INTERNATIONAL UNION OF PURE AND APPLIED CHEMISTRY

ANALYTICAL CHEMISTRY DIVISION
COMMISSION ON SOLUBILITY DATA

SOLUBILITY DATA SERIES

Volume 7

OXYGEN AND OZONE

SOLUBILITY DATA SERIES

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OXYGEN AND OZONE

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SOLUBILITY DATA SERIES

INTERNATIONAL UNION OF PURE AND APPLIED CHEMISTRY

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FOREWORD

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

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

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

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

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

On the other hand, tertiary sources - handbooks, reference books, and other tabulated and graphical compilations - as they exist today, are comprehensive but, as a rule, uncritical. They usually attempt to cover whole disciplines, thus obviously are superficial in treatment. Since they command a wide market, we believe that their service to 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 sufficient evaluative commentary and a comprehensive review with a complete bibliography to both good and poor data.

It is the standard practice that 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, developed during our four years of existence, 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 15 years ago to refrain from unnecessary publication has not achieved much. The literature is still, in 1980, cluttered with poor-quality articles. The Weinberg report (in "Reader in Science Information", Eds. 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

Oxygen is the "acid former." Oxygen is 49.5% of the crust of the earth, 29.5% of the whole earth, and 0.96% of the universe by weight. Oxygen also forms about 20.94% of the atmosphere by mol per cent, and it is this latter abundance with which we are concerned in this volume. Oxygen from the air dissolves in the oceans, in all natural waters, in any fluids left out in the open or through which air is bubbled, and, of course, oxygen dissolves in biological fluids.

This volume is concerned with the solubility of oxygen (and ozone) in pure liquids, liquid mixtures, aqueous and organic solutions, biological fluids, and some miscellaneous solvents and mixtures. The coverage is on gas/liquid systems at high and low pressures. However, some fluids such as molten salts, alloys, glasses, and slags have been excluded, as well as polymeric materials. The scientific literature starting historically with W. Henry in 1803 has been systematically searched and the coverage should include most articles published through the end of 1980. (The editor would appreciate hearing about articles which were missed.)

This volume contains individual data sheets for each gas/liquid system in the author(s)' own reported units. In those cases where a given system was studied by several authors data sheets were not prepared for papers containing data of poor precision. However, reference is made to omitted papers. Again, for particular systems which have been studied by several authors, a critical evaluation is done of the data and recommended (or tentative) values are presented for that system along with a brief discussion of the contributions. These smoothed values represent our best judgement at this time. Users may use the smoothed values or the raw data in the individual data sheets.

The oxygen/water system has been widely studied by both chemical and physical means. The agreement between the two approaches is quite remarkable and I continue the recommendation made by R. Battino and H. L. Clever (*Chem. Rev.* 1966, *66*, 395-463) to use this system as a reference standard for work in the field. The smoothed values appearing in the critical evaluation section on oxygen/water are currently the best attainable and it is my recommendation that they be used as a reference standard.

For anyone working on data compilations (such as this one) involving solubilities, the principal bugaboo has to be solubility units. In the third edition of Hildebrand and Scott's "Solubility of Nonelectrolytes" they present a table showing the solubility of sulfur (S_8) at 25°C in benzene and toluene. In weight per cent sulfur is more soluble in benzene; however, in mol per cent or grams per liter sulfur is more soluble in toluene. There are about ten commonly used solubility units for gas solubilities, some of them historical, some in general use, and some specific to a given discipline. In the data sheets we have tabulated the solubilities in the units reported in the original paper. Where feasible the compilers have converted these solubilities to the Ostwald coefficient and/or the mole fraction solubility at 1 atm (101.325 kPa) partial pressure of gas. The conversions were carried out so that users of this volume would find most solubilities reported in a single unit, which could then be used for comparative purposes. Unless otherwise specified the units for the Bunsen coefficients reported herein are cm^3(STP) cm^{-3} atm^{-1}.

Although data are reported in the units presented in the original paper, they are also presented in SI in the tables (where feasible), and always in SI in the "VARIABLES" box. With respect to naming components, we have attempted to use IUPAC nomenclature throughout, the Hill system for the formulas, and the unique Chemical Abstracts Registry Numbers for the substances.

Error estimates are always difficult to do. The individual compilers have either made their own estimates or cited those of the authors. In many cases the source and purity of the materials used in the investigations were missing in the original papers. Authors should be aware that such information is useful for other workers and as a means of validating their own work. Sometimes descriptions of procedures and apparatus were sketchy. The compilers have done their best in obtaining this information from articles which were published in other languages than English.

The smoothing equations used have been of the simple two-constant form for data of average precision or of the three-constant form used by Weiss based on the Clarke and Glew approach.

$$\Delta\bar{G}_1^\circ/\mathrm{J\ mol^{-1}} = -RT \ln x_1 = A + BT \qquad (1)$$

or

$$\ln x_1 = -\Delta\bar{G}_1^\circ/RT = -(A/R)/T - (B/R) \qquad (2)$$

or

$$\ln x_1 = A_0 + A_1/(T/100\ \mathrm{K}) + A_2 \ln(T/100\ \mathrm{K}) \qquad (3)$$

Using T/100 K as a variable rather than T/K leads to coefficients of similar order of magnitude. The smoothing equations and the thermodynamic functions calculated from them are presented in the "critical evaluation" sections.

Real gas corrections are not necessary for oxygen since the molar volume at STP is 22,393 $\mathrm{cm^3 mol^{-1}}$ which leads to a correction of 0.09 per cent. Only the data of B. B. Benson and his co-workers are sufficiently precise to require real gas corrections and the reported values were so corrected. The second virial coefficient for oxygen varies smoothly from -45 $\mathrm{cm^3\ mol^{-1}}$ at 200 K to -1.0 $\mathrm{cm^3\ mol^{-1}}$ at 400 K. This converts to correction factors of 0.27 per cent at 200 K to 0.063 per cent at 300 K to 0.003 per cent at 400 K. Again, these corrections are negligible considering the general precision of most of the work reported herein of 0.5 to 2.0 per cent.

In most cases the sorting of systems according to the table of contents was easy. However, for data sheets reporting on solubility in a number of solvents and for some of the "miscellaneous" systems the editor had to make some arbitrary decisions. Common names of solvents are used as well as the systematic names to aid the reader.

The literature search turned up no data for the solubility of oxygen in heavy water, D_2O. This system should be measured. The reader will also note the paucity of high pressure solubility measurements for oxygen. This is no doubt due to the probability of converting the dissolution vessel into a bomb calorimeter.

The Editor appreciates the advice and suggestions made by members of the IUPAC Commission on Solubility Data, the encouragement of the Chief Editor of this series, the cooperation and hard work of the Evaluators and Compilers, and the efforts of the secretaries and assistants who worked on the project - Marty Tucker, Pauline Shively, B. Ramalingam, Tracy Park, Carolyn Dowie, and Lesley Flanagan.

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Rubin Battino

Dayton, OH

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

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

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

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

where $v^{\circ}(1)$ 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(1) is the original (starting) volume of absorbing solvent. The mole fraction solubility x is related to the Bunsen coefficient by

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

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

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

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

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

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

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

$$P(g) = K_H x$$

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

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

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

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

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

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

SALT EFFECTS

The effect of a dissolved salt in the solvent on the solubility of a gas is often studied. The activity coefficient of a dissolved gas is a function of the concentration of all solute species (see ref. 8). At a given temperature and pressure the logarithm of the dissolved gas activity coefficient can be represented by a power series in C_s, the electrolyte concentration, and C_i, the nonelectrolyte solute gas concentration

$$\log f_i = \sum_{m,n} k_{mn}\ C_s^{\ n}\ C_i^{\ m}$$

It is usually assumed that only the linear terms are important for low C_s and C_i values when there is negligible chemical interaction between solute species.

$$\log f_i = k_s C_s + k_i C_i$$

where k_s is the salt effect parameter and k_i is the solute-solute gas interaction parameter. The dissolved gas activity is the same in the pure solvent and a salt solution in that solvent for a given partial pressure and temperature

$$a_i = f_i S_i = f_i^{\ o} S_i^{\ o} \text{ and } f_i = f_i^{\ o}\ \frac{S_i^{\ o}}{S_i}$$

where S_i and $S_i^{\ o}$ are the gas solubility in the salt solution and in the pure solvent, respectively, and the f's are the corresponding activity coefficients. If follows that $\log f_i/f_o = \log S_i^{\ o}/S_i = k_s C_s + k_i(S_i - S_i^{\ o})$. When the quantity $(S_i - S_i^{\ o})$ is small the second term is negligible even though k_s and k_i may be of similar magnitude. This is generally the case for gas solubilities and the equation reduces to

$$\log \frac{f_i}{f_i^{\ o}} = \log \frac{S_i^{\ o}}{S_i} = k_s C_s$$

which is the form of the empirical Setschenow equation in use since the 1880's. A salt that increases the activity coefficient of the dissolved gas is said to salt-out and a salt that decreases the activity coefficient of the dissolved gas is said to salt-in.

Although salt effect studies have been carried out for many years, there appears to be no common agreement of the units for either the gas solubility or the salt concentration. Both molar ($mol\ dm^{-3}$) and molal ($mol\ kg^{-1}$) are used for the salt concentration. The gas solubility ratio $S_i^{\ o}/S_i$ is given as Bunsen coefficient ratio and Ostwald coefficient ratio, which would be the same as a molar ratio; Kueunen coefficient ratio, volume dissolved in 1 g or 1 kg of solvent which would be a molal ratio; and mole fraction ratio. Recent theoretical treatments use salt concentration in mol dm^{-3} and $S_i{}^0/S_i$ ratio as mole fraction ratio with each salt ion acting as a mole. Evaluations which compare the results of several workers are made in the units most compatible with present theory.

