}x_1}\right]$$

$$\ln f_2 = -\ln(x_2 + \Lambda_{21}x_1) - x_1\left[\frac{\Lambda_{12}}{x_1 + \Lambda_{12}x_2} - \frac{\Lambda_{21}}{x_2 + \Lambda_{21}x_1}\right]$$

where f_1 = activity coefficient of amine

f_2 = activity coefficient of hexane

x_1 = mole fraction of amine in liquid

x_2 = mole fraction of hexane in liquid.

COMPONENTS:

1. 2-Propanamine (*iso*-propyl amine); C_3H_9N; [75-31-0]
2. Glycols

ORIGINAL MEASUREMENTS:

Copley, M.J.; Ginsberg, E.; Zellhoefer, G.F.; Marvel, C.S.

J. Amer. Chem. Soc.

1941, *63*, 254-256.

VARIABLES:

PREPARED BY:

P. G. T. Fogg

EXPERIMENTAL VALUES:

Solvent	T/K	$p_{C_3H_9N}$/mmHg*	Mole fraction $x_{C_3H_9N}$
1,2-Ethanediol (ethylene glycol); $C_2H_6O_2$; [107-21-1]	305.4	223	0.488
2,2'-Oxybis-ethanol, (diethylene glycol); $C_4H_{10}O_3$; [111-46-6]	305.4	223	0.517
2,2'-[1,2-ethanediylbis(oxy)]bis-ethanol, (triethylene glycol); $C_6H_{14}O_4$; [112-27-6]	305.4	223	0.552

* The pressure of 2-propanamine was said by the authors to correspond to its vapor pressure at 4.5 °C. The authors stated that they measured the vapor pressure at several temperatures and determined the value at 4.5 °C from a plot of the logarithm of the vapor pressure against K/T.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The absorption apparatus was developed for studies of refrigeration systems (ref. (1)) and consisted of a copper drum 4 x 12 cm, fitted with a needle valve and two-way outlet with one outlet connected to a manometer. The drum was evacuated to a pressure of 1 mmHg and about 40 cm^3 of solvent drawn into this drum which was then reweighed and immersed in a water bath at 32.2 °C. The drum was agitated and 2-propanamine vapor allowed to flow slowly into it until the final pressure corresponded to the vapor pressure of 2-propanamine at 4.5 °C. The drum and contents were weighed again to find the weight of vapor which had been absorbed.

SOURCE AND PURITY OF MATERIALS:

The authors stated that the materials used were all purified carefully by chemical means and fractional distillation where feasible.

ESTIMATED ERROR:

REFERENCES:

1. Zellhoefer, G.F. *Ind. Eng. Chem.* 1937, *29*, 548.

COMPONENTS:

1. 1-Butanamine, (*n*-butylamine); $C_4H_{11}N$; [109-73-9]
2. Glycols and amines

ORIGINAL MEASUREMENTS:

Copley, M.J.; Ginsberg, E.; Zellhoefer, G.F.; Marvel, C.S.

J. Amer. Chem. Soc.

1941, *63*, 254-256.

VARIABLES:

PREPARED BY:

P. G. T. Fogg

EXPERIMENTAL VALUES:

Solvent	T/K	$p_{C_4H_{11}N}$/mmHg*	Mole fraction $x_{C_4H_{11}N}$
1,2-Ethanediol, (ethylene glycol); $C_2H_6O_2$; [107-21-1]	305.4	24	0.400
2,2'-Oxybis-ethanol, (diethylene glycol); $C_4H_{10}O_3$; [111-46-6]	305.4	24	0.384
2,2'-[1,2-ethanediylbis(oxy)]bis-ethanol, (triethylene glycol); $C_6H_{14}O_4$; [112-27-6]	305.4	24	0.405
2,2'-[oxybis(2,1-ethanediyloxy)]bis-ethanol, (tetraethylene glycol) ; $C_8H_{18}O_5$; [112-60-7]	305.4	24	0.410
1,6-Hexanediamine (hexamethylenediamine); $C_6H_{16}N_2$; [124-09-4]	305.4	24	0.144
N,N'-bis(2-aminoethyl)-1,2-ethanediamine, (triethylenetetramine); $C_6H_{18}N_4$; [112-24-3]	305.4	24	0.145

* The pressure of 1-butanamine was said by the authors to correspond to its vapor pressure at 4.5°C. The authors stated that they measured the vapor pressure at several temperatures and determined the values at 4.5°C from a plot of the logarithm of the vapor pressure against (K/T).

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The absorption apparatus was developed for studies of refrigeration systems (ref. (1)) and consisted of a copper drum, 4 x 12 cm, fitted with a needle valve and two-way outlet with one outlet connected to a manometer. The drum was evacuated to a pressure of 1 mmHg and about 40 cm^3 of solvent drawn into this drum which was then reweighed and immersed in a water bath at 32.2°C. The drum was agitated and 1-butanamine vapor allowed to flow slowly into it until the final pressure corresponded to the vapor pressure of 1-butanamine at 4.5°C. The drum and contents were weighed again to find the weight of vapor which had been absorbed.

SOURCE AND PURITY OF MATERIALS:

The authors stated that the materials used were all purified carefully by chemical means and fractional distillation where feasible.

ESTIMATED ERROR:

REFERENCES:

1. Zellhoefer, G.F. *Ind. Eng. Chem.* 1937, *29*, 548.

COMPONENTS:

1. 2-Butanamine, (*sec*-butylamine); $C_4H_{11}N$; [13952-84-6]
2. 1,2-Ethanediol, (ethylene glycol); $C_2H_6O_2$; [107-21-1]

ORIGINAL MEASUREMENTS:

Copley, M.J.; Ginsberg, E.; Zellhoefer, G.F.; Marvel, C.S.

J. Amer. Chem. Soc.

1941, *63*, 254-256.

VARIABLES:

PREPARED BY:

P. G. T. Fogg

EXPERIMENTAL VALUES:

T/K	$P_{C_4H_{11}N}$/mmHg*	Mole fraction $x_{C_4H_{11}N}$
305.4	56.5	0.397

760 mmHg = 1 atm = 1.013 x 10^5 Pa.

* The pressure of 2-butanamine was said by the authors to correspond to its vapor pressure at 4.5°C. The authors stated that they measured the vapor pressure at several temperatures and determined the value at 4.5°C from a plot of the logarithm of the vapor pressure against (K/T).

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The absorption apparatus was developed for studies of refrigeration systems (ref. (1)) and consisted of a copper drum, 4 x 12 cm, fitted with a needle valve and two-way outlet with one outlet connected to a manometer. The drum was evacuated to a pressure of 1 mmHg and about 40 cm^3 of solvent drawn into this drum which was then reweighed and immersed in a water bath at 32.2°C. The drum was agitated and 2-butanamine vapor allowed to flow slowly into it until the final pressure corresponded to the vapor pressure of 2-butanamine at 4.5°C. The drum and contents were weighed again to find the weight of vapor which had been absorbed.

SOURCE AND PURITY OF MATERIALS:

The authors stated that the materials used were all purified carefully by chemical means and fractional distillation where feasible.

ESTIMATED ERROR:

REFERENCES:

1. Zellhoefer, G.F. *Ind. Eng. Chem.* 1937, *29*, 548.

COMPONENTS:

1. 2-Methyl-1-propanamine, (*iso*-butylamine); $C_4H_{11}N$; [78-81-9]

2. 1,2-Ethanediol, (ethylene glycol); $C_2H_6O_2$; [107-21-1]

ORIGINAL MEASUREMENTS:

Copley, M.J.; Ginsberg, E.; Zellhoefer, G.F.; Marvel, C.S.

J. Amer. Chem. Soc.

1941, *63*, 254-256.

VARIABLES:

PREPARED BY:

P. G. T. Fogg

EXPERIMENTAL VALUES:

T/K	$p_{C_4H_{11}N}$/mmHg*	Mole fraction $x_{C_4H_{11}N}$
305.4	45.4	0.381

760 mmHg = 1 atm = 1.013×10^5 Pa.

* The pressure of 2-methyl-1-propanamine was said by the authors to correspond to its vapor pressure at 4.5°C. The authors stated that they measured the vapor pressure at several temperatures and determined the value at 4.5°C from a plot of the logarithm of the vapor pressure against 1/(T/K).

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The absorption apparatus was developed for studies of refrigeration systems (ref. (1)) and consisted of a copper drum, 4 x 12 cm, fitted with a needle valve and two-way outlet with one outlet connected to a manometer. The drum was evacuated to a pressure of 1 mmHg and about 40 cm^3 of solvent drawn into this drum which was then reweighed and immersed in a water bath at 32.2°C. The drum was agitated and the amine vapor allowed to flow slowly into it until the final pressure corresponded to the vapor pressure of the amine at 4.5°C. The drum and contents were weighed again to find the weight of vapor which had been absorbed.

SOURCE AND PURITY OF MATERIALS:

The authors stated that the materials used were all purified carefully by chemical means and fractional distillation where feasible.

ESTIMATED ERROR:

REFERENCES:

1. Zellhoefer, G.F. *Ind. Eng. Chem.* 1937, *29*, 548.

COMPONENTS:	ORIGINAL MEASUREMENTS:
1. *N*-Ethylethanamine (diethylamine) $C_4H_{11}N$; [109-89-7] 2. 1,2-Ethanediol, (ethylene glycol); $C_2H_6O_2$; [107-21-1]	Copley, M.J.; Ginsberg, E.; Zellhoefer, G.F.; Marvel, C.S. *J. Amer. Chem. Soc.* 1941, *63* 254-256.
VARIABLES:	PREPARED BY: P. G. T. Fogg

EXPERIMENTAL VALUES:

T/K	$p_{C_4H_{11}N}$/mmHg*	Mole fraction $x_{C_4H_{11}N}$
305.4	88	0.371

760 mmHg = 1 atm = 1.013 x 10^5 Pa.

* The pressure of diethylamine was said by the authors to correspond to its vapor pressure at 4.5°C. The authors stated that they measured the vapor pressure at several temperatures and determined the value at 4.5°C from a plot of the logarithm of the vapor pressure against (K/T).

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The absorption apparatus was developed for studies of refrigeration systems (ref. (1)) and consisted of a copper drum, 4 x 12 cm, fitted with a needle valve and two-way outlet with one outlet connected to a manometer. The drum was evacuated to a pressure of 1 mmHg and about 40 cm^3 of solvent drawn into this drum which was then reweighed and immersed in a water bath at 32.2°C. The drum was agitated and diethylamine vapor allowed to flow slowly into it until the final pressure corresponded to the vapor pressure of diethylamine at 4.5°C. The drum and contents were weighed again to find the weight of vapor which had been absorbed.

SOURCE AND PURITY OF MATERIALS:

The authors stated that the materials used were all purified carefully by chemical means and fractional distillation where feasible.

ESTIMATED ERROR:

REFERENCES:

1. Zellhoefer, G.F. *Ind. Eng. Chem.* 1937, *29*, 548.

COMPONENTS:	ORIGINAL MEASUREMENTS:
1. *N*,*N*-Diethylethanamine, (Triethylamine); $C_6H_{16}N$; [121-44-8] 2. Nitro-methane; CH_3NO_2; [75-52-5]	Halban, H. *Z. Phys. Chem.* 1913, *84*, 129-159.
VARIABLES:	PREPARED BY:
Concentration	P. G. T. Fogg

EXPERIMENTAL VALUES:

T/K	Concentration of $C_6H_{16}N$ in solution/ mol dm^{-3}	$p_{C_6H_{16}N}$/mmHg	Concentration of $C_6H_{16}N$ in solution/ concentration in gas phase	Mole fraction in solution* $x_{C_6H_{16}N}$
298.2	0.300	13.7	408	0.0159
	0.214	9.76	407	0.0114
	0.190	8.83	400	0.0102

* Calculated by the compiler, using the density of the solvent given in ref. (1), on the assumption that dissolution of gas caused negligible change of volume of the liquid phase.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The partial pressures of triethylamine above solutions of concentrations determined by titration, were measured by a dynamic method (refs. (2) & (3)). Mixtures of hydrogen and oxygen, produced by electrolysis of sodium hydroxide solution, were passed through each solution of triethylamine. The triethylamine in the gas stream was absorbed in hydrochloric acid and estimated from changes in electrical conductivity due to partial neutralisation of the acid. The volumes of hydrogen/oxygen gas mixture produced by electrolysis were found from the barometric pressure and changes in a copper voltameter in series with the cell for producing the gas. The partial pressures of triethylamine were calculated on the assumption that equilibrium was established between triethylamine in solution and that in the gas phase, during passage of hydrogen/oxygen mixture through the solution.

SOURCE AND PURITY OF MATERIALS:

1. Hydrated chloride from Kahlbaum; reacted with KOH; gas dried with NaOH.
2. Prepared according to ref. (4); dried over potassium carbonate; b.p. 100.6°C (751 mmHg).

REFERENCES:

1. Timmermans, J. *Physico-Chemical Constants of Pure Organic Compounds* Vol. 2, Elsevier, Amsterdam. 1965
2. Gaus, *Z. Anorg. Chem.* 1900, *25*, 236.
3. Abegg, R.; Riesenfeld, H. *Z. Phys. Chem.* 1902, *40*, 84.
4. Steinkopf, W; Kirchoff, G. *Ber. Dtsch. Chem. Ges.* 1909, *42*, 3438.

COMPONENTS:

1. *N,N*-Diethylethanamine, (Triethylamine); $C_6H_{16}N$; [121-44-8]
2. Hexane; C_6H_{14}; [110-54-3]

ORIGINAL MEASUREMENTS:

Halban, H.

Z. Phys. Chem.

1913, *84*, 129-159.

VARIABLES:

Concentration

PREPARED BY:

P. G. T. Fogg

EXPERIMENTAL VALUES:

T/K	Concentration of $C_6H_{16}N$ in solution/ mol dm^{-3}	$p_{C_6H_{16}N}$/mmHg	Concentration of $C_6H_{16}N$ in solution/ concentration in gas phase	Mole fraction in solution* $x_{C_6H_{16}N}$
298.2	0.300	2.56	2175	0.0380
	0.269	2.35	2129	0.0342
	0.238	2.04	2169	0.0304

* Calculated by the compiler, using the density of the solvent given in ref. (1), on the assumption that dissolution of gas caused negligible change of volume of the liquid phase.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The partial pressures of triethylamine above solutions of concentrations determined by titration, were measured by a dynamic method (refs. (2) & (3)). Mixtures of hydrogen and oxygen, produced by electrolysis of sodium hydroxide solution, were passed through each solution of triethylamine. The triethylamine in the gas stream was absorbed in hydrochloric acid and estimated from changes in electrical conductivity due to partial neutralisation of the acid. The volumes of hydrogen/oxygen gas mixture produced by electrolysis were found from the barometric pressure and changes in a copper voltameter in series with the cell for producing the gas. The partial pressures of triethylamine were calculated on the assumption that equilibrium was established between triethylamine in solution and that in the gas phase, during passage of hydrogen/oxygen mixture through the solution.

SOURCE AND PURITY OF MATERIALS:

1. Hydrated chloride from Kahlbaum; reacted with KOH; gas dried with NaOH.
2. Kahlbaum *n-Hexan aus Propyljodid*; distilled over Na; b.p. 67.85-68.10°C (745 mmHg).

ESTIMATED ERROR:

REFERENCES:

1. Dreisbach, R.R. *Physical Properties of Chemical Compounds*, Vol. 2, A.C.S., Washington. 1959.
2. Gaus, *Z. Anorg. Chem.* 1900, *25*, 236.
3. Abegg, R.; Riesenfeld, H. *Z. Phys. Chem.* 1902, *40*, 84.

COMPONENTS:	EVALUATOR:
1. Phosphine; PH_3; [7803-51-2] 2. Organic liquids.	P. G. T. Fogg, School of Chemistry, Polytechnic of North London, Holloway, London N7 8DB United Kingdom. August 1983

CRITICAL EVALUATION:

Data obtained by Palmer *et al* (1) and by Devyatykh *et al* (2) have been discussed in detail by Gerrard (3). Mole fraction solubilities calculated from measurements by Palmer *et al.* fall into a consistent pattern with a lower solubility in hydrogen bonded solvents compared with other solvents. There is also an increase in mole fraction solubility with increase in chain length in the case of straight chain alkanes. Solubilities are in the order:

in benzene < in cyclohexene < in cyclohexane

and

in benzene < in toluene < in xylene.

The variation of solubility in nitrobenzene, with change in temperature, was measured by both Palmer *et al.* and by Devyatykh *et al.* The ratio $\text{vol.}_{PH_3}/\text{vol.}_{\text{solvent}}$ for a temperature of 295.2 K has been estimated by the compiler from data given by Devyatykh *et al.* to be 8.4. This may be compared with the value of 3.06 given by Palmer *et al.* for a pressure of 1 atm. There is a similar discrepancy between the solubility in liquid paraffin calculated from the data of Devyatykh *et al* and that measured by Palmer.

There is also a marked difference between the solubility of phosphine in didecyl phthalate calculated from data given by Devyatykh and that in dibutyl phthalate measured by Palmer. Expressed as $\text{vol.}_{PH_3}/\text{vol.}_{\text{solvent}}$ at 295.7 K the former gives 22.2 and the latter 3.23. If it could be assumed that Devyatykh's data could be extrapolated to a partial pressure of phosphine of 1 atm, the corresponding mole fraction solubility at 295.7 K for didecyl phthalate would be about 0.3 compared with the value of 0.0342 given by Palmer for dibutyl phthalate at this temperature.

Solubilities measured with conventional apparatus by Palmer *et al.* are likely to be reliable. Solubilities for a partial pressure of 1 atm calculated from distribution constants determined by gas chromatography by Devyatykh *et al.* are likely to be unreliable. They may, perhaps, be used to estimate relative solubilities in the solvents which were studied but such estimates may not be precise.

The solubility in cyclohexanol at 299.2 K was measured by Cauquil (4) using very simple apparatus. The mole fraction solubility at a partial pressure of 1 atm, calculated from the Ostwald coefficient reported by this author, is close to values for other polar solvents reported by Palmer *et al.* The value for cyclohexanol may therefore be accepted as a tentative value in the absence of other data for this solvent.

The solubility in trifluoroacetic acid was measured by Fujioka and Cady (5) who also used very simple apparatus. They calculated the Ostwald coefficient to be 15.9 from measurements at 653 mmHg and 299.2 K. This corresponds to a mole fraction solubility of 0.040 at this pressure and about 0.046 at 760 mmHg. These measurements are in sharp contrast to those of Palmer *et al.* who reported an Ostwald coefficient of 2.46 at 760 mmHg and 293.2 K for 95.3% trifluoroacetic acid and a value of 2.64 at 760 mmHg and 294.7 K for a 96.8% sample. Unfortunately the purity of the acid used by Fujioka and Cady was not stated and direct comparison of the two sets of work may not be justified.

(cont.)

COMPONENTS:	EVALUATOR:
1. Phosphine; PH_3; [7803-51-2] 2. Organic liquids.	P. G. T. Fogg, School of Chemistry, Polytechnic of North London, Holloway, London N7 8DB United Kingdom. August 1983

CRITICAL EVALUATION:

References:

1. Palmer, M. G.; Lessels, R.W.M.; Childs, A. F.; McCoubrey, J. C. Albright & Wilson (Mfg.) Ltd., Technical Note No. 60, 1963. (Quoted by Gerrard, W. *Gas Solubilities - Widespread Applications*, Pergamon Press, Oxford, 1980.)

2. Devyatykh, G. G.; Ezheleva, A. E.; Zorin, A. D.; Zueva, M. V. *Zh. Neorgan. Khim.* 1963, *8*, 1307. (*Russ. J. Inorg. Chem.* 1963, *8*, 678.)

3. Gerrard, W. *Solubility of Gases in Liquids*, Plenum Press, New York, 1976.

4. Cauquil, G. *J. Chim. Phys. Phys. Chim. Biol.* 1927, *24*, 53.

5. Fujioka, G.S.; Cady, G.H. *J. Amer. Chem. Soc.* 1957, *79*, 2451.

COMPONENTS:	ORIGINAL MEASUREMENTS:
1. Phosphine; PH_3; [7803-51-2] 2. Alkanes	Palmer, M. G.; Lessels, R. W. M.; Childs, A. F.; McCoubrey, J. C. *Albright & Wilson (Mfg.) Ltd., Technical Note No. 60*, 1963. Quoted by Gerrard, W., *"Gas Solubilities - Widespread Applications"*, 1980, Pergamon Press, Oxford.
VARIABLES:	PREPARED BY: P. G. T. Fogg

EXPERIMENTAL VALUES:

Solvent	T/K	Mole fraction x_{PH_3} (1 atm)	Ostwald Coefficient, L
Pentane; C_5H_{12}; [109-66-0]	294.65	0.0200	4.33
Hexane; C_6H_{14}; [110-54-3]	294.65	0.0354	6.79
Heptane; C_7H_{16}; [142-82-5]	294.65	0.0413	7.12
2,2,4-Trimethylpentane; C_8H_{18}; [540-84-1]	294.4	0.0400	6.19
Decane; $C_{10}H_{22}$; [124-18-5]	294.05	0.0432	5.73
Dodecane; $C_{12}H_{26}$; [112-40-3]	293.15	0.0469	5.35

Measurements were made at a total pressure equal to barometric pressure (unspecified) and solubility values were adjusted to a partial pressure of phosphine of 101.325 kPa (1 atm) using Henry's law.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Gas saturated with solvent vapor was passed into a glass absorption vessel connected to a gas burette. A measured volume of liquid was introduced into the vessel and stirred with a magnetic stirrer. A measured volume of gas was added from a gas burette to restore the total pressure in the absorption vessel to its original value which was apparently equal to barometric pressure. The procedure was repeated several times and the mean value of the solubility was taken. The apparatus was shielded from draughts and measurements made at room temperature.

In calculating the solubility of the gas, account was taken of the partial vapor pressure of the solvent and the partial pressure of hydrogen present as an impurity in the phosphine.

SOURCE AND PURITY OF MATERIALS:

1. Prepared from zinc amalgam; phosphorus and dilute phosphoric acid; contained 2.5% hydrogen as impurity; dried with conc. H_3PO_4 and with P_2O_5.
2. C_5H_{12}; C_6H_{14}; C_7H_{16}; C_8H_{18}: pure materials supplied by Esso Petroleum Ltd; $C_{10}H_{22}$; $C_{12}H_{26}$: technical grade samples purified by distillation.

ESTIMATED ERROR:

REFERENCES:

COMPONENTS: 1. Phosphine; PH_3; [7803-51-2] 2. 2,6-Dimethyl-2-heptane; C_9H_{18}; [5557-98-2]	ORIGINAL MEASUREMENTS: Palmer, M. G.; Lessels, R. W. M.; Childs, A. F.; McCoubrey, J. C. *Albright & Wilson (Mfg.) Ltd., Technical Note No. 60,* 1963. Quoted by Gerrard, W., *"Gas Solubilities - Widespread Applications"*, 1980, Pergamon Press, Oxford.
VARIABLES:	PREPARED BY: P. G. T. Fogg

EXPERIMENTAL VALUES:

T/K	Ostwald Coefficient, *L*
293.65	5.87

Measurements were made at a total pressure equal to barometric pressure (unspecified) and solubility values were adjusted to a partial pressure of phosphine of 101.325 kPa (1 atm) using Henry's law.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Gas saturated with solvent vapor was passed into a glass absorption vessel connected to a gas burette. A measured volume of liquid was introduced into the vessel and stirred with a magnetic stirrer. A measured volume of gas was added from a gas burette to restore the total pressure in the absorption vessel to its original value which was apparently equal to barometric pressure. The procedure was repeated several times and the mean value of the solubility was taken. The apparatus was shielded from draughts and measurements made at room temperature.

In calculating the solubility of the gas, account was taken of the partial vapor pressure of the solvent and the partial pressure of hydrogen present as an impurity in the phosphine.

SOURCE AND PURITY OF MATERIALS:

1. Prepared from zinc amalgam, phosphorus and dilute phosphoric acid; contained 2.5% hydrogen as impurity; dried with conc. H_3PO_4 and with P_2O_5.
2. G.P.R. grade, distilled under reduced pressure (ca. 17 mmHg), to remove dissolved gases.

ESTIMATED ERROR:

REFERENCES:

COMPONENTS:

1. Phosphine; PH_3; [7803-51-2]

2. Alicyclic compounds

ORIGINAL MEASUREMENTS:

Palmer, M. G.; Lessels, R. W. M.; Childs, A. F.; McCoubrey, J. C. *Albright & Wilson (Mfg.) Ltd., Technical Note No. 60*, 1963. Quoted by Gerrard, W., *"Gas Solubilities - Widespread Applications"*, 1980, Pergamon Press, Oxford.

VARIABLES:

PREPARED BY:

P. G. T. Fogg

EXPERIMENTAL VALUES:

Solvent	T/K	Mole fraction x_{PH_3} (1 atm)	Ostwald Coefficient, L
Cyclohexene; C_6H_{10}; [110-83-8]	294.15	0.0280	6.85
Cyclohexane; C_6H_{12}; [110-82-7]	291.65	0.0326	7.47
Undecafluoro(trifluoromethyl)-cyclohexane; C_7F_{14}; [355-02-2]	294.95		1.31
1,2,3,4-Tetrahydronaphthalene; $C_{10}H_{12}$; [119-64-2]	295.25	0.0291	5.34
2,6,6-Trimethylbicyclo[3.1.1]-hept-2-ene,(α-pinene); $C_{10}H_{16}$; [80-56-8]	292.65		19.5
Decahydronaphthalene; $C_{10}H_{18}$; [91-17-8]	295.35	0.0316	5.05

Measurements were made at a total pressure equal to barometric pressure (unspecified) and solubility values were adjusted to a partial pressure of phosphine of 101.325 kPa (1 atm) using Henry's law.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Gas saturated with solvent vapor was passed into a glass absorption vessel connected to a gas burette. A measured volume of liquid was introduced into the vessel and stirred with a magnetic stirrer. A measured volume of gas was added from a gas burette to restore the total pressure in the absorption vessel to its original value which was apparently equal to barometric pressure. The procedure was repeated several times and the mean value of the solubility was taken. The apparatus was shielded from draughts and measurements made at room temperature.

In calculating the solubility of the gas, account was taken of the partial vapor pressure of the solvent and the partial pressure of hydrogen present as an impurity in the phosphine.