TEMPERATURE DEPENDENCE OF GAS SOLUBILITY

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

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

It is then possible to write the thermodynamic functions $\Delta\overline{G}_1^0, \Delta\overline{H}_1^0, \Delta\overline{S}_1^0$ and $\Delta\overline{C}^0_{p1}$ for the transfer of the gas from the vapor phase at 101.325 Pa partial pressure to the (hypothetical) solution phase of unit mole fraction as:

$$\Delta\overline{G}_1^0 = -RAT - 100\ RB - RCT \ln (T/100)$$

$$\Delta\overline{S}_1^0 = RA + RC \ln (T/100) + RC$$

$$\Delta\overline{H}_1^0 = -100\ RB + RCT$$

$$\Delta\overline{C}^0_{p1} = RC$$

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

$$\Delta\overline{G}_1^0 = - RT \ln x = A + BT$$

in which case $A = \Delta\overline{H}_1^0$ and $-B = \Delta\overline{S}_1^0$.

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COMPONENTS:	EVALUATOR:
(1) Oxygen; O_2; [7782-44-7] (2) Water; H_2O; [7732-18-5]	Rubin Battino Department of Chemistry Wright State University Dayton, OH 45435 U.S.A.

CRITICAL EVALUATION:

The solubility of oxygen in water at atmospheric pressure has probably been the most intensively studied gas solubility system. The work started with the early and crude measurements of Bunsen in 1855 and extends to the high precision measurements of Benson, Krause, and Peterson in 1979. The solubility may be determined by strictly physical means such as measuring P, V, and T, by chemical means via some version of the Winkler method, by gas chromatography, and via electrochemical methods using some version of the Clark electrode and polarography. The correspondence between the several approaches is surprisingly good.

Since this system is of such interest to oceanographers and biologists and biochemists and limnologists and sanitary engineers and physical chemists (to name a few!), I will be presenting two sets of recommended values. The first set covers the temperature range 273 to 348K and is a smoothed composite of the work in some fifteen papers. The second set covers the range 273 to 333K and is the smoothed values of Benson, Krause, and Peterson. (Details follow.) The agreement on these solubility values to a precision of about ±0.2 per cent leads me to recommend that the Benson, Krause, and Peterson smoothed values be taken as standard for comparison and that all workers in the field test their apparatus and methods against them, particularly the 298.15K mole fraction solubility at 101.325kPa partial pressure of gas of 2.301×10^{-5}. This value is 0.17 per cent higher than the smoothed value recommended in the review by Wilhelm, Wilcock, and Battino (1) and 0.30 per cent higher than the value recommended in the earlier review by Battino and Clever (2). Thus, it would be safe to state that the recommended values are reliable to at least ±0.30 per cent.

Over forty papers with data on the O_2/H_2O system were screened - of these some twenty-five were considered to contain data of sufficient accuracy (comparing them against the smoothed valued in reference 1) to attempt smoothing as a group. After many trials and rejecting the papers containing points about two standard deviations beyond the smoothed line, a group of fifteen papers remained which used a variety of approaches to the measurements. The 149 points used in the smoothing were obtained as follows (reference - number of data points used from that reference): 3-21, 4-37, 5-26, 6-14, 7-2, 8-15, 9-1, 10-3, 11-14, 12-1, 13-1, 14-1, 15-8, 16-3, 17-2. The fitting equation used was

$$\ln x_1 = A + B/(T/100K) + C \ln (T/100K) \tag{1}$$

By using T/100K as the variable the coefficients were all of the same order of magnitude. Increasing the order of fit to four and five constants did not improve the fit at all. The best fit for the 149 points gave

$$\ln x_1 = -66.73538 + 87.47547/(T/100K) + 24.45264 \ln (T/100K) \tag{2}$$

where x_1 is the mole fraction solubility at 101.325 kPa partial pressure of gas. The standard deviation of the fit in x_1 was $\pm 0.72 \times 10^{-7}$ for a per cent deviation of ±0.36 per cent at the middle of the temperature range of 273 to 348K. Table 1 gives smoothed values of the mole fraction at 101.325 kPa partial pressure of gas and the Ostwald coefficient at 5K intervals.

Table 1 also gives the thermodynamic functions $\Delta\bar{G}_1^\circ$, $\Delta\bar{H}_1^\circ$, and $\Delta\bar{S}_1^\circ$, for the transfer of gas from the vapor phase at 101.325 kPa partial pressure to the (hypothetical) solution phase of unit mole fraction. These thermodynamic properties were calculated from the smoothing equation according to the following equations:

$$\Delta\bar{G}_1^\circ = -RAT-100RB-RCT \ln(T/100) \tag{3}$$

$$\Delta\bar{S}_1^\circ = RA + RC \ln(T/100) + RC \tag{4}$$

continued on following page

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

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

EVALUATOR:

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

CRITICAL EVALUATION:

continued

$$\Delta\bar{H}_1^\circ = -100RB + RCT \qquad (5)$$

$$\Delta C_{p_1}^\circ = RC \qquad (6)$$

The $\Delta\bar{C}_{p_1}^\circ$ value was constant at 203 J $mol^{-1}K^{-1}$.

TABLE 1. Smoothed values of the solubility of oxygen in water, and thermodynamic functions at 5K intervals using equation 2 at 101.325 kPa partial pressure of gas

T/K	$10^5\ x_1^a$	$10^2 L^b$	$\Delta\bar{G}_1^\circ$/ kJ mol^{-1}	$\Delta\bar{H}_1^\circ$/ kJ mol^{-1}	$\Delta\bar{S}_1^\circ$/ J $mol^{-1}K^{-1}$
273.15	3.949	4.913	23.02	-17.20	-147.3
278.15	3.460	4.384	23.75	-16.18	-143.6
283.15	3.070	3.958	24.46	-15.16	-139.9
288.15	2.756	3.614	25.15	-14.15	-136.4
293.15	2.501	3.333	25.83	-13.13	-132.9
298.15	2.293	3.104	26.48	-12.11	-129.5
303.15	2.122	2.918	27.12	-11.10	-126.1
308.15	1.982	2.766	27.74	-10.08	-122.7
313.15	1.867	2.643	28.35	- 9.06	-119.5
318.15	1.773	2.545	28.94	- 8.05	-116.3
333.15	1.697	2.468	29.51	- 7.03	-113.1
328.15	1.635	2.409	30.07	- 6.01	-110.0
333.15	1.586	2.367	30.61	- 5.00	-106.9
338.15	1.549	2.339	31.14	- 3.98	-103.9
343.15	1.521	2.325	31.65	- 2.97	-100.9
348.15	1.502	2.323	32.15	- 1.95	- 97.9

[a] Mole fraction solubility at 101.325 kPa partial pressure of gas.

[b] Ostwald coefficient.

Benson, Krause, and Peterson (4) studied the solubility of oxygen in water and attained an unprecedented precision in their work. If we fit their 37 data points using equation (1) we get

$$\ln x_1 = -64.21517 + 83.91236/(T/100K) + 23.24323 \ln(T/100K) \qquad (7)$$

This is for the temperature range 273 to 333 K and it fits the data with a standard deviation in x_1 of $\pm 0.36 \times 10^{-7}$ or ±0.17 per cent at the mid-point. However, the authors chose to fit their data to the following equation

$$\ln k = 3.71814 + 5.59617 \times 10^3/(T/K) - 1.049668 \times 10^6/(T/K)^2 \qquad (8)$$

where the fugacity $f = k\ x_1$ and k is the Henry coefficient. They recommend this equation over the 273 to 373 K range. For unit fugacity the mole fraction solubilities calculated from this equation are given in Table 2 at 5 K intervals. The standard deviation of the fit to this equation is ±0.017 per cent. If equation 8 is written in the general form of

$$\ln k = a_0 + a_1/(T/K) + a_2/(T/K)^2 \qquad (9)$$

then the thermodynamic functions are given by:

$$\Delta\bar{G}_1^\circ = R\ [a_0(T/K) + a_1 + a_2/(T/K)] \qquad (10)$$

continued on following page

COMPONENTS:	EVALUATOR:
(1) Oxygen; O_2 [7782-44-7] (2) Water; H_2O; [7732-18-5]	Rubin Battino Department of Chemistry Wright State University Dayton, OH 45435 U.S.A.

CRITICAL EVALUATION:

continued

$$\Delta\bar{H}_1^\circ = R \quad a_1 + 2a_2/(T/K)$$

$$\Delta\bar{S}_1^\circ = R \quad -a_0 + a_2/(T/K)^2$$

$$\Delta\bar{C}p_1^\circ = -2 \; R \; a_2/(T/K)^2$$

The values calculated from these equations differ little from those presented in Table 1 except, of course, for the heat capacity. Equation 13 predicts a temperature dependence which equation 6 does not.

TABLE 2. Smoothed values of the solubility of oxygen in water using equation 8 at 5K intervals and at unit fugacity

T/K	10^5x_1 [a]	T/K	10^5x_1 [a]	T/K	10^5x_1
273.15	3.9583	308.15	1.9906	343.15	1.4930
278.15	3.4655	313.15	1.8743	348.15	1.4634
283.15	3.0747	318.15	1.7776	353.15	1.4403
288.15	2.7614	323.15	1.6973	358.15	1.4230
293.15	2.5078	328.15	1.6305	363.15	1.4107
298.15	2.3009	333.15	1.5753	368.15	1.4031
303.15	2.1310	338.15	1.5299	373.15	1.3996

[a] Mole fraction solubility at unit fugacity.

Benson, et al. (4) also analyzed the high-pressure data of Stephan, et al. (18) and calculated Henry coefficients from this data. Benson, et al., fit the Stephan, et al., data with their own and obtained equation 14 which they recommend for values above 373K. The Stephan, et al., data was

$$\ln k = -4.1741 + 1.3104 \times 10^4/(T/K) - 3.4170 \times 10^6/(T/K)^2 + 2.4749 \times 10^8/(T/K)^3 \qquad (14)$$

fit to ±2.0 per cent which was within their experimental error. Table 3 contains the mole fraction solubilities calculated using equation 14 in the temperature range 373 to 563K.

TABLE 3. Smoothed values of the mole fraction solubility of oxygen in water using equation 14 at 5K intervals and 101.325 kPa partial pressure of gas.

T/K	10^5x_1	T/K	10^5x_1	T/K	10^5x_1
373.15	1.414	438.15	1.889	503.15	3.312
378.15	1.423	443.15	1.960	508.15	3.477
383.15	1.437	448.15	2.036	513.15	3.653
388.15	1.455	453.15	2.117	518.15	3.839
393.15	1.478	458.15	2.205	523.15	4.036
398.15	1.505	463.15	2.298	528.15	4.245
403.15	1.537	468.15	2.399	533.15	4.467
408.15	1.573	473.15	2.506	538.15	4.701
413.15	1.614	478.15	2.620	543.15	4.949
418.15	1.659	483.15	2.742	548.15	4.701
423.15	1.710	488.15	2.871	553.15	5.488
428.15	1.765	493.15	3.009	558.15	5.781
433.15	1.824	498.15	3.156	563.15	6.090

continued on following page

COMPONENTS:	EVALUATOR:
(1) Oxygen; O_2; [7782-44-7] (2) Water; H_2O; [7732-18-5]	Rubin Battino Department of Chemistry Wright State University Dayton, OH 45435 U.S.A.

CRITICAL EVALUATION:

continued

Ten references (19-28) contained data of sufficient accuracy and/or historical interest to have had data sheets prepared. However, they did not meet the overall requirements of being included in the group of fifteen used for the initial smoothing.

For completeness of coverage I am also including references to other work (29-50), most of which was of much poorer precision. Bunsen's papers, for example, are of historic interest, but his values are erratically 10-20 per cent off from modern measurements. Finally, the Klots and Benson paper (51) contains data for the ratio of $^{32}O_2$ to $^{34}O_2$ solubilities in water. The heavier isotope is more soluble by about 0.08 per cent.

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continued on following page

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

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

EVALUATOR:

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CRITICAL EVALUATION:

continued

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COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

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

ORIGINAL MEASUREMENTS:

Timofeev, W.

Z. Physik. Chem. 1890, *6*, 141-52.

VARIABLES:

T/K = 279-286

P/kPa = 101.325

PREPARED BY:

R. Battino

EXPERIMENTAL VALUES:

T/K^a	$10^5\ x_1$ [b]	$10^2\ L^c$	$10^2\alpha^d$
279.55	3.328	4.236	4.1408
285.72	2.896	3.767	3.6011

[a] Temperature reported to 0.1°C.

[b] Mole fraction solubility at 101.325 kPa (1atm) partial pressure of gas. Calculated by compiler.

[c] Ostwald coefficient calculated by compiler.

[d] Bunsen coefficient.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Used a Bunsen absorption apparatus as modified by Ostwald. Basically, a manometric/volumetric apparatus. Details and a drawing are given in the paper.

SOURCE AND PURITY OF MATERIALS:

No details given.

ESTIMATED ERROR:

$\delta\alpha/\alpha$ = ±0.01, estimate by compiler.

REFERENCES:

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

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

ORIGINAL MEASUREMENTS:

Geffcken, G.

Z. Physik. Chem. 1904, *49*, 257-302.

VARIABLES:

T/K = 288 - 298

P/kPa = 101.325 (1 atm)

PREPARED BY:

R. Battino

EXPERIMENTAL VALUES:

T/K^a	$10^5\ x_1$ [b]	10^2L^c
288.15	2.768	3.630^d
298.15	2.275	3.080^e

[a] Temperature reported as 15 and 25°C.

[b] Mole fraction solubility at 101.325 kPa (1 atm) partial pressure of gas. Calculated by compiler.

[c] Ostwald coefficient.

[d] Average of the following values (10^2L): 3.639, 3.640, 3.619, 3.635, 3.618, 3.643, 3.618.

[e] Average of the following values (10^2L): 3.096, 3.074, 3.096, 3.087, 3.081, 3.081, 3.091. (Average is 3.088, although the author reported 3.080.)

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The design of Ostwald was used. The critical gas burets and a absorption vessel were thermostatted. A manometric/volumetric procedure. Details and a drawing given in the original paper.

SOURCE AND PURITY OF MATERIALS:

(1) Prepared from heating pure $KClO_3$ and MnO_2. Washed in dilute KOH and dried over concentrated H_2SO_4.

(2) No comment by author.

ESTIMATED ERROR:

$\delta L/L = \pm 0.01$, estimate by compiler.

REFERENCES:

COMPONENTS:

(1) Oxygen; O_2; [7782-44-77]

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

ORIGINAL MEASUREMENTS:

Fox, C.J.J.

Trans. Faraday Soc. 1909, *5*, 68-87.

VARIABLES:

T/K = 273-316

PREPARED BY:

R. Battino

EXPERIMENTAL VALUES:

T/K[a]	Mole Fraction[b] 10^5x_1	Ostwald Coefficient[c] 10^2L	Bunsen Coefficient[d] $10^2\alpha$
273.76	3.907	4.872	4.861
273.96	3.873	4.832	4.818
278.66	3.422	4.344	4.258
278.75	3.422	4.345	4.258
283.97	3.035	3.925	3.775
284.05	3.036	3.927	3.776
288.75	2.733	3.591	3.397
288.75	2.752	3.616	3.421
293.95	2.500	3.341	3.105
293.96	2.489	3.326	3.091
299.15	2.296	3.118	2.847
299.15	2.300	3.123	2.852
304.13	2.034	2.805	2.519
304.19	2.032	2.803	2.517
308.64	1.993	2.785	2.465
308.74	1.993	2.786	2.465
313.19	1.889	2.674	2.332
313.24	1.887	2.672	2.330
318.44	1.782	2.559	2.195
318.44	1.778	2.553	2.190
323.40	1.699	2.472	2.088
323.44	1.699	2.472	2.088

continued on following page

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

A modified form of the Estreicher (1) apparatus was used. Diagram and procedure given in paper. The water is degassed by boiling using a double flask system. The quantity of water is determined by weighing. The dry gas is introduced from a gas buret, the flask shaken and a final reading of the volume of gas absorbed is made after there are no changes. A manometer is used to take readings at different pressures. Several readings at different temperatures are taken on one loading of the absorption flask.

SOURCE AND PURITY OF MATERIALS:

(1) Generated by heating $KMnO_4$ in in a tube and then passing it over soda lime and P_2O_5.

(2) Distilled.

ESTIMATED ERROR:

$\delta\alpha/\alpha = \pm 0.004$ estimated by compiler.

REFERENCES:

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COMPONENTS:

(1) Oxygen; O_2; [7782-44-77]

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

ORIGINAL MEASUREMENTS:

Fox, C.J.J.

Trans. Faraday Soc. 1909, 5, 68-87.

continued

T/K[a]	Mole Fraction[b] 10^5x_1	Ostwald Coefficient[c] 10^2L	Bunsen Coefficient[d] $10^2\alpha$
274.78[e]	3.799	4.755	4.727
275.33	3.726	4.673	4.636
279.35	3.367	4.284	4.189
279.75	3.342	4.258	4.158
282.68	3.116	4.011	3.876
282.76	3.116	4.012	3.876
286.80	2.855	3.727	3.550
286.90	2.844	3.714	3.536
289.87	2.691	3.549	3.344
289.90	2.680	3.534	3.330
296.95	2.391	3.226	2.967
297.05	2.383	3.216	2.957
303.01	2.140	2.941	2.651
303.03	2.147	2.951	2.660
310.66	1.950	2.740	2.409
310.69	1.947	2.737	2.406
316.40	1.818	2.596	2.241
316.44	1.817	2.595	2.240

[a] Original temperature reported at °C to 0.01°C.

[b] Mole fraction solubility at 101.325 kPa (1 atm) partial pressure of gas calculated by compiler.

[c] Ostwald coefficients calculated by compiler.

[d] Bunsen coefficients reported in original paper.

[e] Second series of measurements.

[f] Smoothing equation of author given as

$$1000\ \alpha = 49.239 - 1.3440t + 0.28752\ t^2 - 0.0003024\ t^3$$

with t in °C.

[g] Author also determined the solubility of oxygen in seawater (0-28°C) and 0-20 per $\mathrm{mille}^{\mathrm{Cl}}_{\mathrm{Cl}}$.

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

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

ORIGINAL MEASUREMENTS:

Bohr, C.

Z. Physik. Chem. 1910, *71*, 47-50.

VARIABLES:

T/K = 294

P/kPa = 101.325

PREPARED BY:

R. Battino

EXPERIMENTAL VALUES:

T/K^a	$10^5\ x_1{}^b$	$10^2 L^c$	$10^2 \alpha^d$
294.15	2.480	3.316	3.079

[a] Temperature reported to 0.1°C.

[b] Mole fraction solubility at 101.325 kPa (1 atm) partial pressure of gas calculated by compiler.

[c] Ostwald coefficient calculated by compiler.

[d] Bunsen coefficient.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The absorption measuring apparatus is described in reference (1). Paper also reports solubilities in sulfuric acid solutions.

SOURCE AND PURITY OF MATERIALS:

No details given.

ESTIMATED ERROR:

$\delta\alpha/\alpha = \pm 0.01$, estimate by author.

REFERENCES:

1. Bohr, C. *Sauerstoffaufnahme des Blutfarbstoffes.* Kopenhagen 1895. *Jolin, Archiv f. (Anat. u.) Physiologie* 1889, 265.

COMPONENTS: (1) Oxygen; O_2; [7782-44-7] (2) Water; H_2O; [7732-18-5]	ORIGINAL MEASUREMENTS: Müller, C. *Z. Physik. Chem.* <u>1912</u>, *81*, 483-503.
VARIABLES: T/K = 288-289 P/kPa = 101.325	PREPARED BY: R. Battino

EXPERIMENTAL VALUES:

T/K[a]	Mole Fraction[b] $10^5\ x_1$	Ostwald Coeff.[c] $10^2 L$	Bunsen Coeff.[d] $10^2 \alpha$
288.45	2.715	3.564	3.375
289.35	3.528	3.528	3.330

[a] Temperature reported to 0.1°C.

[b] Mole fraction solubility at 101.325 kPa (1atm) partial pressure of gas calculated by compiler.

[c] Ostwald coefficient calculated by compiler.

[d] Bunsen coefficient.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Water is degassed by pumping under vacuum. The absorption vessel is about 600 cm^3 and is separately thermostatted from the buret gas measuring system. Both are connected by a copper capillary tube. Gas uptake is real on the volume and all liquid volumes were calibrated with mercury. Original paper contains details and a drawing. Solubilities also reported in sucrose, d-glucose, chloral hydrate, and glycerol aqueous solutions.