SOURCE AND PURITY OF MATERIALS:

1. Prepared from zinc amalgam, phosphorus and dilute phosphoric acid; contained 2.5% hydrogen as impurity; dried with conc. H_3PO_4 and with P_2O_5.
2. Cyclohexene Technical grade, purified by distillation. Other solvents "Analar" or G.P.R. grade, distilled under reduced pressure (ca. 17 mmHg) to remove dissolved gases.

ESTIMATED ERROR:

REFERENCES:

COMPONENTS:

1. Phosphine; PH_3; [7803-51-2]
2. Aromatic compounds

ORIGINAL MEASUREMENTS:

Palmer, M. G.; Lessels, R. W. M.; Childs, A. F.; McCoubrey, J. C. *Albright & Wilson (Mfg.) Ltd., Technical Note No. 60,* 1963. Quoted by Gerrard, W., *"Gas Solubilities - Widespread Applications"*, 1980, Pergamon Press, Oxford.

VARIABLES:

PREPARED BY:

P. G. T. Fogg

EXPERIMENTAL VALUES:

Solvent	T/K	Mole fraction x_{PH_3} (1 atm)	Ostwald Coefficient, L
Benzene; C_6H_6; [71-43-2]	295.15	0.0260	7.26
Benzenamine; C_6H_7N; [62-53-3]	295.15	0.0105	2.80
Dimethylbenzene; C_8H_{10}; [1330-20-7]	294.65	0.0320	6.52
(1-Methylethyl)benzene; C_9H_{12}; [98-82-8]	294.65	0.0316	5.68
1,2-Benzenedicarboxylic acid, dibutyl ester; $C_{16}H_{22}O_4$; [119-64-2]	295.65	0.0342	3.23
Hexafluorobenzene 98.5%; C_6F_6; [392-56-3]	295.4		4.36

Measurements were made at a total pressure equal to barometric pressure (unspecified) and solubility values were adjusted to a partial pressure of phosphine of 101.325 kPa (1 atm) using Henry's law.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Gas saturated with solvent vapor was passed into a glass absorption vessel connected to a gas burette. A measured volume of liquid was introduced into the vessel and stirred with a magnetic stirrer. A measured volume of gas was added from a gas burette to restore the total pressure in the absorption vessel to its original value which was apparently equal to barometric pressure. The procedure was repeated several times and the mean value of the solubility was taken. The apparatus was shielded from draughts and measurements made at room temperature.

In calculating the solubility of the gas, account was taken of the partial vapor pressure of the solvent and the partial pressure of hydrogen present as an impurity in the phosphine.

SOURCE AND PURITY OF MATERIALS:

1. Prepared from zinc amalgam, phosphorus and dilute phosphoric acid; contained 2.5% hydrogen as impurity; dried with conc. H_3PO_4 and with P_2O_5.
2. C_6H_6; C_6H_7N; C_8H_{10}: "Analar" or G.P.R. grade; distilled under reduced pressure (ca. 17 mmHg) to remove dissolved gases; C_9H_{12}; $C_{16}H_{22}O_4$: technical grade, purified by distillation.

ESTIMATED ERROR:

REFERENCES:

COMPONENTS:

1. Phosphine; PH_3; [7803-51-2]
2. Methylbenzene; C_7H_8; [108-88-3]

ORIGINAL MEASUREMENTS:

Palmer, M. G.; Lessels, R. W. M.; Childs, A. F.; McCoubrey, J. C. *Albright & Wilson (Mfg.) Ltd., Technical Note No. 60*, 1963. Quoted by Gerrard, W., "*Gas Solubilities - Widespread Applications*", 1980, Pergamon Press, Oxford.

VARIABLES:

PREPARED BY:

P. G. T. Fogg

EXPERIMENTAL VALUES:

T/K	Mole fraction x_{PH_3} (1 atm)	Ostwald Coefficient, L
293.85	0.0290	-
295.15	0.0304	7.15
313.4	0.0194	-
334.95	0.0129	-

Measurements were made at a total pressure equal to barometric pressure (unspecified) and solubility values were adjusted to a partial pressure of phosphine of 101.325 kPa (1 atm) using Henry's law.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Gas saturated with solvent vapor was passed into a glass absorption vessel connected to a gas burette. A measured volume of liquid was introduced into the vessel and stirred with a magnetic stirrer. A measured volume of gas was added from a gas burette to restore the total pressure in the absorption vessel to its original value which was apparently equal to barometric pressure. The procedure was repeated several times and the mean value of the solubility was taken. The apparatus was shielded from draughts for measurements at room temperature (293.85 K). Temperatures were thermostatically controlled for other measurements.

In calculating the solubility of the gas, account was taken of the partial vapor pressure of the solvent and the partial pressure of hydrogen present as an impurity in the phosphine.

SOURCE AND PURITY OF MATERIALS:

1. Prepared from zinc amalgam, phosphorus and dilute phosphoric acid; contained 2.5% hydrogen as impurity; dried with conc. H_3PO_4 and with P_2O_5.

ESTIMATED ERROR:

REFERENCES:

COMPONENTS:

1. Phosphine; PH_3; [7803-51-2]
2. Cyclohexanol; $C_6H_{12}O$; [108-93-0]

ORIGINAL MEASUREMENTS:

Cauquil, G.

J. Chim. Phys. Phys. Chim. Biol. 1927, *24*, 53-55.

VARIABLES:

PREPARED BY:

P. G. T. Fogg

EXPERIMENTAL VALUES:

T/K	p_{PH_3}/mmHg	Ostwald Coefficient, L	Mole fraction* x_{PH_3} (1 atm.)
299.2	766	2.856	0.01226

760 mmHg = 1 atm = 1.013×10^5 Pa.

* Value of x_{PH_3} (1 atm) has been calculated by the compiler using densities of cyclohexanol at 293.2 K and 303.2 K given in refs. (1) and (2), respectively, and values of van der Waals constants for phosphine given in ref. (1).

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

A measured volume of cyclohexanol was put into contact with a measured volume of phosphine in a graduated tube over mercury. The final volume of gas and the temperature and pressure were measured when equilibrium had been reached. The author considered that no allowance for the vapor pressure of cyclohexanol at the temperature of measurement was necessary.

SOURCE AND PURITY OF MATERIALS:

2. All dissolved air was removed by boiling; b.p. 334.1 K (766 mmHg).

ESTIMATED ERROR:

REFERENCES:

1. *Handbook of Chemistry and Physics*, (61st edition), C.R.C. Press, Cleveland, Ohio, 1980.
2. Timmermans, J. *Physico-Chemical Constants of Pure Organic Compounds*, Vol. II, Elsevier, London, 1965.

COMPONENTS:

1. Phosphine; PH_3; [7803-51-2]
2. Petroleum ethers and liquid paraffin

ORIGINAL MEASUREMENTS:

Palmer, M. G.; Lessels, R. W. M.; Childs, A. F.; McCoubrey, J. C. *Albright & Wilson (Mfg.) Ltd., Technical Note No. 60,* 1963. Quoted by Gerrard, W., *"Gas Solubilities - Widespread Applications"*, 1980, Pergamon Press, Oxford.

VARIABLES:

PREPARED BY:

P. G. T. Fogg

EXPERIMENTAL VALUES:

Solvent	T/K	Ostwald Coefficient, *L*
Liquid paraffin	292.35	4.86
40/60 Petroleum ether	292.15	4.36
60/80 " "	292.15	8.02
80/100 " "	296.15	6.42
100/120 " "	295.65	6.15
120/160 " "	293.9	6.14

Measurements were made at a total pressure equal to barometric pressure (unspecified) and solubility values were adjusted to a partial pressure of phosphine of 101.325 kPa (1 atm) using Henry's law.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Gas saturated with solvent vapor was passed into a glass absorption vessel connected to a gas burette. A measured volume of liquid was introduced into the vessel and stirred with a magnetic stirrer. A measured volume of gas was added from a gas burette to restore the total pressure in the absorption vessel to its original value which was apparently equal to barometric pressure. The procedure was repeated several times and the mean value of the solubility was taken. The apparatus was shielded from draughts and measurements made at room temperature.

In calculating the solubility of the gas, account was taken of the partial vapor pressure of the solvent and the partial pressure of hydrogen present as an impurity in the phosphine.

SOURCE AND PURITY OF MATERIALS:

1. Prepared from zinc amalgam, phosphorus and dilute phosphoric acid; contained 2.5% hydrogen as impurity; dried with conc. H_3PO_4 and with P_2O_5.
2. Solvents were "Analar" or G.P.R. grade; distilled under reduced pressure (ca. 17 mmHg) to remove dissolved gases.

ESTIMATED ERROR:

REFERENCES:

COMPONENTS:

1. Phosphine; PH_3; [7803-51-2]
2. Aliphatic compounds containing oxygen.

ORIGINAL MEASUREMENTS:

Palmer, M. G.; Lessels, R. W. M.; Childs, A. F.; McCoubrey, J. C. *Albright & Wilson (Mfg.) Ltd., Technical Note No. 60*, 1963.
Quoted by Gerrard, W., *"Gas Solubilities - Widespread Applications"*, 1980, Pergamon Press, Oxford.

VARIABLES:

PREPARED BY:

P. G. T. Fogg

EXPERIMENTAL VALUES:

Solvent	T/K	Mole fraction x_{PH_3} (1 atm)	Ostwald Coefficient, L
Trifluoroacetic acid 95.3%; C_2HF_3O; [76-05-1]	293.15		2.46
Trifluoroacetic acid 96.8%; C_2HF_3O; [76-05-1]	294.65		2.64
Acetic acid; $C_2H_4O_2$; [64-19-7]	294.15	0.0075	3.19
1,2-Ethanediol; $C_2H_6O_2$; [107-21-1]	292.35	0.0033	1.45
2-Propanone; C_3H_6O; [67-64-1]	295.55	0.0132	4.45
1,2-Epoxypropene*; C_3H_6O; [75-56-9]	295.95	0.0088	3.06
Nitropropane*; $C_3H_7NO_2$; [25322-01-4]	294.4	0.0157	4.26
3-oxo-butanoic acid, ethyl ester*; $C_6H_{10}O_3$; [141-97-9]	294.95	0.0114	2.23

Measurements were made at a total pressure equal to barometric pressure (unspecified) and solubility values were adjusted to a partial pressure of phosphine of 101.325 kPa (1 atm) using Henry's law.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Gas saturated with solvent vapor was passed into a glass absorption vessel connected to a gas burette. A measured volume of liquid was introduced into the vessel and stirred with a magnetic stirrer. A measured volume of gas was added from a gas burette to restore the total pressure in the absorption vessel to its original value which was apparently equal to barometric pressure. The procedure was repeated several times and the mean value of the solubility was taken. The apparatus was shielded from draughts and measurements made at room temperature.

In calculating the solubility of the gas, account was taken of the partial vapor pressure of the solvent and the partial pressure of hydrogen present as an impurity in the phosphine.

SOURCE AND PURITY OF MATERIALS:

1. Prepared from zinc amalgam, phosphorus and dilute phosphoric acid; contained 2.5% hydrogen as impurity; dried with conc. H_3PO_4 and with P_2O_5.
2. Compounds marked with * were technical grade and purified by distillation. Other solvents were "Analar" or G.P.R. grade distilled under reduced pressure (ca. 17 mmHg) to remove dissolved gases.

ESTIMATED ERROR:

REFERENCES:

COMPONENTS:

1. Phosphine; PH_3; [7803-51-2]
2. Tetrahydrofuran; C_4H_8O; [109-99-9]

ORIGINAL MEASUREMENTS:

Palmer, M. G.; Lessels, R. W. M.; Childs, A. F.; McCoubrey, J. C. *Albright & Wilson (Mfg.) Ltd., Technical Note No. 60,* 1963.
Quoted by Gerrard, W., *"Gas Solubilities - Widespread Applications"*, 1980, Pergamon Press, Oxford.

VARIABLES:

PREPARED BY:

P. G. T. Fogg

EXPERIMENTAL VALUES:

T/K	Mole fraction x_{PH_3} (1 atm)	Ostwald Coefficient, L
295.15	0.0245	7.49

Measurements were made at a total pressure equal to barometric pressure (unspecified) and solubility values were adjusted to a partial pressure of phosphine of 101.325 kPa (1 atm) using Henry's law.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Gas saturated with solvent vapor was passed into a glass absorption vessel connected to a gas burette. A measured volume of liquid was introduced into the vessel and stirred with a magnetic stirrer. A measured volume of gas was added from a gas burette to restore the total pressure in the absorption vessel to its original value which was apparently equal to barometric pressure. The procedure was repeated several times and the mean value of the solubility was taken. The apparatus was shielded from draughts and measurements made at room temperature.

In calculating the solubility of the gas, account was taken of the partial vapor pressure of the solvent and the partial pressure of hydrogen present as an impurity in the phosphine.

SOURCE AND PURITY OF MATERIALS:

1. Prepared from zinc amalgam, phosphorus and dilute phosphoric acid; contained 2.5% hydrogen as impurity; dried with conc. H_3PO_4 and with P_2O_5.
2. "Analar" or G.P.R. grade, distilled under reduced pressure (ca. 17 mmHg) to remove dissolved gases.

ESTIMATED ERROR:

REFERENCES:

COMPONENTS: 1. Phosphine; PH_3; [7803-51-2] 2. Nitrobenzene; $C_6H_5NO_2$; [98-95-3]	ORIGINAL MEASUREMENTS: Palmer, M. G.; Lessels, R. W. M.; Childs, A. F.; McCoubrey, J. C. *Albright & Wilson (Mfg.) Ltd., Technical Note No. 60*, 1963. Quoted by Gerrard, W., "*Gas Solubilities - Widespread Applications*", 1980, Pergamon Press, Oxford.
VARIABLES:	PREPARED BY: P. G. T. Fogg

EXPERIMENTAL VALUES:

T/K	Mole fraction x_{PH_3} (1 atm)	Ostwald Coefficient, L
293.65	0.0139	-
295.65	0.0127	3.06
313.25	0.0100	-

Measurements were made at a total pressure equal to barometric pressure (unspecified) and solubility values were adjusted to a partial pressure of phosphine of 101.325 kPa (1 atm) using Henry's law.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Gas saturated with solvent vapor was passed into a glass absorption vessel connected to a gas burette. A measured volume of liquid was introduced into the vessel and stirred with a magnetic stirrer. A measured volume of gas was added from a gas burette to restore the total pressure in the absorption vessel to its original value which was apparently equal to barometric pressure. The procedure was repeated several times and the mean value of the solubility was taken. The apparatus was shielded from draughts for measurements at room temperature (293.65 K). Temperatures were thermostatically controlled for other measurements.

In calculating the solubility of the gas, account was taken of the partial vapor pressure of the solvent and the partial pressure of hydrogen present as an impurity in the phosphine.

SOURCE AND PURITY OF MATERIALS:

1. Prepared from zinc amalgam, phosphorus and dilute phosphoric acid; contained 2.5% hydrogen as impurity; dried with conc. H_3PO_4 and with P_2O_5.

ESTIMATED ERROR:

REFERENCES:

COMPONENTS: 1. Phosphine; PH_3; [7803-51-2] 2. Dinonylamine, (*N*-nonyl-1-nonanamine); $C_{18}H_{39}N$; [2044-21-5]	ORIGINAL MEASUREMENTS: Palmer, M. G.; Lessels, R. W. M.; Childs, A. F.; McCoubrey, J. C. *Albright & Wilson (Mfg.) Ltd., Technical Note No. 60*, 1963. Quoted by Gerrard, W., *"Gas Solubilities - Widespread Applications"* 1980, Pergamon Press, Oxford.
VARIABLES:	PREPARED BY: P. G. T. Fogg

EXPERIMENTAL VALUES:

T/K	Mole fraction x_{PH_3} (1 atm)	Ostwald Coefficient, L
294.4	0.0593	4.55

Measurements were made at a total pressure equal to barometric pressure (unspecified) and solubility values were adjusted to a partial pressure of phosphine of 101.325 kPa (1 atm) using Henry's law.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Gas saturated with solvent vapor was passed into a glass absorption vessel connected to a gas burette. A measured volume of liquid was introduced into the vessel and stirred with a magnetic stirrer. A measured volume of gas was added from a gas burette to restore the total pressure in the absorption vessel to its original value which was apparently equal to barometric pressure. The procedure was repeated several times and the mean value of the solubility was taken. The apparatus was shielded from draughts and measurements made at room temperature.

In calculating the solubility of the gas, account was taken of the partial vapor pressure of the solvent and the partial pressure of hydrogen present as an impurity in the phosphine.

SOURCE AND PURITY OF MATERIALS:

1. Prepared from zinc amalgam, phosphorus and dilute phosphoric acid; contained 2.5% hydrogen as impurity; dried with conc. H_3PO_4 and with P_2O_5.
2. Technical grade purified by distillation.

ESTIMATED ERROR:

REFERENCES:

COMPONENTS:

1. Phosphine; PH_3; [7803-51-2]
2. Tetrachloromethane; CCl_4; [56-23-5]
   or
   1,2-Dichloroethane; $C_2H_4Cl_2$; [107-06-2]

ORIGINAL MEASUREMENTS:

Palmer, M. G.; Lessels, R. W. M.; Childs, A. F.; McCoubrey, J. C. *Albright & Wilson (Mfg.) Ltd., Technical Note No. 60*, 1963. Quoted by Gerrard, W., *"Gas Solubilities - Widespread Applications"* 1980, Pergamon Press, Oxford.

VARIABLES:

PREPARED BY:

P. G. T. Fogg

EXPERIMENTAL VALUES:

Solvent	T/K	Mole fraction x_{PH_3} (1 atm)	Ostwald Coefficient, L
Tetrachloromethane	293.65	0.0165	4.19
1,2-Dichloroethane	294.4	0.0176	5.48

Measurements were made at a total pressure equal to barometric pressure (unspecified) and solubility values were adjusted to a partial pressure of phosphine of 101.325 kPa (1 atm) using Henry's law.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Gas saturated with solvent vapor was passed into a glass absorption vessel connected to a gas burette. A measured volume of liquid was introduced into the vessel and stirred with a magnetic stirrer. A measured volume of gas was added from a gas burette to restore the total pressure in the absorption vessel to its original value which was apparently equal to barometric pressure. The procedure was repeated several times and the mean value of the solubility was taken. The apparatus was shielded from draughts and measurements made at room temperature.

In calculating the solubility of the gas, account was taken of the partial vapor pressure of the solvent and the partial pressure of hydrogen present as an impurity in the phosphine.

SOURCE AND PURITY OF MATERIALS:

1. Prepared from zinc amalgam, phosphorus and dilute phosphoric acid; contained 2.5% hydrogen as impurity; dried with conc. H_3PO_4 and with P_2O_5.
2. Solvents were "Analar" or G.P.R. grade; distilled under reduced pressure (ca. 17 mmHg) to remove dissolved gases.

ESTIMATED ERROR:

REFERENCES:

COMPONENTS:

1. Phosphine; PH_3; [7803-51-2]
2. Carbon disulfide; CS_2; [75-15-0]

ORIGINAL MEASUREMENTS:

Palmer, M. G.; Lessels, R. W. M.; Childs, A. F.; McCoubrey, J. C. *Albright & Wilson (Mfg.) Ltd., Technical Note No. 60*, 1963. Quoted by Gerrard, W., *"Gas Solubilities - Widespread Applications"*, 1980, Pergamon Press, Oxford.

VARIABLES:

PREPARED BY:

P. G. T. Fogg

EXPERIMENTAL VALUES:

T/K	Mole fraction x_{PH_3} (1 atm)	Ostwald Coefficient, L
294.15	0.0250	10.25

Measurements were made at a total pressure equal to barometric pressure (unspecified) and solubility values were adjusted to a partial pressure of phosphine of 101.325 kPa (1 atm) using Henry's law.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Gas saturated with solvent vapor was passed into a glass absorption vessel connected to a gas burette. A measured volume of liquid was introduced into the vessel and stirred with a magnetic stirrer. A measured volume of gas was added from a gas burette to restore the total pressure in the absorption vessel to its original value which was apparently equal to barometric pressure. The procedure was repeated several times and the mean value of the solubility was taken. The apparatus was shielded from draughts and measurements made at room temperature.

In calculating the solubility of the gas, account was taken of the partial vapor pressure of the solvent and the partial pressure of hydrogen present as an impurity in the phosphine.

SOURCE AND PURITY OF MATERIALS:

1. Prepared from zinc amalgam, phosphorus and dilute phosphoric acid; contained 2.5% hydrogen as impurity; dried with conc. H_3PO_4 and with P_2O_5.
2. No details given.

ESTIMATED ERROR:

REFERENCES:

COMPONENTS:

1. Phosphine; PH_3; [7803-51-2]
2. Various Liquids.

ORIGINAL MEASUREMENTS:

Devyatykh, G.G.; Ezheleva, A.E.; Zorin, A.D.; Zueva, M.V.

Russ. J. Inorg. Chem. 1963, *8*, 678-682.

VARIABLES:

Temperature

PREPARED BY:

P.G.T. Fogg.

EXPERIMENTAL VALUES:

Solvent	Distribution constant $vol_{PH_3}/vol_{solvent}$	Heat of solution /kcal mol^{-1}
2-Furancarboxaldehyde, $C_5H_4O_2$; [98-01-1]	11.8	-3.4
1,2-Benzenedicarboxylic acid, didecyl ester, $C_{28}H_{46}O_4$; [84-77-5]	23.5	-4.0
Triethoxysilane, $C_6H_{16}O_3Si$; [998-30-1]	12.2	-5.4
Silicic acid, tetraethyl ester, $C_8H_{20}O_4Si$; [78-10-4]	12.45	-5.0
Silicone 702-DF	15.3	-3.6
Silicone VKZh-94B	25.3	-6.0

Temperature = 293.2 K.

Distribution constants were measured between 278.2 K and 323.2 K. The partial pressures of phosphine at which these measurements were made were not stated. The total pressure of phosphine and carrier gas was about 760 mmHg. in each case. Distribution constants were reported at one

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

A chromatographic method was used. Temperatures were controlled to ±0.5K. The support phase consisted of Nichrome spirals. The carrier gas was either nitrogen or hydrogen. The volume, V_l, of the liquid phase was calculated from the weight of the column before and after filling with liquid and allowing to drain. The free volume, V_g, was equated with the retention volume for hydrogen gas. The distribution constant, K, was calculated from the James and Martin equation.

$$V_R = V_g + KV_l$$

where V_R is the retention volume for phosphine.

SOURCE AND PURITY OF MATERIALS:

1. Prepared from phosphorus and aqueous alkali; purified by vacuum distillation; no impurities detected by chromatography.

H_2 & N_2: passed through activated carbon and through molecular sieve.

ESTIMATED ERROR:

REFERENCES:

COMPONENTS:

1. Phosphine; PH_3; [7803-51-2]
2. Various liquids

ORIGINAL MEASUREMENTS:

Devyatykh, G.G.; Ezheleva, A.E.; Zorin, A.D.; Zueva, M.V.

Russ. J. Inorg. Chem. 1963, *8*, 678-682.

EXPERIMENTAL VALUES:

temperature only but heats of solution, said to have been calculated from the variation of distribution constants with temperature, were given.

If it is assumed that distribution constants vary with temperature according to equations of the form :

$$\ln K = (-\Delta H/RT) + A$$

where K is the distribution constant for a temperature T, ΔH is the heat of solution of phosphine in the solvent and A is a constant for the solvent, then distribution constants at any temperature in the range 278.2 K to 323.2 K may be estimated from a value at 293.2 K and the corresponding value of the heat of solution. The equation for K may be written in the form :

$$K = \exp\,[A + (B/T)]$$

The following values of A and B have been calculated by the compiler:

Solvent	A	B/K
2-Furancarboxaldehyde	-3.371	1712
1,2-Benzenedicarboxylic acid, didecyl ester	-3.712	2014
Triethoxysilane	-6.772	2719
Silicic acid, tetraethyl ester	-6.065	2518
Silicone 702-DF	-3.455	1813
Silicone VKZh-94B	-7.073	3021

In the opinion of the compiler these distribution constants cannot be equated with Ostwald coefficients unless the assumption is made that equilibrium was established between gas and liquid phases under the conditions of the experiment.

In addition, possible adsorption of phosphine at the stationary phase-carrier gas interface may have lowered the accuracy of the results.

COMPONENTS:

1. Phosphine; PH_3; [7803-51-2]
2. Various liquids

ORIGINAL MEASUREMENTS:

Devyatykh, G.G.; Ezheleva, A.E. Zorin, A.D.; Zueva, M.V.

Russ. J. Inorg. Chem. 1963, *8*, 678-682.

VARIABLES:

Temperature, pressure

PREPARED BY:

P.G.T. Fogg.

EXPERIMENTAL VALUES:

Solvent	Pressure range /mmHg	Distribution constant $vol_{PH_3}/vol_{solvent}$	Heat of solution /kcal mol^{-1}
2-Ethoxyethanol, $C_4H_{10}O_2$; [110-80-5]	0.3-25.0	9.4	-0.95
1,1´-oxybis [2-chloroethane]; $C_4H_8Cl_2O$; [111-44-4]	0.05-19.0	20.0	-2.2
Nitrobenzene, $C_6H_5NO_2$; [98-95-3]	0.02-18.0	8.59	-1.56
Liquid paraffin	0.1 -43.0	15.9	-3.0
Silicone PFMS-4F	0.03-23.0	16.5	-2.3

Temperature = 293.2K 760 mmHg = 1 atm = 1.013×10^5 Pa.

Distribution constants were measured between 278.2 K and 323.2 K over a range of partial pressures of phosphine and a total pressure of about 760 mmHg. At a fixed temperature the distribution constants did not depart from the mean values by more than ±3%. These mean values were reported at one temperature only but heats of solution, said to have been calculated from the variation of distribution constants with temperature, were given. If it is assumed that distribution constants vary with temperature according to equations of the form :

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

A chromatographic method was used. Temperatures were controlled to ± 0.5 K. The support phase consisted of Nichrome spirals. The carrier gas was either nitrogen or hydrogen. The volume, V_l , of the liquid phase was calculated from the weight of the column before and after filling with liquid and allowing to drain. The free volume, V_g, was equated with the retention volume for hydrogen gas. The distribution constant, *K*, was calculated from the James and Martin equation.

$$V_R = V_g + KV_l$$

where V_R is the retention volume for phosphine.

SOURCE AND PURITY OF MATERIALS:

1. Prepared from phosphorus and aqueous alkali; purified by vacuum distillation; no impurities detected by chromatography.

   H_2 and N_2: passed through activated carbon and through molecular sieve.

ESTIMATED ERROR:

REFERENCES:

COMPONENTS:

1. Phosphine; PH_3; [7803-51-2]
2. Various liquids.

ORIGINAL MEASUREMENTS:

Devyatykh, G.G.; Ezheleva, A.E.
Zorin, A.D.; Zueva, M.V.