SOURCE AND PURITY OF MATERIALS:

(1) From the heating of $KMnO_4$ and washed in concentrated KOH solution.

(2) No comment by author.

ESTIMATED ERROR:

$\delta\alpha/\alpha = \pm 0.01$, estimate by compiler.

REFERENCES:

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

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

ORIGINAL MEASUREMENTS:

Adeney, W. E.; Becker, H. G.

Royal Dublin Soc. Scientific Pro. 1919, *15*, 609-28.

VARIABLES:

T/K = 276-308

PREPARED BY:

R. Battino

EXPERIMENTAL VALUES:

t/°C	T^a/K	$10^5 x_1{}^{a,b}$	$10^2 L^{a,c}$	$10^2 \alpha^d$/cm^3(STP)cm^{-3}atm^{-1}
2.5	275.7	3.529	4.431	4.390
8.8	282.0	2.982	3.830	3.710
15.5	288.7	2.580	3.389	3.206
20.2	293.4	2.379	3.174	2.955
25.2	298.4	2.203	2.985	2.732
30.3	303.5	1.990	2.739	2.465
35.1	308.3	1.835	2.562	2.270

[a] Calculated by compiler.

[b] Mole fraction solubility at 101.325 kPa partial pressure of gas.

[c] Ostwald coefficient.

[d] Bunsen coefficient.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

A manometric system using water-jacketed burets was used.

SOURCE AND PURITY OF MATERIALS:

(1) Prepared from heating potassium permanganate and washing the gas with caustic potash.

(2) Distilled.

ESTIMATED ERROR:

$\delta\alpha/\alpha = \pm 0.02$, compiler's estimate.
$\delta T/K = \pm 0.1$

REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Oxygen; O_2; [7782-44-7] (2) Water; H_2O; [7732-18-5]	Livingston, J.; Morgan, R.; Richardson, A.H. *J. Phys. Chem.* 1930, *34*, 2356-66.

VARIABLES:	PREPARED BY:
T/K = 298 P/kPa = 23 - 101	R. Battino

EXPERIMENTAL VALUES:

t/°C	T^a/K	$10^5x_1{}^{a,b}$	$10^2L^{a,c}$	q'^d
25	298	2.304	3.120	0.04080

[a] Calculated by compiler.

[b] Mole fraction solubility at 101.325 kPa partial pressure of gas.

[c] Ostwald coefficient.

[d] Weight of oxygen absorbed by 1000 cm^3 of solvent at 25°C and a partial pressure of 760 mm Hg. Average of twelve measurements at slightly varying total pressures near 760 mm Hg.

P_{O_2}/mmHg	10^2q^a	10^2L^b
174.7	0.95	3.158
202.2	1.07	3.073
240.7	1.28	3.088
242.5	1.28	3.065
280.7	1.50	3.103

continued on following page

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The Winkler method was used to determine the amount of dissolved oxygen. Details are given in the paper. For the hydrostatic pressure measurements the equilibration flask was under a pressure due to a column of water.

SOURCE AND PURITY OF MATERIALS:

No details given.

ESTIMATED ERROR:

$\delta q'/q'$ = ±0.003, authors' estimate.

REFERENCES:

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

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

ORIGINAL MEASUREMENTS:

Livingston, J.; Morgan, R.; Richardson, A.H.

J. Phys. Chem. 1930, *34*, 2356-66.

continued

P_{O_2}/mm Hg	10^2q^a	10^2L^b
300.3	1.60	3.094
349.0	1.84	3.062
364.1	1.96	3.126
396.1	2.10	3.079
413.7	2.10	3.088
433.3	2.27	3.042
440.5	2.33	3.072
446.7	2.35	3.055
458.3	2.43	3.079
478.1	2.54	3.085
504.8	2.65	3.049
511.4	2.73	3.107
539.7	2.83	3.045
559.3	2.95	3.063
577.7	3.03	3.046
610.2	3.25	3.093
614.6	3.27	3.090
639.7	3.37	3.059
649.2	3.42	3.059
738.7	3.87	3.042
741.1	3.94	3.087
741.1	3.93	3.080

[a] Grams of oxygen/1000 cm^3 solvent at the partial pressure of gas indicated. All measurements at 25°C (298 K).

[b] Ostwald coefficient. Calculated from

$$L = \frac{224 \times 298 \times 760 \times q}{320 \times 273 \times P_{O_2}}$$

t/°C	T^a/K	P_T^b/mm Hg	$10^2 gO_2^c/dm^3$	$10^2 q'^{,d}$	$10^2 L^e$
15.2	288.4	815.4	5.438	5.016	3.833
15.2	288.4	850.9	5.478	4.865	3.717
15.2	288.4	861.3	5.582	4.898	3.743
15.2	288.4	921.2	5.889	4.891	3.737
16.6	289.8	801.8	5.346	4.847	3.704
16.6	289.8	855.6	5.306	4.520	3.454
16.6	289.8	862.2	5.441	4.601	3.516
16.6	289.8	887.0	5.881	4.840	3.698
17.2	290.4	819.0	4.198	4.765	3.641
17.2	290.4	857.5	5.193	4.549	3.476
17.2	290.4	884.9	5.553	4.715	3.603
17.2	290.4	908.6	5.806	4.803	3.670
19.2	292.4	794.1	4.890	4.524	3.457
19.2	292.4	839.7	5.046	4.423	3.380
19.2	292.4	867.5	5.305	4.506	3.365
19.2	292.4	897.7	5.564	4.511	3.447
20.2	293.4	796.8	4.716	4.370	3.339
20.2	293.4	853.8	5.024	4.352	3.326
20.2	293.4	869.4	5.036	4.287	3.276
20.2	293.4	884.9	5.106	4.272	3.264
20.4	293.6	804.9	4.796	4.579	3.499
20.4	293.6	857.1	5.065	4.441	3.394

continued on following page

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

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

ORIGINAL MEASUREMENTS:

Livingston, J.; Morgan, R.;
Richardson, A.H.

J. Phys. Chem. 1930, *34*, 2356-66.

continued

t/°C	T^a/K	P_T^b/mm Hg	$10^2 g O_2^c/dm^3$	$10^2 q'^c$	$10^2 L^e$
20.4	293.6	875.8	5.193	4.457	3.406
20.4	293.6	904.3	5.454	4.451	3.401
20.6	293.8	802.6	4.796	4.377	3.345
20.6	293.8	857.0	5.043	4.320	3.301
20.6	293.8	859.6	4.972	4.247	3.245
20.6	293.8	891.5	5.271	4.346	3.321
21.0	294.2	832.7	4.926	4.392	3.357
21.0	294.2	839.0	4.966	4.395	3.358
21.0	294.2	868.1	5.056	4.328	3.307
21.0	294.2	894.1	5.111	4.251	3.248
21.0	294.2	797.0	4.684	4.380	3.347
21.0	294.2	829.6	4.826	4.339	3.316
21.0	294.2	878.1	5.123	4.355	3.328
21.0	294.2	895.1	5.209	4.346	3.321
21.5	294.7	781.5	4.580	4.346	3.321
21.5	294.7	807.7	4.741	4.320	3.301
21.5	294.7	864.8	5.078	4.330	3.309
21.5	294.7	883.3	5.186	4.332	3.310

[a] Calculated by compiler.

[b] Total pressure. Height of a column of water plus atmospheric pressure.

[c] Grams of oxygen/dm^3 solvent at the pressure of the measurement.

[d] Grams of oxygen/dm^3 solvent at 1 atm (101.325 kPa) partial pressure of oxygen.

[e] Ostwald coefficient.

[f] All measurements at 25°C (298 K).

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

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

ORIGINAL MEASUREMENTS:

Morrison, T.J.; Billett, F.

J. Chem. Soc. 1952, 3819-22.

VARIABLES:

T/K - 286 - 348

PREPARED BY:

R. Battino

EXPERIMENTAL VALUES:

T/K[a]	Mole Fraction[b] 10^5x_1	Ostwald Coeff.[c] 10^2L	S_o[d]
285.85	2.926	3.808	36.39
286.65	2.860	3.732	35.56
290.45	2.622	3.464	32.58
294.65	2.427	3.250	30.13
303.15	2.138	2.940	26.49
312.55	1.889	2.670	23.33
322.45	1.715	2.490	21.09
331.65	1.615	2.400	19.77
338.45	1.562	2.360	19.05
345.65	1.508	2.318	18.32
348.05	1.500	2.319	18.20

[a] Temperature reported to 0.1°C.

[b] Mole fraction solubility at 101.325 Pa (1 atm) partial pressure of gas calculated by compiler.

[c] Ostwald coefficient calculated by compiler.

[d] S_o is the solubility in cm^3 at standard temperature and pressure per 1000g of water at a total gas pressure of 1 atm.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Solvent is degassed by thorough boiling. It then flows in a thin film down a glass spiral and into a buret system containing the gas to be dissolved. Equilibrium is rapidly attained. Flow rates may be varied over a wide range without affecting the solubility. The solvent serves as its own gas buret and volumes read on the burets are used to calculate the solubility. The method is described in reference (1). The present paper describes an improved degassing section based on the vapor-pump principle.

SOURCE AND PURITY OF MATERIALS:

(1) From a cylinder and from $KMnO_4$ gave the same results.

(2) No comment by authors.

ESTIMATED ERROR:

$\delta S_o/S_o = \pm 0.005$, estimate of reproducibility by authors.

REFERENCES:

1. Morrison, T.J.; Billett, F. *J. Chem. Soc.* 1948, 2033-5.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Oxygen; O_2; [7782-44-7] (2) Water; H_2O; [7732-18-5]	Steen, H. *Limnol. Oceanog.* 1958, 3, 423-6.

VARIABLES:	PREPARED BY:
T/K = 279 - 297 P/kPa = 101.325	R. Battino

EXPERIMENTAL VALUES:

T/K^a	$10^5x_1{}^b$	10^2L^c	$10^2\alpha^d$
279.15	3.367	4.281	4.189^e
285.15	2.952	3.832	3.671
291.15	2.599	3.442	3.229
297.15	2.341	3.160	2.905

[a] Temperature reported to 0.1°C.

[b] Molefraction solubility at 101.325 kPa (1 atm) partial pressure of gas. Calculated by compiler.

[c] Ostwald coefficient calculated by compiler.

[d] Bunsen coefficient.

[e] Average values at each temperature. Raw values are (all $\alpha \times 10^2$):

279.15K	285.15K	291.15K	297.15K
4.188	3.673	3.229	2.901
4.186	3.664	3.231	2.908
4.196	3.674	3.222	2.898
4.186	3.673	3.235	2.913

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The procedure followed was that used by Scholander (1) in his $0.5cm^3$ analyzer. Gas-free water was prepared by boiling. Temperature was controlled to ±0.01°C and known to ±0.05°C.

SOURCE AND PURITY OF MATERIALS:

No details given.

ESTIMATED ERROR:

$\delta\alpha/\alpha$ = ±0.3%, estimate by author.

$\delta T/T$ = ±0.05K, estimate by author.

REFERENCES:

1. Scholander, P.F. *J. Biol. Chem.* 1947, *167*, 235-50.

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

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

ORIGINAL MEASUREMENTS:

Elmore, H.L.; Hayes, T.W.

J. Sanit. Eng. Div. Am. Soc. Civil Engrs. 1960, *86(SA4)*, 41-53.

VARIABLES:

T/K = 275-302

PREPARED BY:

R. Battino

EXPERIMENTAL VALUES:

t/°C	T^a/K	$10^5 x_1^{a,b}$	$10^2 L^{a,c}$	$10^2 \alpha^{a,d}$/ cm^3(STP)$cm^{-3}atm^{-1}$	C_s^e
1.81	274.96	3.750	4.697	4.666	13.874
1.82	274.97	3.756	4.704	4.673	13.894
1.83	274.98	3.765	4.716	4.685	13.930
1.85	275.00	3.761	4.711	4.680	13.914
4.99	278.14	3.480	4.409	4.330	12.851
4.99	278.14	3.464	4.388	4.310	12.791
4.99	278.14	3.479	4.407	4.328	12.845
4.99	278.14	3.453	4.375	4.297	12.753
4.99	278.14	3.456	4.379	4.301	12.764
5.09	278.24	3.457	4.381	4.300	12.762
5.09	278.24	3.470	4.398	4.318	12.813
5.09	278.24	3.467	4.394	4.313	12.800
5.09	278.24	3.465	4.391	4.311	12.792
5.29	278.44	3.458	4.386	4.303	12.771
9.19	282.34	3.107	3.995	3.865	11.439
9.29	282.44	3.104	3.993	3.862	11.428
9.29	282.44	3.104	3.993	3.862	11.430
9.39	282.54	3.103	3.993	3.860	11.423
9.39	282.54	3.100	3.989	3.856	11.410
9.39	282.54	3.099	3.987	3.854	11.405
9.59	282.74	3.104	3.997	3.861	11.421
9.59	282.74	3.114	4.009	3.873	11.457

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AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The determination of the amount of dissolved oxygen was via the Winkler method. The procedure and the reagents used are described in detail. The endpoint in the final titration was detected amperometrically. Equilibrium saturation was attained via two methods:
(a) after the water was deoxygenated by bubbling nitrogen through it, the water was allowed to absorb oxygen from the overlying atmosphere with gentle stirring;
(b) the water was first supersaturated with gaseous oxygen and then allowed to approach the saturation level under the influence of constant gentle stirring.

SOURCE AND PURITY OF MATERIALS:

(1) From air or from a tank.

(2) Distilled.

ESTIMATED ERROR:

δC_s = ±0.020, standard deviation. Estimate by authors. Ranges from ±0.032 at 2°C to ±0.008 at 29°C.
δT/K = ±0.05

REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Oxygen; O_2; [7782-44-7] (2) Water; H_2O; [7732-18-5]	Elmore, H.L.; Hayes, T.W. *J. Sanit. Eng. Div. Am. Soc. Civil Engrs.* 1960, *86(SA4)*, 41-53.

continued

t/°C	T^a/K	$10^5 x_1^{a,b}$	$10^2 L^{a,c}$	$10^2 \alpha^{a,d}$/ cm^3(STP)$cm^{-3}atm^{-1}$	C_s^e
15.56	288.71	2.705	3.544	3.353	9.862
15.56	288.71	2.708	3.558	3.366	9.901
15.56	288.71	2.707	3.557	3.366	9.899
15.56	288.71	2.704	3.552	3.360	9.883
15.56	288.71	2.707	3.566	3.373	9.922
15.57	288.72	2.708	3.558	3.366	9.900
20.45	293.60	2.456	3.279	3.051	8.917
20.65	293.80	2.457	3.282	3.052	8.919
20.65	293.80	2.457	3.282	3.052	8.882
20.65	293.80	2.453	3.276	3.046	8.903
20.75	293.90	2.454	3.279	3.047	8.900
20.75	293.90	2.443	3.264	3.034	8.862
20.80	293.95	2.460	3.288	3.055	8.937
20.80	293.95	2.450	3.274	3.043	8.888
20.80	293.95	2.451	3.275	3.044	8.891
20.90	294.05	2.448	3.272	3.039	8.876
20.90	294.05	2.434	3.254	3.023	8.831
20.95	294.10	2.444	3.268	3.035	8.867
22.97	296.12	2.353	3.166	2.920	8.499
22.98	296.13	2.356	3.170	2.924	8.511
22.98	296.13	2.354	3.167	2.921	8.502
23.12	296.27	2.344	3.156	2.909	8.468
23.17	296.32	2.359	3.176	2.924	8.510
23.18	296.33	2.340	3.151	2.905	8.455
29.11	302.26	2.098	2.877	2.600	7.568
29.12	302.27	2.100	2.879	2.602	7.572
29.13	302.28	2.089	2.865	2.589	7.534
29.13	302.28	2.094	2.871	2.594	7.550
29.16	302.31	2.093	2.870	2.593	7.548
29.30	302.45	2.091	2.869	2.591	7.542

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[a] Calculated by compiler.

[b] Mole fraction solubility at 101.325 kPa partial pressure of gas.

[c] Ostwald coefficient.

[d] Bunsen coefficient.

[e] Solubility in mg O_2 per liter. All values reported are the means of five replicate determinations. The authors give the following smoothing curve:

$$C_s = 14.652 - 0.41022(t/°C) + 0.0079910(t/°C)^2 - 0.000077774(t/°C)^3$$

valid in the range 0 to 30°C.

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

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

ORIGINAL MEASUREMENTS:

Morris, C. J.; Stumm, W.; Galal, H.A.

Proc. Am. Soc. Civil Engrs. 1961, 85 81-6.

VARIABLES:

T/K = 278-303

PREPARED BY:

R. Battino

EXPERIMENTAL VALUES:

t/°C	T^a/K	$10^5x_1{}^{a,b}$	$10^2L^{a,c}$	$10^2\alpha^{d,e}$/ $cm^3(STP)cm^{-3}atm^{-1}$	$C_s{}^{d,f}$
5.14	278.29	3.483	4.415	4.333	12.833
7.24	280.39	3.275	4.182	4.074	12.050
9.53	282.68	3.142	4.044	3.908	11.542
9.58	282.73	3.096	3.986	3.851	11.371
9.93	283.08	3.082	3.973	3.834	11.319
14.76	287.91	2.766	3.624	3.438	10.104
18.16	291.31	2.606	3.453	3.238	9.475
18.50	291.65	2.588	3.433	3.215	9.404
19.41	292.56	2.588	3.433	3.215	9.265
23.47	296.62	2.379	3.206	2.952	8.567
25.80	298.95	2.271	3.083	2.817	8.141
29.10	302.25	2.198[g]	3.013[g]	2.723[g]	7.813[g]

[a] Calculated by compiler.

[b] Mole fraction solubility at 101.325 kPa partial pressure of gas.

[c] Ostwald coefficient.

[d] Determined by the chemical method.

[e] Bunsen coefficient.

[f] Solubility in mg O_2 per liter.

[g] Doubtful point-author's comment.

continued on following page

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

In the chemical method distilled water was saturated with CO_2 free normal air for three days and the dissolved oxygen determined by the Winkler method. In the manometric method pure gaseous oxygen at a known pressure was brought into contact with a known volume of degassed water in a closed system. At equilibrium, the solubility was determined from a buret reading. Details of both methods are given in the original paper.

SOURCE AND PURITY OF MATERIALS:

(1) Normal air freed from CO_2 for chemical method. No comment for physical method.

(2) Distilled.

ESTIMATED ERROR:

$\delta\alpha/\alpha = \pm 0.001$, authors' estimate.

$\delta T/K = \pm 0.03$

REFERENCES:

COMPONENTS:	EVALUATOR:
(1) Oxygen; O_2; [7782-44-7] (2) Water; H_2O; [7732-18-5]	Morris, C.J.; Stumm, W.; Galal, H.A. *Proc. Am. Soc. Civil Engrs.*, 1961, 85, 81-6.

continued

t/°C	T^a/K	$10^5x^{a,b}$	$10^2L^{a,c}$	$10^2\alpha^{d,e}$/ cm^3(STP)cm^{-3}atm^{-1}	$C_s^{d,f}$
11.47	284.62	2.965	3.843	3.688	10.89
14.54	287.69	2.767	3.623	3.440	10.13
15.00	288.15	2.766	3.627	3.438	10.12
15.00	288.15	2.729	3.579	3.398	9.99
17.03	290.18	2.660	3.511	3.305	9.70
22.79	295.94	2.376	3.195	2.949	8.59
22.79	295.94	2.364	3.179	2.934	8.54
22.79	295.94	2.382	3.203	2.956	8.61
22.79	295.94	2.359	3.172	2.928	8.53
22.79	295.94	2.364	3.179	2.934	8.54
26.97	300.12	2.216	3.018	2.747	7.93
26.98	300.13	2.223	3.028	2.756	7.95
29.96	303.11	2.163	2.974	2.680	7.69

[a] Calculated by compiler.

[b] Mole fraction solubility at 101.325 kPa partial pressure of gas.

[c] Ostwald coefficient.

[d] Determined manometrically.

[e] Bunsen coefficient.

[f] Solubility in mg O_2 per liter.

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

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

ORIGINAL MEASUREMENTS:

Klots, C. E.; Benson, B. B.