Russ, J. Inorg. Chem. 1963, *8*,
678-682.

EXPERIMENTAL VALUES:

$$\ln K = (-\Delta H/RT) + A$$

where K is the distribution constant for a temperature T, ΔH is the heat of solution of phosphine in the solvent and A is a constant for the solvent, then distribution constants at any temperature in the range 278.2 K to 323.2 K may be estimated from a value at 293.2K and the corresponding value of the heat of solution. The equation for K may be written in the form:

$$K = \exp\,[A + (B/T)]$$

The following values of A and B have been calculated by the compiler:

Solvent	A	B/K
2-Ethoxyethanol	0.609	478
1,1´-oxybis [2-chloroethane]	-0.782	1108
Nitrobenzene	-0.528	785
Liquid paraffin	-2.386	1511
Silicone PFMS-4F	-1.147	1158

In the opinion of the compiler these distribution constants cannot be equated with Ostwald coefficients unless the assumption is made that equilibrium was established between gas and liquid phases under the conditions of the experiment.

In addition,possible adsorption of phosphine at the stationary phase-carrier gas interface may have lowered the accurary of the results.

COMPONENTS: 1. Phosphine; PH_3; [7803-51-2] 2. Carbon disulfide; CS_2; [75-15-0] 3. Phosphorus; P_4; [7723-14-0]	ORIGINAL MEASUREMENTS: Palmer, M. G.; Lessels, R. W. M.; Childs, A. F.; McCoubrey, J. C. *Albright & Wilson (Mfg.) Ltd., Technical Note No. 60*, 1963. Quoted by Gerrard, W., *"Gas Solubilities - Widespread Applications"*, 1980, Pergamon Press, Oxford.
VARIABLES:	PREPARED BY: P. G. T. Fogg

EXPERIMENTAL VALUES:

T/K	Percentage by weight of CS_2	Percentage by weight of P_4	Ostwald Coefficient, L
294.15	88.69	11.31	6.25

Measurements were made at a total pressure equal to barometric pressure (unspecified) and solubility values were adjusted to a partial pressure of phosphine of 101.325 kPa (1 atm) using Henry's law.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE: Gas saturated with solvent vapor was passed into a glass absorption vessel connected to a gas burette. A measured volume of liquid was introduced into the vessel and stirred with a magnetic stirrer. A measured volume of gas was added from a gas burette to restore the total pressure in the absorption vessel to its original value which was apparently equal to barometric pressure. The procedure was repeated several times and the mean value of the solubility was taken. The apparatus was shielded from draughts and measurements made at room temperature. In calculating the solubility of the gas, account was taken of the partial vapor pressure of the solvent and the partial pressure of hydrogen present as an impurity in the phosphine.	SOURCE AND PURITY OF MATERIALS: 1. Prepared from zinc amalgam, phosphorus and dilute phosphoric acid; contained 2.5% hydrogen as impurity; dried with conc. H_3PO_4 and with P_2O_5. ESTIMATED ERROR: REFERENCES:

COMPONENTS:

1. Phosphine; PH_3; [7803-51-2]
2. Trifluoroacetic acid; $C_2HF_3O_2$; [76-05-1]

ORIGINAL MEASUREMENTS:

Fujioka, G. S.; Cady, G. H.
J. Amer. Chem. Soc.
1957, *79*, 2451-2454.

VARIABLES:

PREPARED BY:

P. G. T. Fogg

EXPERIMENTAL VALUES:

T/K	p_{PH_3}/mmHg	Ostwald Coefficient L	Mole fraction* x_{PH_3}
299.2	653	15.9	0.040

760 mmHg = 1 atm
1 atm = 1.013×10^5 Pa

* Calculated by the compiler using the density of trifluoroacetic acid at 25°C given in ref. (1).

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

This solubility measurement was carried out during investigations of inorganic reactions in anhydrous trifluoroacetic acid. Phosphine was confined over mercury in a gas measuring tube and a measured sample of trifluoroacetic acid was added above the mercury by a hypodermic syringe. The apparatus was shaken for several hours until the new volume of gas was constant. The amount of gas absorbed was calculated from the change in volume of the gas phase. In the calculation of the partial pressure of phosphine the total pressure was corrected to allow for the partial pressure of trifluoroacetic acid but details of the correction were not given.

SOURCE AND PURITY OF MATERIALS:

1. No details given.
2. Supplied by Minnesota Mining and Manufacturing Co. and used without further purification.

ESTIMATED ERROR:

REFERENCES:

1. *Encyclopedia of Chemical Technology*, 3rd ed. Vol. 10, Wiley, New York, 1980.

COMPONENTS:	EVALUATOR:
1. Arsine; AsH_3; [7784-42-1] 2. Organic liquids	P. G. T. Fogg, School of Chemistry, Polytechnic of North London, Holloway, London, N7 8DB, UNITED KINGDOM. August 1983

CRITICAL EVALUATION:

The data published by Devyatykh *et al.* (1) and those published by Corriez and Berton (2) have been discussed in detail by Gerrard (3). The data of Devyatykh *et al.* (1) were determined using a gas chromatographic technique. The solubility refers to that at a very low pressure of arsine and it is unlikely that extrapolation to one atmosphere pressure is valid. In addition, possible adsorption at the stationary phase-carrier gas interface could have occurred and the results should be viewed with caution. It is unwise to use the data given by Devyatykh to predict gas solubilities at 1 atmosphere pressure. The data may, perhaps, be used to estimate relative solubilities in the solvents which were studied but such estimates may not be very percise.

Solubilities measured by Corriez and Berton are consistent with the properties of the solvents which were studied and may be accepted as provisional values.

References

1. Devyatykh, G. G.; Ezheleva, A. E.; Zorin, A. D.; Zueva, M. V.
Zh. Neorgan. Khim. 1963, *8*, 1307 (*Russ. J. Inorg. Chem.* 1963, *8*, 678).

2. Corriez, P.; Berton, A.
Bull. Soc. Chim. France 1950, 43.

3. Gerrard, W.
Gas Solubilities – Widespread Applications, Pergamon Press, Oxford, 1980.

COMPONENTS:

1. Arsine; AsH_3; [7784-42-1]
2. Hydrogen cyanide and aliphatic nitriles.

ORIGINAL MEASUREMENTS:

Corriez, P.; Berton, A.
Bull. Soc. Chim. France
1950, 43-45.

VARIABLES:

PREPARED BY:

P. G. T. Fogg

EXPERIMENTAL VALUES:

Solvent	T/K	Bunsen coefficient α	Mole fraction* x_{AsH_3} (1 atm)
Hydrocyanic acid; HCN; [74-90-8]	287.2	0.7	0.0012
Acetonitrile; C_2H_3N; [75-05-8]	287.2	5.3	0.0122
Propanenitrile (propionitrile); C_3H_5N; [107-12-0]	287.2	7.9	0.0242
Butanenitrile (butyronitrile); C_4H_7N; [109-74-0]	287.2	8.0	0.0302

* Calculated by compiler using the density of arsine given in ref. (1) and the densities of solvents given in refs. (2) and (3).

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The initial volume of gas was measured over mercury in a gas burette at the barometric pressure. This volume was adjusted to 0 °C and 1 atm by the relation PV = RT. Gas was passed into an absorption pipette containing a known volume of liquid S. The final volume of gas was measured at the barometric pressure, p_{total}. The final pressure of arsine, p_{AsH_3}, was taken to be p_{total} minus vapor pressure of pure solvent. The final volume of gas was adjusted from p_{AsH_3} to 1 atm and 0 °C. The Bunsen absorption coefficient, α, was the difference between the initial and final adjusted volumes divided by the volume of solvent.

SOURCE AND PURITY OF MATERIALS:

No information given.

REFERENCES:

1. Mellor, J.W., *Comprehensive Treatise on Inorganic & Theoretical Chemistry*, Vol. IX, Longmans, London. 1929.
2. Timmermans, J., *Physico-Chemical Constants of Pure Organic Compounds* Vol. 1, Elsevier , Amsterdam. 1950.
3. Timmermans, J., *Physico-Chemical Constants of Pure Organic Compounds* Vol. 2, 1965.

COMPONENTS:	ORIGINAL MEASUREMENTS:
1. Arsine; AsH_3; [7784-42-1] 2. Various liquids	Devyatykh, G.G.; Ezheleva, A.E.; Zorin, A.D.; Zueva, M.V. *Russ. J. Inorg. Chem.* 1963, *8*, 678-682.
VARIABLES:	PREPARED BY:
Temperature, pressure	P.G.T. Fogg

EXPERIMENTAL VALUES:

Solvent	Pressure range /mmHg	Distribution constant $vol_{AsH_3}/vol_{solvent}$	Heat of solution /kcal mol^{-1}
2-Ethoxyethanol, $C_4H_{10}O_2$; [110-80-5]	0.2 - 23.4	16.5	-0.98
1,1´-oxybis [2-chloroethane], $C_4H_8Cl_2O$; [111-44-4]	0.05- 13.4	22.4	-2.5
Nitrobenzene, $C_6H_5NO_2$; [98-95-3]	0.01- 17.0	11.72	-1.80
Liquid paraffin	0.2 - 26.5	22.7	-3.5
Silicone PFMS-4F	0.02- 17.5	31.4	-3.2

Temperature = 293.2 K 760 mmHg = 1 atm = 1.013×10^5Pa.

Distribution constants were measured between 278.2 K and 323.2 K over a range of partial pressures of arsine and a total pressure of about 760 mmHg. At a fixed temperature the distribution constants did not depart from the mean values by more than ±3%. These mean values were reported at one temperature only but heats of solution, said to have been calculated from the variation of distribution constants with temperature, were given. If it is assumed that distribution constants vary with temperature according to equations of the form :

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

A chromatographic method was used. Temperatures were controlled to ± 0.5K. The support phase consisted of Nichrome spirals. The carrier gas was either nitrogen or hydrogen. The volume, V_l, of the liquid phase was calculated from the weight of the column before and after filling with liquid and allowing to drain. The free volume, V_g, was equated with the retention volume for hydrogen gas. The distribution constant, *K*, was calculated from the James and Martin equation:

$$V_R = V_g + KV_l$$

where V_R is the retention volume for arsine.

SOURCE AND PURITY OF MATERIALS:

1. Prepared by reaction between Zn_3As_2 and aqueous acid; purified by vacuum distillation; no impurities detected by chromatography.

   H_2 & N_2 : passed through activated carbon and through molecular sieve.

ESTIMATED ERROR:

REFERENCES:

COMPONENTS:

1. Arsine; AsH ; [7784-42-1]
2. Various liquids

ORIGINAL MEASUREMENTS:

Devyatykh, G.G.; Ezheleva, A.E.; Zorin, A.D.; Zueva, M.V.

Russ, J. Inorg. Chem. 1963, *8*, 678-682.

EXPERIMENTAL VALUES:

$$\ln K = (-\Delta H/RT) + A$$

where K is the distribution constant for a temperature T,ΔH is the heat of solution of arsine in the solvent and A is a constant for the solvent, then distribution constants at any temperature in the range 278.2 K to 323.2 K may be estimated from a value at 293.2 K and the corresponding value of the heat of solution. The equation for K may be written in the form.

$$K = \exp\,[A + (B/T)]$$

The following values of A and B have been calculated by the compiler:

Solvent	A	B/K
2-Ethoxyethanol	1.120	493
1,1´-oxybis [2-chloroethane]	-1.184	1259
Nitrobenzene	-0.630	906
Liquid paraffin	-2.888	1762
Silicone PFMS-4F	-2.049	1611

In the opinion of the compiler these distribution constants cannot be equated with Ostwald coefficients unless the assumption is made that equilibrium was established between gas and liquid phases under the conditions of the experiment.

In addition,possible adsorption of arsine at the stationary phase-carrier gas interface may have lowered the accuracy of the results.

COMPONENTS:

1. Arsine, AsH_3; [7784-42-1]
2. Various liquids

ORIGINAL MEASUREMENTS:

Devyatykh, G.G.; Ezheleva, A.E.; Zorin, A.D.; Zueva, M.V.

Russ. J. Inorg. Chem. 1963, *8*, 678-682.

VARIABLES:

Temperature

PREPARED BY:

P.G.T. Fogg

EXPERIMENTAL VALUES:

Solvent	Distribution constant $vol_{AsH_3}/vol_{solvent}$	Heat of solution /kcal mol^{-1}
2-Furancarboxaldehyde; $C_5H_4O_2$; [98-01-1]	15.68	-3.6
1,2-Benzenedicarboxylic acid, didecyl ester; $C_{28}H_{46}O_4$; [84-77-5]	31.8	-3.0
Triethoxysilane, $C_6H_{16}O_3Si$; [998-30-1]	19.7	-5.8
Silicic acid, tetraethyl ester, $C_8H_{20}O_4Si$; [78-10-4]	17.0	-4.3
Silicone 702-DF	38.0	-4.7
Silicone VKZh-94B	26.2	-5.6

Temperature = 293.2 K

Distribution constants were measured between 278.2 K and 323.2 K. The partial pressures of arsine at which these measurements were made were not stated but would have been very small. The total pressure of arsine and carrier gas was about 760 mmHg in each case. Distribution constants were reported at one temperature only but heats of solution, said to have been calculated from the variation of distribution constants with

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

A chromatographic method was used. Temperatures were controlled to ± 0.5 K. The support phase consisted of Nichrome spirals. The carrier gas was either nitrogen or hydrogen. The volume, V_l, of the liquid phase was calculated from the weight of the column before and after filling with liquid and allowing to drain. The free volume, V_g, was equated with the retention volume for hydrogen gas. The distribution constant, K, was calculated from the James and Martin equation :

$$V_R = V_g + KV_l$$

where V_R is the retention volume for arsine.