J. Marine Res. (Sears Found. Marine Res.) 1963, 21, 48-57.

VARIABLES:

T/K = 275-299

PREPARED BY:

R. Battino

EXPERIMENTAL VALUES:

T/K^a	Mole Fraction[b] 10^5x_1	Ostwald Coeff.[c] 10^2L	Bunsen Coeff.[d] $10^2\alpha$	$\alpha(O_2)/\alpha(N_2)^e$
275.44	3.736	4.687	4.648	2.047
276.10	3.651	4.591	4.542	2.037
278.93	3.389	4.305	4.216	2.027
279.69	3.336	4.249	4.150	2.029
280.19	3.292	4.202	4.096	2.026
284.87	2.957	3.835	3.677	2.004
284.95	2.945	3.820	3.662	1.999
287.52	2.801	3.665	3.482	1.997
295.13	2.417	3.241	3.000	1.955
296.29	2.365	3.184	2.935	1.947
296.35	2.366	3.186	2.937	1.950
296.83	2.344	3.161	2.909	1.947
296.86	2.348	3.167	2.914	1.950
297.20	2.333	3.150	2.895	1.949
297.51	2.324	3.141	2.884	1.949
299.42	2.247	3.055	2.787	1.936

continued on following page

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Two bulbs of ca. 300 cm^3 capacity are connected by two stopcocks. Degassed water is introduced into one bulb. Dry gas is introduced into the other bulb. The volumes of both are known to better than 0.05%. The stopcocks between the bulbs are opened, about one-half the water is moved into the gas bulb and the apparatus agitated in a thermostat for up to 48 hrs. Then the bulbs are placed upright and the saturated water and the gas phase isolated. The undissolved gas is removed and its pressure, volume and temperature measured in the dry state to determine the number of moles. The moles of dissolved gas are similarly determined. Constancy of gas mass in an experiment is about 0.05%. Solubility is calculated from the known volumes and quantities.

SOURCE AND PURITY OF MATERIALS:

(1) "Tank" grade with less than 0.2% nitrogen.

(2) "Sterile" distilled.

ESTIMATED ERROR:

Precision $\delta\alpha/\alpha$ = ±0.002, author's estimate.

REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Oxygen; O_2; [7782-44-7] (2) Water; H_2O; [7732-18-5]	Klots, C. E.; Benson, B. B. *J. Marine Res. (Sears Found. Marine Res.)* 1963, *21*, 48-57.

continued

T/K	$\alpha(O_2)/\alpha(N_2)$ [f]
278.90	2.024
284.10	2.002
285.05	1.999
285.05	2.002
295.55	1.947
296.85	1.944

[a] Calculated by compiler. Temperatures reported to 0.01°C.

[b] Mole fraction solubility at 101.325 Pa (1 atm) partial pressure of gas calculated by compiler.

[c] Ostwald coefficient calculated by compiler.

[d] Bunsen coefficient - data originally reported as.

[e] Ratio of solubility of O_2 to N_2 as Bunsen coefficients from a 50:50 mixture. Determined manometrically.

[f] Same as (e) but determined mass spectrometrically.
The precision in the solubility ratios (authors) is about 0.2%.

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

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

ORIGINAL MEASUREMENTS:

Douglas, E.

J. Phys. Chem. 1964, *68*, 169-74.

VARIABLES:

T/K = 281 - 302

P/kPa = 101.325

PREPARED BY:

R. Battino

EXPERIMENTAL VALUES:

T/K^a	Mole fraction[b] 10^5x_1	Ostwald Coeff.[c] 10^2L	Bunsen Coeff.[d] $10^2\alpha/cm^3(STP)cm^{-3}atm^{-1}$
281.15	3.202	4.101	3.984
281.15	3.207	4.107	3.990
281.15	3.204	4.103	3.986
281.15	3.198	4.095	3.978
281.15	3.200	4.098	3.981
293.09	2.492	3.321	3.095
293.09	2.494	3.324	3.098
293.09	2.494	3.324	3.098
293.09	2.496	3.326	3.100
293.09	2.490	3.318	3.092
302.30	2.139	2.934	2.651
302.30	2.142	2.937	2.654
302.30	2.143	2.938	2.655
302.30	2.141	2.936	2.653
302.30	2.139	2.934	2.651

[a] Temperature reported to 0.01°C.

[b] Mole fraction solubility at 101.325 kPa (1 atm) partial pressure of gas calculated by compiler.

[c] Ostwald coefficient calculated by compiler.

[d] Bunsen coefficient.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The apparatus and procedures are based on the Scholander microgasometric apparatus (1). This version uses one arm with an expanded solvent reservoir. Degassed water is introduced into this reservoir and sealed over mercury. The water is then tipped into the absorption chamber. Gas is introduced and the entire apparatus is shaken in a water thermostat (controlled to 0.01K). Gas and liquid volumes are read on a micrometer syringe by displacement of mercury.

SOURCE AND PURITY OF MATERIALS:

(1) No comment by author.

(2) Double distilled.

ESTIMATED ERROR:

$\delta\alpha/\alpha$ = ±0.003, estimate by author.

$\delta T/T$ = ±0.01 (to 0.02K), estimate by author

REFERENCES:

1. Scholander, P.F. *J. Biol. Chem.* 1947, *167*, 235-50.

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

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

ORIGINAL MEASUREMENTS:

Carpenter, J.H.

Limnol. Oceanog. 1966, *11*, 264-77.

VARIABLES:

T/K = 274 - 308

PREPARED BY:

R. Battino

EXPERIMENTAL VALUES:

t/°C	T^a/K	$10^5 x_1^{a,b}$	$10^2 L^{a,c}$	S^d	
0.48	273.63	3.909	4.872	10.120	
0.52	273.67	3.897	4.857	10.088	
0.64	273.79	3.887	4.847	10.062	
5.10	278.25	3.441	4.361	8.887	(7)[e]
5.21	278.36	3.430	4.349	8.858	
9.89	283.04	3.068	3.954	7.894	(4)[e]
10.10	283.25	3.056	3.942	7.863	
10.22	283.37	3.047	3.932	7.839	
11.68	284.83	2.952	3.828	7.584	
12.04	285.19	2.933	3.808	7.531	
12.40	285.55	2.912	3.786	7.476	(8)[e]
14.55	287.70	2.788	3.650	7.139	
14.72	287.87	2.780	3.642	7.116	
14.97	288.12	2.766	3.626	7.078	
14.99	288.14	2.766	3.627	7.079	
15.12	288.27	2.757	3.616	7.054	
15.14	288.29	2.758	3.618	7.057	
20.08	293.23	2.496	3.327	6.340	
20.10	293.25	2.497	3.330	6.344	
25.10	298.25	2.290	3.102	5.761	
25.35	298.50	2.280	3.091	5.734	
25.36	298.51	2.284	3.096	5.742	
29.80	302.95	2.132	2.929	5.301	

continued on following page

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Water in a plexiglass box was rocked in contact with the air. Equilibrated water is transferred to a calibrated 500 cm^3 bottle and the dissolved oxygen determined by the modified Winkler method described in reference (1). The precision of the titration technique is stated to be ±0.02%, but with an estimated accuracy of ±0.1%. Measurements made with 3 hr and 14 hr equilibration times agreed within ±0.1%. Details are given in reference (1). This paper also reports on oxygen solubility in seawater.

SOURCE AND PURITY OF MATERIALS:

(1) From air of 20.94% oxygen content.

(2) No details given. Presumably distilled.

ESTIMATED ERROR:

$\delta S/S = \pm 0.001$, author's estimate.

$\delta T/K = \pm 0.01$

REFERENCES:

1. Carpenter, J.H. *Limnol. Oceanog.* 1965, *10*, 135-40.

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

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

ORIGINAL MEASUREMENTS:

Carpenter, J.H.

Limnol. Oceanog. 1966, *11*, 264-77.

CRITICAL EVALUATION: continued

t/°C	T^a/K	$10^5 x_1^{a,b}$	$10^2 L^{a,c}$	S^d
29.81	302.96	2.135	2.933	5.308
34.76	307.91	1.988	2.772	4.867
34.82	307.97	1.989	2.773	4.868

[a] Calculated by compiler.

[b] Mole fraction solubility at 101.325 kPa partial pressure of gas.

[c] Ostwald coefficient.

[d] Solubility in cm^3/dm^3 of solvent corrected to 760 mm Hg total pressure, 100% relative humidity, and 20.94% oxygen. The Ostwald coefficient is then given by:

$$L = \frac{(T/K)}{273.15} \times \frac{760S}{10\ X\ (760 - P_w)}$$

where X = % oxygen and P_w = saturation vapor pressure of water.

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

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

ORIGINAL MEASUREMENTS:

Power, G. G.

J. Appl. Physiol. 1968, *24*, 468-74.

VARIABLES:

T/K =310
P/kPa =50-95

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	P_{O_2}/mmHg	P_{O_2}/kPa	Bunsen coefficient, $\alpha/\text{cm}^3(\text{STP})\,\text{cm}^{-3}\,\text{atm}^{-1}$
310.15	398	53.1	0.0239
	398	53.1	0.0237
	398	53.1	0.0240
	398	53.1	0.0236
	398	53.1	0.0236
	711	94.8	0.0239
	371	49.5	0.0238
	371	49.5	0.0239
	395	52.7	0.0238
	395	52.7	0.0237

Average .. 0.0238 ± 0.0001

[a] The compiler calculated an Ostwald coefficient of 0.02702 and a mole fraction solubility at 101.325 kPa partial pressure of gas of 1.925×10^{-5} from these data.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Liquid samples were equilibrated with gas and then the dissolved gas was stripped out under vacuum and measured in a manometric Van Slyke apparatus.

SOURCE AND PURITY OF MATERIALS:

No details given.

ESTIMATED ERROR:

$\delta T/K = \pm 0.03$.

REFERENCES:

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

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

ORIGINAL MEASUREMENTS:

Shchukarev, S.A.; Tolmacheva, T.A.

Zh. Strukt. Khim. 1968, 9, 21-8;
J. Struct. Chem. 1968, 9, 16-21.