SOURCE AND PURITY OF MATERIALS:

1. Prepared by reaction between Zn_3As_2 and aqueous acid; purified by vacuum distillation. no impurities detected by chromatography.

H_2 & N_2 : passed through activated carbon and through molecular sieve.

ESTIMATED ERROR:

REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
1. Arsine, AsH_3; [7784-42-1] 2. Various liquids	Devyatykh, G.G.; Ezheleva, A.E.; Zorin, A.D.; Zueva, M.V. *Russ. J. Inorg. Chem.* 1963, *8*, 678-682.

EXPERIMENTAL VALUES:

temperature, were given.

If it is assumed that distribution constants vary with temperature according to equations of the form :

$$\ln K = (-\Delta H/RT) + A$$

where K is the distribution constant for a temperature T, ΔH is the heat of solution of arsine in the solvent and A is a constant for the solvent, then distribution constants at any temperature in the range 278.2 K to 323.2 K may be estimated from a value at 293.2 K and the corresponding value of the heat of solution. The equation for K may be written in the form:

$$K = \exp [A + (B/T)]$$

The following values of A and B have been calculated by the compiler:

Solvent	A	B/K
2-Furancarboxaldehyde	-3.430	1813
1,2-Benzenedicarboxylic acid, didecyl ester	-1.693	1511
Triethoxysilane	-6.980	2920
Silicic acid, tetraethyl ester	-4.551	2165
Silicone 702-DF	-4.434	2367
Silicone VKZh-94B	-6.351	2820

In the opinion of the compiler these distribution constants cannot be equated with Ostwald coefficients unless the assumption is made that equilibrium was established between gas and liquid phases under the conditions of the experiment.

In addition, possible adsorption of the arsine at the stationary phase-carrier gas interface may have lowered the accuracy of the results.

COMPONENTS:

1. Arsine; AsH_3; [7784-42-1]
2. Various liquids.

ORIGINAL MEASUREMENTS:

Corriez, P.; Berton, A.

Bull. Soc. Chim. France, 1950, 43-45.

VARIABLES:

PREPARED BY:

P. G. T. Fogg

EXPERIMENTAL VALUES:

Solvent	T/K	Bunson coefficient α	Mole fraction* x_{AsH_3} (1 atm)
Huile de vaseline (liquid paraffin)	290.2	8	-
2-Propanone (acetone); C_3H_6O; [67-64-1]	298.2	9.3	0.030
Tetrahydronaphthalene (tetralin). $C_{10}H_{22}$; [119-64-2]	298.2	10	0.062
2-Aminoethanol (monoethanolamine); C_2H_7NO; [141-43-5]	285.2	1.75	0.0047
2,2',2"-Nitrilotris-ethanol (triethanolamine); $C_6H_{15}NO_3$; [102-71-6]	285.2	0.8	0.0047

1 atm = 1.015×10^5 Pascal

* Calculated by the compiler using the density of arsine given in ref. (1) and the densities of solvents given in ref. (2)

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The initial volume of gas was measured over mercury in a gas burette at the barometric pressure. This volume was adjusted to 0°C and 1 atm by the relation PV = RT. Gas was passed into an absorption pipette containing a known volume of solvent. The final volume of gas was measured at the barometric pressure, p_{total}. The final pressure of arsine, p_{AsH_3} was taken to be p_{total} minus the vapor pressure of the pure solvent. The final volume of gas was adjusted from p_{AsH_3} to 1 atm and 0°C. The Bunsen absorption coefficient, α, was the difference between the initial and final adjusted volumes divided by the volume of solvent.

SOURCE AND PURITY OF MATERIALS:

2. Acetone was 'pure' grade. Tetralin, monoethanolamine, and triethanolamine were 'technical' grades.

ESTIMATED ERROR:

REFERENCES:

1. Mellor, J.W. *Comprehensive Treatise on Inorganic & Theoretical Chemistry*, Vol. IX, Longmans, London, 1929.
2. Timmermans, J., *Physico-Chemical Constants of Pure Organic Compounds* Vol. 2, Elsevier, Amsterdam, 1965.

COMPONENTS:

1. Arsine; AsH_3; [7784-42-1]
2. Chlorinated alkanes.

ORIGINAL MEASUREMENTS:

Corriez, P.; Berton, A. *Bull. Soc. Chim. France* 1950, 43-45

VARIABLES:

PREPARED BY:

P. G. T. Fogg

EXPERIMENTAL VALUES:

Solvent	T/K	Bunsen coefficient α	Mole fraction* x_{AsH_3} (1 atm)
Dichloromethane; CH_2Cl_2; [75-09-2]	298.2	10.7	0.0300
Trichloromethane, (Chloroform); $CHCl_3$; [67-66-3]	298.2	10.9	0.0379
Tetrachloromethane, (carbon tetrachloride); CCl_4; [56-23-5]	298.2	11.7	0.0485
1,2-Dichloroethane; $C_2H_4Cl_2$; [107-06-2]	298.2	8.8	0.0304
1,1,2,2-Tetrachloroethane; $C_2H_2Cl_4$; [79-34-5]	298.2	9.7	0.0440
1,2-Dichloroethene; $C_2H_2Cl_2$; [540-59-0]	298.2	12.3	0.0404
Trichloroethene; C_2HCl_3; [79-01-6]	298.2	12.5	0.0482
Tetrachloroethene; C_2Cl_4; [127-18-4]	298.2	11.2	0.0490

* Calculated by compiler using the density of arsine given in ref. (1) and the densities of solvents given in refs. (2), (3) and (4).

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The initial volume of gas was measured over mercury in a gas burette at the barometric pressure. This volume was adjusted to 0 °C and 1 atm by the relation PV = RT. Gas was passed into an absorption pipette containing a known volume of liquid S. The final volume of gas was measured at the barometric pressure, p_{total}. The final pressure of arsine, p_{AsH_3}, was taken to be p_{total} minus vapor pressure of pure solvent. The final volume of gas was adjusted from p_{AsH_3} to 1 atm and 0 °C. The Bunsen absorption coefficient, α, was the difference between the initial and final adjusted volumes divided by the volume of solvent.

SOURCE AND PURITY OF MATERIALS:

No information given.

REFERENCES:

1. Mellor, J.W., *Comprehensive Treatise on Inorganic & Theoretical Chemistry*, Vol. IX, Longmans, London. 1929.
2. R.R. Dreisbach, *Physical Properties of Chemical Compounds*, A.C.S., Washington. 1959, 1961.
3. *Handbook of Chemistry & Physics* (61st edition), C.R.C. Press, Cleveland, Ohio. 1980.
4. *Lange's Handbook of Chemistry* (12th edition), McGraw-Hill, New York. 1979.

COMPONENTS:	EVALUATOR:
1. Stibine; SbH_3; [7803-52-3] 2. Organic liquids	P. G. T. Fogg, School of Chemistry, Polytechnic of North London, Holloway, London, N7 8DB, UNITED KINGDOM. August 1983

CRITICAL EVALUATION:

Distribution constants for systems consisting of the gas and eight different liquids have been measured by Devyatykh *et al.* (1) using a chromatographic technique. (See comments under arsine evaluation and on compiled tables.) It is, however, unwise to equate these constants with Ostwald coefficients in order to calculate solubilities for a particular partial pressure of gas. Analogy with measurements on phosphine reported by these authors makes it likely that such estimates could be several hundred per cent too large. The data may perhaps be used to estimate relative solubilities of stibine in different solvents but such estimates are unlikely to be very precise.

References

1. Devyatykh, G. G.; Ezheleva, A. E.; Zorin, A. D.; Zueva, M. V. *Zh. Neorgan. Khim.* 1963, *8*, 1307 (*Russ. J. Inorg. Chem.* 1963, *8*, 678).

COMPONENTS:

1. Stibine; SbH_3; [7803-52-3]
2. Various liquids

ORIGINAL MEASUREMENTS:

Devyatykh, G.G.; Ezheleva, A.E.; Zorin, A.D.; Zueva, M.V.

Russ. J. Inorg. Chem. 1963, *8*, 678-682

VARIABLES:

Temperature

PREPARED BY:

P.G.T. Fogg

EXPERIMENTAL VALUES:

Solvent	Distribution constant $vol_{SbH_3}/vol_{solvent}$	Heat of solution /kcal mol^{-1}
2-Furancarboxaldehyde; $C_5H_4O_2$; [98-01-1]	25.2	-4.1
Triethoxysilane; $C_6H_{16}O_3Si$; [998-30-1]	39.8	-6.0
Silicic acid, tetraethyl ester; $C_8H_{20}O_4Si$; [78-10-4]	28.5	-5.4
Silicone VKZh-94B	58.8	-6.2

Temperature = 293.2 K.

Distribution constants were measured between 278.2 K and 323.2 K. The partial pressures of stibine at which these measurements were made were not stated. The total pressure of stibine and carrier gas was about 760 mmHg in each case. Distribution constants were reported at one temperature only but heats of solution, said to have been calculated from the variation of distribution constants with temperature, were given.

If it is assumed that distribution constants vary with temperature according to equations of the form :

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

A chromatographic method was used. Temperatures were controlled to ±0.5K. The support phase consisted of Nichrome spirals. The carrier gas was either nitrogen or hydrogen. The volume, V_l, of the liquid phase was calculated from the weight of the column before and after filling with liquid and allowing to drain. The free volume, V_g, was equated with the retention volume for hydrogen gas. The distribution constant, *K*, was calculated from the James and Martin equation:

$$V_R = V_g + KV_l$$

where V_R is the retention volume for stibine.

SOURCE AND PURITY OF MATERIALS:

1. Prepared from $SbCl_3$ and aqueous sodium tetrahydroborate; purified by vacuum distillation; chromatographic analysis indicated about 5% H_2.

   H_2 & N_2: passed through activated carbon and through molecular sieve.

ESTIMATED ERROR:

REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
1. Stibine; SbH_3; [7803-52-3] 2. Various liquids.	Devyatykh, G.G.; Ezheleva, A.E.; Zorin, A.D.; Zueva, M.V. *Russ. J. Inorg. Chem.* 1963, *8*, 678-682.

EXPERIMENTAL VALUES:

$$\ln K = (-\Delta H/RT) + A$$

where K is the distribution constant for a temperature T, ΔH is the heat of solution in the solvent and A is a constant for the solvent, then distribution constants at any temperature in the range 278.2 K to 323.2 K may be estimated from a value at 293.2 K and the corresponding value of the heat of solution. The equation for K may be written in the form :

$$K = \exp [A + (B/T)]$$

The following values of A and B have been calculated by the compiler:

Solvent	A	B/K
2-Furancarboxaldehyde	-3.814	2064
Triethoxysilane	-6.620	3021
Silicic acid, tetraethyl ester	-5.924	2719
Silicone VKZh-94B	-6.573	3122

In the opinion of the compiler these distribution constants cannot be equated with Ostwald coefficients unless the assumption is made that equilibrium was established between gas and liquid phases under the conditions of the experiment.

In addition, possible adsorption of stibine at the stationary phase-carrier gas interface may have lowered the accuracy of the results.

COMPONENTS:

1. Stibine; SbH_3; [7803-52-3]
2. Various liquids

ORIGINAL MEASUREMENTS:

Devyatykh, G. G.; Ezheleva, A. E.; Zorin, A. D.; Zueva, M. V.

Russ. J. Inorg. Chem.

1963, *8*, 678-682.

VARIABLES:

Temperature

PREPARED BY:

P. G. T. Fogg

EXPERIMENTAL VALUES:

Solvent	P_{SbH_3}/mmHg	Distribution constant vol_{SbH_3} /$vol_{solvent}$	Heat of solution /kcal mol^{-1}
2-Ethoxyethanol; $C_4H_{10}O_2$; [110-80-5]	0.3	40.7	-1.2
1,1'-oxybis[2-chloroethane]; $C_4H_8Cl_2O$; [111-44-4]	0.2	28.9	-3.5
Nitrobenzene; $C_6H_5NO_2$; [98-95-3]	0.2	22.9	-1.82
Liquid paraffin	0.3	39.7	-

Temperature = 293.2 K. 760 mmHg = 1 atm = 1.013×10^5 Pa.

Distribution constants were measured between 278.2 K and 323.2 K with a total pressure of stibine and carrier gas of about 760 mmHg. Distribution constants were reported at one temperature only but heats of solution, said to have been calculated from the variation of distribution constants with temperature, were given. If it is assumed that distribution constants vary with temperature according to equations of the form:

$$\ln K = (-\Delta H/RT) + A$$

where K is the distribution constant for a temperature T, ΔH is the heat

(cont.)

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

A chromatographic method was used. Temperatures were controlled to ±0.5 K. The support phase consisted of Nichrome spirals. The carrier gas was either nitrogen or hydrogen. The volume, V_ℓ, of the liquid phase was calculated from the weight of the column before and after filling with liquid and allowing to drain. The free volume, V_g, was equated with the retention volume for hydrogen gas. The distribution constant, K, was calculated from the James and Martin equation:

$$V_R = V_g + KV_\ell$$

where V_R is the retention volume for stibine.