VARIABLES:

T/K = 277-323
P/kPa = 101.325

PREPARED BY:

R. Battino

EXPERIMENTAL VALUES:

T/K[a]	Molefraction[b] 10^5x_1	Ostwald Coeff.[c] 10^2L
277.15	3.573	4.51
285.15	2.935	3.81
298.15	2.289	3.10
323.15	1.636[d]	2.38[d]

[a] Temperature reported to 1°C, but as integer values, i.e., 4, 12, 25, 50°C.

[b] Mole fraction solubility at 101.325 kPa (latm) partial pressure at gas calculated by compiler.

[c] Ostwald coefficient.

[d] This value off from smoothing curve by 3.6%, other values are within 0.5%.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Degassed water is transferred to an absorption vessel. The water is sealed over mercury. Gas is added and stirring accomplished with a magnetic bob. Uptake is read on a gas buret system which is thermostatted along with the absorption vessel. Details of operation and a drawing are in the original paper. The paper also reports the solubility of oxygen in water/ethanol solutions, 0-100%.

SOURCE AND PURITY OF MATERIALS:

(1) Prepared by electrolysis of NaOH solution, followed by removal of hydrogen traces, and thoroughly dried before use. No purity given.

(2) Distilled.

ESTIMATED ERROR:

$\delta L/L$ = ± 0.01, estimate by compiler

REFERENCES:

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

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

ORIGINAL MEASUREMENTS:

Murray, C.N.; Riley, J.P.; Wilson, T.R.S.

Deep-Sea Research 1969, *16*, 297-310.

VARIABLES:

T/K = 287-301

P/kPa = 101.325

PREPARED BY:

R. Battino

EXPERIMENTAL VALUES:

T/K[a]	Mole Fraction[b] $10^5 x_1$	Ostwald Coeff.[c] $10^2 L$	Bunsen Coeff.[d] $10^2 \alpha$
286.75	2.838	3.704	3.528
298.87	2.269	3.079	2.814
301.46	2.166	2.963	2.685

[a] Temperature reported to 0.01°C.

[b] Mole fraction solubility at 101.325 kPa (1atm) partial pressure of gas calculated by compiler.

[c] Ostwald coefficient calculated by compiler.

[d] Bunsen coefficient.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The apparatus was a modification of the design by Ben-Naim and Baer (1). Degassed water is forced by centrifugal action up two outside tubes of the absorption vessel and down a center tube, contacting gas along the way. Gas uptake is read on a gas buret system. The whole apparatus is thermostatted to ±0.012°C. The degassing apparatus was a modification of the design of Battino and Evans utilizing a magnetically driven centrifugal pump.

SOURCE AND PURITY OF MATERIALS:

(1) British Oxygen Company; contains 0.05% Ar and less than 0.1% N_2.

(2) Distilled.

ESTIMATED ERROR:

$\delta T = \pm 0.02$K, estimate by compiler

$\delta \alpha/\alpha = \pm 0.0019$, estimate of authors

REFERENCES:

1. Ben-Naim, A.; Baer, S. *Trans. Faraday Soc.* 1963, *59*, 2735-8.

2. Battino, R.; Evans, F.D. *Anal. Chem.* 1966, *38*, 1627-9.

COMPONENTS:

(1) Oxygen, O_2; [7782-44-7]

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

ORIGINAL MEASUREMENTS:

Murray, C. N.; Riley, J. P.

Deep-Sea Research 1969, *16*, 311-20.

VARIABLES:

$T/K = 274\text{-}303$

$P/kPa = 101.325$

PREPARED BY:

R. Battino

EXPERIMENTAL VALUES:

T/K[a]	Mole Fraction[b] $10^5 x_1$	Bunsen Coeff.[c] $10^2\alpha$	Ostwald Coeff.[d] $10^2 L$	Solubility[e]
273.89	3.871	4.816	4.829	10.021
274.95	3.754	4.670	4.702	9.713
278.05	3.450	4.292	4.369	8.910
280.60	3.251	4.044	4.154	8.382
283.10	3.065	3.812	3.951	7.887
288.27	2.748	3.415	3.605	7.031
293.15	2.503	3.109	3.337	6.360
298.10	2.302	2.856	3.117	5.794
302.95	2.136	2.646	2.935	5.312
307.95	1.986	2.457	2.770	4.862

[a] Temperature reported to 0.01°C.

[b] Mole fraction solubility at 101.325 kPa (1 atm) partial pressure of gas calculated by compiler.

[c] Bunsen coefficient calculated from last column ("solubility")

Via $\alpha = \dfrac{760 \times \text{solubility}}{10 \times X \times (760 - P_w)}$ where X = 20.94 or the percentage of oxygen in the atmosphere and P_w is the saturation vapor pressure of water at T.

continued on following page

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The chemical determination of oxygen solubility involved analyzing water saturated with air by the Winkler method. A modification of Carpenter's method (1) was used, precautions being taken to minimize the loss of iodine during the titration. Details are given in the paper including the kind of reagents used.

The physical method was that of Ben-Naim and Baer (2) as modified and described by Murray, et al. (3). The apparatus uses a new degassing unit modified on the design of Battino and Evans (4). Details are given with drawings in (3).

This paper also reports the solubility of oxygen in sea water of various salinities.

SOURCE AND PURITY OF MATERIALS:

(1a) (Chemical Method) - from saturating water with air.

(1b) (Physical Method) - 99.9% pure by mass spectrometric analysis; from the British Oxygen Company.

(2) Distilled

ESTIMATED ERROR:

$\delta T = \pm 0.02 K$, estimate by compiler.

δ(Solubility) = ±0.01 $cm^3\ O_2/dm^3$, estimate by authors for both chemical and physical methods.

REFERENCES:

1. Carpenter, J.H. *Limnol. Oceanogr.* 1966, *11*, 264-77.
2. Ben-Naim, A.; Baer, S. *Trans. Faraday Soc.* 1963, *59*, 2735-8.
3. Murray, C.N.; Riley, J.P.; Wilson, T.R.S. *Deep-Sea Research* 1969, *16*, 297-310.

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

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

ORIGINAL MEASUREMENTS:

Murray, C. N.; Riley, J. P.

Deep-Sea Research 1969, *16*, 311-20.

CRITICAL EVALUATION:

continued

[d] Ostwald coefficient calculated by compiler.

[e] Solubility as ml/ℓ from an atmosphere of 20.94% O_2 and 100% relative humidity. These measurements made chemically. See method section.

T/K[a]	Mole Fraction[b] $10^5 x_1$	Bunsen Coeff.[c] $10^2\alpha$	Ostwald Coeff.[d] $10^2 L$	Solubility[e]
279.05	3.374	4.198	4.289	8.71
286.75	2.838	3.528	3.704	7.270
293.30	2.492	3.095	3.323	6.33
298.87	2.269	2.814	3.079	5.711
301.46	2.166	2.685	2.963	5.423

a, b, c, d, e. Footnotes same as for previous table except that these solubilities were determined by physical means. See the methods section.

REFERENCES:

4. Battino, R.; Evans, F. D.
Anal. Chem. 1966, *38*, 1627-9.

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

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

ORIGINAL MEASUREMENTS:

Wise, D.L.; Houghton, L.

Biophys. J. 1969, 9, 36-53.

VARIABLES:

T/K = 283 - 333

PREPARED BY:

R. Battino

EXPERIMENTAL VALUES:

$t/°C$	T/K^a	$10^5 x_1^{a,b}$	$10^2 L^{a,c}$	$10^2 \alpha^d$/ $cm^3(STP)cm^{-3}atm^{-1}$	S_o^e
10	283.2	3.00	3.87	3.73	37.3
20	293.2	2.49	3.32	3.09	30.9
30	303.2	2.07	2.84	2.56	25.7
40	313.2	1.87	2.65	2.31	23.3
50	323.2	1.69	2.46	2.08	21.0
60	333.2	1.57	2.34	1.92	19.5

[a] Calculated by compiler.

[b] Mole fraction solubility at 101.325 kPa partial pressure of gas.

[c] Ostwald coefficient.

[d] Bunsen coefficient.

[e] Solubility in cm^3(STP)/1000 g of solution. Solubilities fitted to:

$$\log_{10} S_o = -11.5783 + 1044.40(T/K) + 3.8533 \log_{10}(T/K).$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Used an adaptation of the Morrison and Billett apparatus (1), but with the gas capacity of the manometer-buret system being about 15 cm^3. The storage spiral, the absorption spiral and the manometer-buret system were thermostatted in glass jackets through which water from a thermostat circulated.

SOURCE AND PURITY OF MATERIALS:

(1) No details given.

(2) Boiled and deionized.

ESTIMATED ERROR:

$\delta\alpha/\alpha = \pm 0.01$

$\delta T/K = \pm 0.1$

REFERENCES:

1. Morrison, T.J.; Billett, F. *J. Chem. Soc.* 1952, 3819-22.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Oxygen; O_2; [7782-44-7] (2) Water; H_2O; [7732-18-5]	Power, G.G.; Stegall, H. *J. Appl. Physiol.* 1970, 29, 145-9.
VARIABLES: T/K = 310	PREPARED BY: C.L. Young

EXPERIMENTAL VALUES:

T/K	Bunsen coefficient, α/cm^3 (STP) cm^{-3} atm^{-1}	S.D.[a]	No. of measurements
310.15	0.02385	0.00039	4

[a] Standard deviation.

[b] The compiler calculated an Ostwald coefficient of 0.02708 and a mole fraction solubility at 101.325 kPa partial pressure of gas of 1.930×10^{-5} from these data.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:	SOURCE AND PURITY OF MATERIALS:
5 to 12 cm^{-3} samples placed in a stirrer cell and gas, saturated with water vapor passed through water for 30-60 mins. Samples of saturated liquid withdrawn and transferred to Van Slyke apparatus. Dissolved gas removed under reduced pressure.	(1) Matheson sample, purity better than 99.7 mole per cent. (2) No details given.
	ESTIMATED ERROR: $\delta T/K = \pm 0.1$
	REFERENCES:

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

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

ORIGINAL MEASUREMENTS:

Novak, D.M.; Conway, B.E.

Chem. Instrumentation 1974, 5, 79-90.