SOURCE AND PURITY OF MATERIALS:

1. Prepared from $SbCl_3$ and aqueous sodium tetrahydroborate; purified by vacuum distillation; chromatographic analysis indicated about 5% H_2.

H_2 and N_2: passed through activated carbon and through molecular sieve.

ESTIMATED ERROR:

REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
1. Stibine; SbH_3; [7803-52-3] 2. Various liquids	Devyatykh, G. G.; Ezheleva, A. E.; Zorin, A. D.; Zueva, M. V. *Russ. J. Inorg. Chem.* 1963, *8*, 678-682.

EXPERIMENTAL VALUES:

of solution of stibine in the solvent and A is a constant for the solvent, then distribution constants at any temperature in the range 278.2 K to 323.2 K may be estimated from a value at 293.2 K and the corresponding value of the heat of solution. The equation for *K* may be written in the form:

$$K = \exp\,[A + (B/T)].$$

The following values of A and B have been calculated by the compiler:

Solvent	A	B/K
2-Ethoxyethanol	1.645	604
1,1'-oxybis[2-chloroethane]	-2.647	1762
Nitrobenzene	0.006	916

In the opinion of the compiler these distribution constants can not be equated with Ostwald coefficients unless the assumption is made that equilibrium was established between gas and liquid phases under the conditions of the experiment.

In addition,possible adsorption of stibine at the stationary phase-carrier gas interface may have lowered the accuracy of the results.

COMPONENTS:	EVALUATOR:
1. Silane; SiH_4; [7803-62-5] Germane; GeH_4; [7782-65-2] Stannane; SnH_4; [2406-52-2] 2. Organic liquids.	P. G. T. Fogg, School of Chemistry, Polytechnic of North London, Holloway, London N7 8DB, United Kingdom. October 1983

CRITICAL EVALUATION:

Devyatykh *et al.* (1) measured distribution constants for each of the three gases and several solvents by a chromatographic method. It is, however, unwise to equate these constants with Ostwald coefficients in order to estimate solubilities. The data may, perhaps, be used to estimate relative solubilities but such estimates may not be precise.

The solubility of silane in cyclohexane was measured by Cauquil (2). Very simple apparatus was used. The possibility that equilibrium between gas and liquid was not achieved should be borne in mind.

References:

1. Devyatykh, G. G.; Ezheleva, A. E.; Zorin, A. D.; Zueva, M. V.
Zh. Neorgan. Khim. 1963, *8*, 1307.
(Russ. J. Inorg. Chem. 1963, *8*, 678.)

2. Cauquil, G.
J. Chim. Phys. Phys. Chim. Biol. 1927, *24*, 53.

COMPONENTS:

1. Silane; SiH_4; [7803-62-5]
2. Various liquids

ORIGINAL MEASUREMENTS:

Devyatykh, G.G.; Ezheleva, A.E.; Zorin, A.D.; Zueva, M.V.

Russ. J. Inorg. Chem. 1963, *8*, 678-682.

VARIABLES:

Temperature, pressure

PREPARED BY:

P.G.T. Fogg

EXPERIMENTAL VALUES:

Solvent	Pressure range /mmHg	Distribution constant $vol_{SiH_4}/vol_{solvent}$	Heat of solution /kcal mol^{-1}
2-Ethoxyethanol; $C_4H_{10}O_2$; [110-80-5]	0.5 -17.18	3.24	-1.2
1,1'-oxybis [2-chloroethane]; $C_4H_8Cl_2O$; [111-44-4]	0.06 -21.0	4.02	-1.2
Nitrobenzene, $C_6H_5NO_2$; [98-95-3]	0.03 -18.7	4.38	-0.93
Liquid paraffin	0.5 -50.0	5.46	-3.8
Silicone PFMS-4F	0.05 -34.0	6.4	-2.2

Temperature = 293.2 K. 760 mmHg = 1 atm = 1.013×10^5 Pa.

Distribution constants were measured between 278.2 K and 323.2 K over a range of partial pressures of silane and a total pressure of about 760 mmHg. At a fixed temperature the distribution constants did not depart from the mean values by more than ±3%. These mean values were reported at one temperature only but heats of solution, said to have been calculated from the variation of distribution constants with temperature, were given. If it is assumed that distribution constants vary with temperature according to equations of the form :

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

A chromatographic method was used. Temperatures were controlled to ± 0.5 K. The support phase consisted of Nichrome spirals. The carrier gas was either nitrogen or hydrogen. The volume, V_l, of the liquid phase was calculated from the weight of the column before and after filling with liquid and allowing to drain. The free volume, V_g, was equated with the retention volume for hydrogen gas. The distribution constant, K, was calculated from the James and Martin equation :

$$V_R = V_g + KV_l$$

where V_R is the retention volume for silane.

SOURCE AND PURITY OF MATERIALS:

1. Prepared by disproportionation of triethoxysilane in the presence of metallic sodium; distilled with low temperature still; chromatographically pure.

   H_2 & N_2: passed through activated carbon and through molecular sieve.

ESTIMATED ERROR:

REFERENCES:

COMPONENTS:

1. Silane; SiH_4; [7803-62-5]
2. Various liquids

ORIGINAL MEASUREMENTS:

Devyatykh, G.G.; Ezheleva, A.E.; Zorin, A.D.; Zueva, M.V.

Russ. J. Inorg. Chem. 1963, *8*, 678-682.

EXPERIMENTAL VALUES:

$$\ln K = (-\Delta H/RT) + A$$

where K is the distribution constant for a temperature T,ΔH is the heat of solution of silane in the solvent and A is a constant for the solvent, then distribution constants at any temperature in the range 278.2 K to 323.2 K may be estimated from a value at 293.2 K and the corresponding value of the heat of solution. The equation for K may be written in the form :

$$K = \exp [A + (B/T)]$$

The following values of A and B have been calculated by the compiler:

Solvent	A	B/K
2-Ethoxyethanol	-0.885	604
1,1´oxybis [2-chloroethane]	-0.670	604
Nitrobenzene	-0.120	468
Liquid paraffin	-4.828	1913
Silicone PFMS-4F	-1.922	1108

In the opinion of the compiler these distribution constants cannot be equated with Ostwald coefficients unless the assumption is made that equilibrium was established between gas and liquid phases under the conditions of the experiment.

In addition,possible adsorption of the silane at the stationary phase-carrier gas interface may have lowered the accuracy of the results.

COMPONENTS:

1. Silane; SiH_4; [7803-62-5]
2. Various liquids

ORIGINAL MEASUREMENTS:

Devyatykh, G.G.; Ezheleva, A.E.; Zorin, A.D.; Zueva, M.V.

Russ. J. Inorg. Chem. 1963, *8*, 678-682

VARIABLES:

Temperature

PREPARED BY:

P.G.T. Fogg

EXPERIMENTAL VALUES:

Solvent	Distribution constant $vol_{SiH_4}/vol_{solvent}$	Heat of solution /kcal mol^{-1}
2-Furancarboxaldehyde; $C_5H_4O_2$; [98-01-1]	3.08	-4.4
1,2-Benzenedicarboxylic acid, didecyl ester; $C_{28}H_{46}O_4$; [84-77-5]	4.8	-3.8
Triethoxysilane; $C_6H_{16}O_3Si$; [998-30-1]	2.8	-6.0
Silicic acid, tetraethyl ester; $C_8H_{20}O_4Si$; [78-10-4]	5.10	-5.4
Silicone 702-DF	3.8	-2.0
Silicone VKZh-94B	3.0	-4.3

Temperature = 293.2 K

Distribution constants were measured between 278.2 K and 323.2 K. The partial pressures of silane at which these measurements were made were not stated. The total pressure of silane and carrier gas was about 760 mmHg in each case. Distribution constants were reported at one temperature only but heats of solution, said to have been calculated from the

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

A chromatographic method was used. Temperatures were controlled to ±0.5K. The support phase consisted of Nichrome spirals. The carrier gas was either nitrogen or hydrogen. The volume, V_l, of the liquid phase was calculated from the weight of the column before and after filling with liquid and allowing to drain. The free volume, V_g, was equated with the retention volume for hydrogen gas. The distribution constant, *K*, was calculated from the James and Martin equation:

$$V_R = V_g + KV_l$$

where V_R is the retention volume for silane.

SOURCE AND PURITY OF MATERIALS:

1. Prepared by disproportionation of triethoxysilane in the presence of metallic sodium; distilled with low temperature still; chromatographically pure.

   H_2 & N_2: passed through activated carbon and through molecular sieve.

ESTIMATED ERROR:

REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
1. Silane; SiH_4; [7803-62-5] 2. Various liquids	Devyatykh, G.G. Ezheleva, A.E. Zorin, A.D.; Zueva, M.V. *Russ. J. Inorg. Chem.* 1963, *8*, 678-682.

EXPERIMENTAL VALUES:

variation of distribution constants with temperature, were given.

If it is assumed that distribution constants vary with temperature according to equations of the form:

$$\ln K = (-\Delta H/RT) + A$$

where K is the distribution constant for a temperature T, ΔH is the heat of solution in the solvent and A is a constant for the solvent, then distribution constants at any temperature in the range 278.2 K to 323.2K may be estimated from a value at 293.2 K and the corresponding value of the heat of solution. The equation for K may be written in the form :

$$K = \exp\ [A + (B/T)\ ]$$

The following values of A and B have been calculated by the compiler:

Solvent	A	B/K
2-Furancarboxaldehyde	-6.431	2215
1,2-Benzenedicarboxylic acid, didecyl ester	-4.957	1913
Triethoxysilane	-9.274	3021
Silicic acid, tetraethyl ester	-7.644	2719
Silicone 702-DF	-2.100	1007
Silicone VKZh-94B	-6.286	2165

In the opinion of the compiler these distribution constants cannot be equated with Ostwald coefficients unless the assumption is made that equilibrium was established between gas and liquid phases under the conditions of the experiment.

In addition, possible adsorption of silane at the stationary phase-carrier gas interface may have lowered the accuracy of the results.

COMPONENTS:	ORIGINAL MEASUREMENTS:
1. Silane, SiH_4; [7803-62-5] 2. Cyclohexanol, $C_6H_{12}O$; [108-93-0]	Cauquil, G. *J. Chim. Phys. Phys. Chim. Biol.* 1927, *24*, 53-55.
VARIABLES:	PREPARED BY: P. G. T. Fogg

EXPERIMENTAL VALUES:

T/K	p_{SiH_4}/mmHg	Ostwald coefficient L	Mole fraction* x_{SiH_4} (1 atm)
299.2	765	0.097	0.00042

760 mmHg = 1 atm
1 atm = 1.013×10^5 Pa

* Calculated by the compiler using constants of the van der Waals equation for SiH_4 given in ref. (1) and densities of $C_6H_{12}O$ given in refs. (1) and (2)

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

A measured volume of cyclohexanol was put into contact with a measured volume of silane in a graduated tube over mercury. The final volume of gas and the temperature and pressure were measured when equilibrium had been reached. The author considered that no allowance for the vapor pressure of cyclohexanol at the temperature of measurement was necessary.

SOURCE AND PURITY OF MATERIALS:

$C_6H_{12}O$: dissolved air removed by boiling.
b.p. 334.1 K (766 mmHg)

ESTIMATED ERROR:

REFERENCES:

1. *Handbook of Chemistry & Physics* (61st edition), C.R.C. Press, Cleveland, Ohio. 1980.
2. J. Timmermans, *Physico-Chemical Constants of Pure Organic Compound* Vol. 2, Elsevier, Amsterdam. 1965.

COMPONENTS:

1. Germane, GeH_4; [7782-65-2]
2. Various liquids

ORIGINAL MEASUREMENTS:

Devyatykh, G.G.; Ezheleva, A.E.; Zorin, A.D.; Zueva, M.V.

Russ. J. Inorg. Chem. 1963, *8*, 678-682.

VARIABLES:

Temperature, pressure

PREPARED BY:

P.G.T. Fogg.

EXPERIMENTAL VALUES:

Solvent	Pressure range /mmHg	Distribution constant $vol_{GeH_4}/vol_{solvent}$	Heat of solution /kcal mol^{-1}
2-Ethoxyethanol, $C_4H_{10}O_2$; [110-80-5]	0.1 - 18.5	6.24	-1.3
1,1′-oxybis [2-chloroethane], $C_4H_8Cl_2O$; [111-44-4]	0.05- 16.3	8.57	-1.5
Nitrobenzene, $C_6H_5NO_2$; [98-95-3]	0.03- 19.0	9.0	-1.64
Liquid paraffin	0.4 - 43.5	9.4	-3.4
Silicone PFMS-4F	0.03- 22.0	11.7	-3.0

Temperature = 293.2K. 760 mmHg = 1 atm = 1.013×10^5 Pa.

Distribution constants were measured between 278.2 K and 323.2 K over a range of partial pressures of germane and a total pressure of about 760 mmHg. At a fixed temperature the distribution constants did not depart from the mean values by more than ±3%. These mean values were reported at one temperature only but heats of solution, said to have been calculated from the variation of distribution constants with temperature, were given. If it is assumed that distribution constants vary with temperature

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

A chromatographic method was used. Temperatures were controlled to ± 0.5 K. The support phase consisted of Nichrome spirals. The carrier gas was either nitrogen or hydrogen. The volume, V_l, of the liquid phase was calculated from the weight of the column before and after filling with liquid and allowing to drain. The free volume, V_g, was equated with the retention volume for hydrogen gas. The distribution constant, K, was calculated from the James and Martin equation:

$$V_R = V_g + KV_l$$

where V_R is the retention volume for germane.

SOURCE AND PURITY OF MATERIALS:

1. Prepared by reduction of $GeCl_4$ by lithium tetrahydroaluminate in ether; distilled with low temperature still; contained 5% H_2

H_2 and N_2 : passed through activated carbon and through molecular sieve.

ESTIMATED ERROR:

REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS
1. Germane, GeH_4; [7782-65-2] 2. Various liquids	Devyatykh, G.G.; Ezheleva, A.E. Zorin, A.D.; Zueva, M.V. *Russ. J. Inorg. Chem.* 1963, *8*, 678-682.

EXPERIMENTAL VALUES:

according to equations of the form:

$$\ln K = (-\Delta H/RT) + A$$

where K is the distribution constant for a temperature T,ΔH is the heat of solution of germane in the solvent and A is a constant for the solvent, then distribution constants at any temperature in the range 278.2 K may be estimated from a value at 293.2 K and the corresponding value of the heat of solution. The equation for K may be written in the form:

$$K = \exp [A + (B/T)]$$

The following values of A and B have been calculated by the compiler:

Solvent	A	B/K
2-Ethoxyethanol	-0.402	655
1,1´-oxybis [2-chloroethane]	-0.428	755
Nitrobenzene	-0.619	826
Liquid paraffin	-3.598	1712
Silicone PFMS-4F	-2.692	1511

In the opinion of the compiler these distribution constants cannot be equated with Ostwald coefficients unless the assumption is made that equilibrium was established between gas and liquid phases under the conditions of the experiment.

In addition, possible adsorption of the germane at the stationary phase-carrier gas interface may have lowered the accuracy of the results.

COMPONENTS:

1. Germane; GeH_4; [7782-65-2]

2. Various liquids

ORIGINAL MEASUREMENTS:

Devyatykh, G.G.; Ezheleva, A.E.; Zorin, A.D.; Zueva, M.V.

Russ. J. Inorg. Chem. 1963, *8*, 678-682.

VARIABLES:

Temperature

PREPARED BY:

P.G.T. Fogg

EXPERIMENTAL VALUES:

Solvent	Distribution constant $vol_{GeH_4}/vol_{solvent}$	Heat of solution / kcal mol^{-1}
2-Furancarboxaldehyde, $C_5H_4O_2$; [98-01-1]	8.31	-4.5
1,2-Benzenedicarboxylic acid, didecyl ester, $C_{28}H_{46}O_4$; [84-77-5]	7.4	-3.4
Triethoxysilane, $C_6H_{16}O_3Si$; [998-30-1]	6.8	-4.4
Silicic acid, tetraethyl ester, $C_8H_{20}O_4Si$; [78-10-4]	11.72	-6.4
Silicone 702-DF	6.14	-3.2
Silicone VKZh-94B	3.98	-4.3

Temperature = 293.2 K

Distribution constants were measured between 278.2 K and 323.2 K. The partial pressures of germane at which these measurements were made were not stated. The total pressure of germane and carrier gas was about 760 mmHg in each case. Distribution constants were reported at one temperature only but heats of solution, said to have been calculated from the variation of distribution constants with temperature, were given.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

A chromatographic method was used. Temperatures were controlled to ± 0.5K. The support phase consisted of Nichrome spirals. The carrier gas was either nitrogen or hydrogen. The volume, V_1, of the liquid phase was calculated from the weight of the column before and after filling with liquid and allowing to drain. The free volume, V_g, was equated with the retention volume for hydrogen gas. The distribution constant, K, was calculated from the James and Martin equation:

$$V_R = V_g + KV_1$$

where V_R is the retention volume for germane.

SOURCE AND PURITY OF MATERIALS:

1. Prepared by reduction of $GeCl_4$ by lithium tetrahydroaluminate in ether; distilled with low temperature still; contained 5% H_2.

H_2 and N_2 : passed through activated carbon and through molecular sieve

ESTIMATED ERROR:

REFERENCES:

COMPONENTS:

1. Germane; GeH_4; [7782-65-2]
2. Various liquids

ORIGINAL MEASUREMENTS

Devyatykh, G.G.; Ezheleva, A.E.
Zorin, A.D.; Zueva, M.V.

Russ. J. Inorg. Chem. 1963, *8*, 678-682.

EXPERIMENTAL VALUES:

If it is assumed that distribution constants vary with temperature according to equations of the form:

$$\ln K = (-\Delta H/RT) + A$$

where K is the distribution constant for a temperature T,ΔH is the heat of solution in the solvent and A is a constant for the solvent, then distribution constants at any temperature in the range 278.2 K to 323.2 K may be estimated from a value at 293.2 K and the corresponding value of the heat of solution. The equation for K may be written in the form:

$$K = \exp\left[A + (B/T)\right]$$

The following values of A and B have been calculated by the compiler:

Solvent	A	B/K
2-Furancarboxaldehyde	-5.611	2266
1,2-Benzenedicarboxylic acid, didecyl ester	-3.837	1712
Triethoxysilane	-5.639	2215
Silicic acid,tetraethyl ester	-8.530	3222
Silicone 702-DF	-3.681	1611
Silicone VKZh-94B	-6.003	2165

In the opinion of the compiler these distribution constants cannot be equated with Ostwald coefficients unless the assumption is made that equilibrium was established between gas and liquid phases under the conditions of the experiment.

In addition,possible adsorption of the germane at the stationary phase-carrier gas interface may have lowered the accuracy of the results.

COMPONENTS:

1. Stannane; SnH_4; [2406-52-2]

2. Various liquids

ORIGINAL MEASUREMENTS:

Devyatykh, G. G.; Ezheleva, A. E.; Zorin, A. D.; Zueva, M. V.

Russ. J. Inorg. Chem.

1963, *8*, 678-682.

VARIABLES:

Temperature, pressure

PREPARED BY:

P. G. T. Fogg

EXPERIMENTAL VALUES:

Solvent	p_{SnH_4} /mmHg	Distribution constant vol_{SnH_4} /$vol_{solvent}$	Heat of solution /kcal mol^{-1}
2-Ethoxyethanol; $C_4H_{10}O_2$; [110-80-5]	0.5	26.2	-1.54
1,1'-oxybis[2-chloroethane]; $C_4H_8Cl_2O$; [111-44-4]	0.3	27.3	-2.3
Nitrobenzene; $C_6H_5NO_2$; [98-95-3]	0.9	15.4	-1.82
Liquid paraffin	1.2	17.0	-3.9
Silicone PFMS-4F	0.9	12.1	-2.8

Temperature = 293.2 K.   760 mmHg = 1 atm = 1.013×10^5 Pa.

Distribution constants were measured between 278.2 K and 323.2 K with a total pressure of stannane and carrier gas of about 760 mmHg. At a fixed temperature the distribution constants did not depart from the mean values by more than ±3%. These mean values were reported at one temperature only but heats of solution, said to have been calculated from the variation of distribution constants with temperature, were given. If it is assumed that distribution constants vary with temperature according to equations of the form:

(cont.)

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

A chromatographic method was used. Temperatures were controlled to ±0.5 K. The support phase consisted of Nichrome spirals. The carrier gas was either nitrogen or hydrogen. The volume, V_ℓ, of the liquid phase was calculated from the weight of the column before and after filling with liquid and allowing to drain. The free volume, V_g, was equated with the retention volume for hydrogen gas. The distribution constant, K, was calculated from the James and Martin equation:

$$V_R = V_g + KV_\ell$$

where V_R is the retention volume for stannane.

SOURCE AND PURITY OF MATERIALS:

1. Prepared by reduction of $SnCl_4$ with aqueous sodium tetrahydroborate in acid; purified by vacuum distillation; contained ∿ 5% H_2.

H_2 and N_2: passed through activated carbon and through molecular sieve.

ESTIMATED ERROR:

REFERENCES:

COMPONENTS:

1. Stannane; SnH_4; [2406-52-2]

2. Various liquids

ORIGINAL MEASUREMENTS:

Devyatykh, G. G.; Ezheleva, A. E.; Zorin, A. D.; Zueva, M. V.

Russ. J. Inorg. Chem.

1963, *8*, 678-682.

EXPERIMENTAL VALUES:

$$\ln K = (-\Delta H/RT) + A$$

where K is the distribution constant for a temperature T, ΔH is the heat of solution of stannane in the solvent and A is a constant for the solvent, then distribution constants at any temperature in the range 278.2 K to 323.2 K may be estimated from a value at 293.2 K and the corresponding value of the heat of solution. The equation for K may be written in the form:

$$K = \exp\,[A + (B/T)].$$

The following values of A and B have been calculated by the compiler:

Solvent	A	B/K
2-Ethoxyethanol	0.621	775
1,1'-oxybis[2-chloroethane]	-0.643	1158
Nitrobenzene	-0.391	916
Liquid paraffin	-3.864	1964
Silicone PFMS-4F	-2.315	1410

In the opinion of the compiler these distribution constants can not be equated with Ostwald coefficients unless the assumption is made that equilibrium was established between gas and liquid phases under the conditions of the experiment.

In addition,possible adsorption of stannane at the stationary phase-carrier gas interface may have lowered the accuracy of the results.

COMPONENTS:	ORIGINAL MEASUREMENTS:
1. Stannane; SnH_4; [2406-52-2] 2. Various liquids	Devyatykh, G. G.; Ezheleva, A. E.; Zorin, A. D.; Zueva, M. V. *Russ. J. Inorg. Chem.* 1963, *8*, 678-682.
VARIABLES:	PREPARED BY:
Temperature	P. G. T. Fogg

EXPERIMENTAL VALUES:

Solvent	Distribution constant $vol_{SnH_4}/vol_{solvent}$	Heat of solution /kcal mol^{-1}
2-Furancarboxaldehyde; $C_5H_4O_2$; [98-01-1]	18.2	-4.6
1,2-Benzenedicarboxylic acid, didecyl ester; $C_{28}H_{46}O_4$; [84-77-5]	8.3	-4.0
Triethoxysilane; $C_6H_{16}O_3Si$; [998-30-1]	31.7	-6.0
Silicic acid, tetraethyl ester; $C_8H_{20}O_4Si$; [78-10-4]	21.6	-5.0
Silicone 702-DF	10.0	-3.0
Silicone VKZh-94B	7.26	-5.6

Temperature = 293.2 K.

Distribution constants were measured between 278.2 K and 323.2 K. The partial pressures of stannane at which these measurements were made were not stated. The total pressure of stannane and carrier gas was about 760 mmHg in each case. Distribution constants were reported at one temperature only but heats of solution, said to have been calculated from the variation of distribution constants with temperature, were given.

(cont.)

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

A chromatographic method was used. Temperatures were controlled to ±0.5 K. The support phase consisted of Nichrome spirals. The carrier gas was either nitrogen or hydrogen. The volume, V_ℓ, of the liquid phase was calculated from the weight of the column before and after filling with liquid and allowing to drain. The free volume, V_g, was equated with the retention volume for hydrogen gas. The distribution constant, K, was calculated from the James and Martin equation:

$$V_R = V_g + KV_\ell$$

where V_R is the retention volume for stannane.

SOURCE AND PURITY OF MATERIALS:

1. Prepared by reduction of $SnCl_4$ with aqueous sodium tetrahydroborate in acid; purified by vacuum distillation; contained ∿ 5% H_2.

H_2 and N_2: passed through activated carbon and through molecular sieve.

ESTIMATED ERROR:

REFERENCES:

COMPONENTS:

1. Stannane; SnH_4; [2406-52-2]

2. Various liquids

ORIGINAL MEASUREMENTS:

Devyatykh, G. G.; Ezheleva, A. E.; Zorin, A. D.; Zueva, M. V.

Russ. J. Inorg. Chem.

1963, *8*, 678-682.

EXPERIMENTAL VALUES:

If it is assumed that distribution constants vary with temperature according to equations of the form:

$$\ln K = (-\Delta H/RT) + A$$

where K is the distribution constant for a temperature T, ΔH is the heat of solution in the solvent and A is a constant for the solvent, then distribution constants at any temperature in the range 278.2 K to 323.2 K may be estimated from a value at 293.2 K and the corresponding value of the heat of solution. The equation for K may be written in the form:

$$K = \exp [A + (B/T)].$$

The following values of A and B have been calculated by the compiler:

Solvent	A	B/K
2-Furancarboxaldehyde	-4.998	2316
1,2-Benzenedicarboxylic acid, didecyl ester	-4.753	2014
Triethoxysilane	-6.848	3021
Silicic acid, tetraethyl ester	-5.514	2518
Silicone 702-DF	-2.849	1511
Silicone VKZh-94B	-7.635	2820

In the opinion of the compiler these distribution constants can not be equated with Ostwald coefficients unless the assumption is made that equilibrium was established between gas and liquid phases under the conditions of the experiment.

In addition, possible adsorption of stannane at the stationary phase-carrier gas interface may have lowered the accuracy of the results.

SYSTEM INDEX

Page numbers preceded with e refer to evaluations whereas those not preceded with e refer to compiled tables.Systems are indexed under solvents not under gases.

REGISTRY NUMBER INDEX

Page numbers preceded with the letter E refer to evaluation texts, whereas those not preceded with E refer to complilation tables.

AUTHOR INDEX

Page numbers preceded by E refer to evaluation text whereas those not preceded by E refer to compiled tables.