VARIABLES:

T/K = 298

P/kPa = 101.325

PREPARED BY:

R. Battino

EXPERIMENTAL VALUES:

T/K[a]	$10^5 x_1$[b]	$10^3 S$[c]
298.15	2.295	1.27

[a] Temperature reported as 25°C but held to ±0.1°C.

[b] Mole fraction solubility at 101.325 kPa (1atm) partial pressure of gas. Calculated by compiler.

[c] Solubility in units of mol dm^{-3} atm^{-1}.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Method is based on the evaluation of the Henry's law constant K_H defined by $n_s = K_H P_g$ where n_s is the mass of gas in moles dissolved by unit volume of solvent at the equilibrium gas pressure P_g. The solubilities were obtained by measuring the (total) pressure in the gas phase and the volumes of the liquid and gas phases. This provided sufficient information to calculate the solubility. Measurements were made at different pressures on the same quantity of gas. Equilibrium takes about 12 hr to attain. The apparatus and procedure are described in detail in the paper.

SOURCE AND PURITY OF MATERIALS:

No details given.

ESTIMATED ERROR:

δT = ± 0.1°C

$\delta S/S$ = ± 0.013, estimate by authors

REFERENCES:

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

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

ORIGINAL MEASUREMENTS:

Wilcock, R.J.; Battino, R.

Nature 1974, *252*, 614-5.

VARIABLES:

T/K = 298

PREPARED BY:

R. Battino

EXPERIMENTAL VALUES:

T/K	$10^5 x_1(O_2)^a$	$10^5 x_1(O_2/N_2)^b$
298.15	2.261	1.775
298.15	2.251	1.779
298.15	2.284	1.757

[a] Mole fraction at 101.325 kPa partial pressure of gas.

[b] Mole fraction, but for a mixture of 49.5 mol per cent oxygen and 50.5 mol per cent nitrogen.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Degassed liquid is flowed slowly through an absorption spiral containing the gas. As the gas dissolves the uptake is determined on burets. Measurements are made at constant pressure. Details are given in reference (1).

SOURCE AND PURITY OF MATERIALS:

(1) No details given.

(2) Distilled.

ESTIMATED ERROR:

$\delta x_1/x_1$ = ±0.01, compiler's estimate.

$\delta T/K$ = ±0.05, compiler's estimate.

REFERENCES:

1. Battino, R.; Evans, F.D.; Danforth, W.F. *J. Am. Oil Chem. Soc.* 1968, *45*, 830.

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

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

ORIGINAL MEASUREMENTS:

Benson, B. B.; Krause, D. Jr.

J. Chem. Phys. 1976, *64*, 689-709.

VARIABLES:

T/K - 274-308

PREPARED BY:

R. Battino

EXPERIMENTAL VALUES:

$t/°C$	T^a/K	$10^5 x_1{}^{a,b}$	$\beta^c/cm^3(STP)l^{-1}\ atm^{-1}$	$10^{-4}k^d/atm$
0.484	273.634	3.9008	48.442	2.5636
1.979	275.129	3.7442	46.503	2.6708
2.973	276.123	3.6450	45.271	2.7435
4.947	278.097	3.4632	43.013	2.8875
5.967	279.117	3.3760	41.929	2.9621
7.958	281.108	3.2166	39.946	3.1089
9.954	283.104	3.0705	38.127	3.2568
11.994	285.144	2.9345	36.432	3.4077
12.969	286.119	2.8713	35.644	3.4827
13.979	287.129	2.8110	34.891	3.5574
14.963	288.113	2.7538	34.175	3.6314
16.983	290.133	2.6445	32.809	3.7814
17.959	291.109	2.5961	32.202	3.8520
19.937	293.087	2.4999	30.999	4.0002
21.967	295.117	2.4093	29.863	4.1505
22.952	296.102	2.3688	29.354	4.2216
26.949	300.099	2.2166	27.441	4.5114
28.945	302.095	2.1496	26.596	4.6521
29.948	303.098	2.1175	26.192	4.7225
32.965	306.115	2.0289	25.073	4.9288
34.953	308.103	1.9767	24.412	5.0589

continued on following page

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Gas-free water and the pure gas are equilibrated and volumetric samples of the liquid and gaseous phases are isolated. The gas dissolved in the water is extracted, and the number of moles determined in a special manometer. After removal of the water vapor, the number of moles in the sample of the gaseous phase is measured with the same manometer, from which the pressure (and fugacity) above the solution may be calculated. Pressures of 0.8 to 0.9 atm are used. Real gas corrections were applied.

SOURCE AND PURITY OF MATERIALS:

No details given.

ESTIMATED ERROR:

$\delta k/k = \pm 0.024$, author's estimate.

REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Oxygen; O_2; [7782-44-7] (2) Water; H_2O; [7732-18-5]	Benson, B. B.; Krause, D. Jr. *J. Chem. Phys.* 1976, *64*, 689-709.

continued

[a] Calculated by compiler.

[b] Mole fraction solubility at 101.325 kPa partial pressure of gas.

[c] Bunsen coefficient, but per liter of solution.

[d] Henry's law constant in units of atmospheres. Authors give the following least squares fit with a standard deviation of ±0.024% in k:

$$\ln(1/(k/\mathrm{atm})) = -4.0605 - 5.4167 \times 10^3/(T/K) + 10.261 \times 10^5/(T/K)^2$$

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

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

ORIGINAL MEASUREMENTS:

Zander, R.; Euler, R.

Measurement of Oxygen. [Proceedings of an Interdisciplinary Symposium Held at Odense University, Denmark, 26-27 September 1974]. Degn, H.; Balslev, I.; Brook, R.; Editors (Elsevier: Amsterdam Neth.). 1976, p. 271-6.
Chem. Abstr. 1976, 85, 43420j.

VARIABLES:

T/K: 310.2

PREPARED BY:

R. Battino

EXPERIMENTAL VALUES:

Apparatus	Soly. Coeff./(ml/ml atm)	L	10^4x_1
1	0.02407	0.02733	0.1715
2	0.02406	0.02732	0.1714
3	0.02418	0.02746	0.1723

Three different versions of the apparatus were used.

Measurements were at 37.0° (310.2 K).

Solubility coefficient is the Bunsen coefficient.

The Ostwald coefficient, L, and the mole fraction solubility, x_1, at 101.325 kPa partial pressure of gas were calculated by the compiler.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The van Slyke (1) apparatus was used with a correction for the unextracted gas applied.

SOURCE AND PURITY OF MATERIALS:

No details given.

ESTIMATED ERROR:

$\delta T/K = \pm 0.1$

±1% in solubility (authors)

REFERENCES:

1. Van Slyke, D.D.; Neill J.M. *J. Biol. Chem.* 1924, *61*, 523.

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]
(also ^{18}O solubility ratios)

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

ORIGINAL MEASUREMENTS:

Benson, B.B.; Krause, D.;
Peterson, M.A.

J. Soln. Chem. 1979, *8*, 655-90.

VARIABLES:

T/K = 273 - 333

PREPARED BY:

R. Battino

EXPERIMENTAL VALUES:

t/°C	T^a/K	P_t^b/atm	$10^{-4}k^c$/atm	$10^3\delta^d 34/32$	$10^5x_1^{a,e}$
0.046	273.196	0.8060	2.52918	0.820	3.95385
0.052	273.202	0.8067	2.52951	0.838	3.95333
1.001	274.151	0.8014	2.59725	0.810	3.85023
1.002	274.152	0.8060	2.59804	0.826	3.84906
1.998	275.148	0.8117	2.66885	0.816	3.74693
2.000	275.150	0.8111	2.66870	0.809	3.74714
3.003	276.153	0.8139	2.74085	0.820	3.64850
4.003	277.153	0.8243	2.81350	0.859	3.55429
4.997	278.147	0.8178	2.88571	0.787	3.46535
6.006	279.156	0.8307	2.95904	0.821	3.37947
7.000	280.150	0.8323	3.03224	0.795	3.29789
8.000	281.150	0.8365	3.10529	0.781	3.22031
10.001	283.151	0.8446	3.25195	0.812	3.07508
12.000	285.150	0.8501	3.40016	0.749	2.94104
13.999	287.149	0.8618	3.54772	-	2.81871
15.002	288.152	0.8744	3.62152	0.747	2.76127
16.003	289.153	0.8687	3.69497	0.774	2.70638
20.003	293.153	0.8871	3.98719	0.744	2.50803
21.998	295.148	0.8863	4.13213	0.688	2.42006
24.001	297.151	0.9135	4.27400	0.738	2.33973
24.002	297.152	0.9118	4.27381	0.718	2.33983
26.999	300.149	0.9254	4.48577	0.668	2.22927
30.001	303.151	0.9459	4.69496	0.682	2.12994
30.004	303.154	0.9361	4.69358	0.674	2.13057

continued on following page

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The equilibrator is composed of concentric spheres of 1 and 2 dm^3 capacity. A liquid phase sample bulb and a gas phase sample bulb are calibrated as to volume. Degassed liquid is pumped through the center of the inner sphere and flows in a gentle film through the gas. After equilibrium is attained (up to 48 hr), the gas in both bulbs is extracted separately and the pressure, volume, and temperature determined in the dry state. Real gas corrections are applied. Details and drawings are given in the paper.

SOURCE AND PURITY OF MATERIALS:

(1) Linde research grade. Total impurity less than 40 ppm.

(2) Distilled water redistilled to give a resistivity greater than 1.5 MΩ-cm.

ESTIMATED ERROR:

δk/k = ±0.00017, authors' estimate.

δT/K = ±0.005, authors' estimate.

REFERENCES:

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]
(also ^{18}O solubility ratios)

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

ORIGINAL MEASUREMENTS:

Benson, B.B.; Krause, D.; Peterson, M.A.

J. Soln. Chem. 1979, *8*, 655-90.

CRITICAL EVALUATION:

continued

$t/°C$	T^a/K	P_t^b/atm	$10^{-4}k^c/atm$	$10^3\delta^d 34/32$	$10^5 x_1^{a,e}$
33.003	306.153	0.9538	4.89287	0.655	2.04379
36.003	309.153	0.9775	5.08821	0.636	1.96533
38.998	312.148	0.9928	5.27426	0.633	1.89600
42.000	315.150	1.0170	5.45555	0.631	1.83300
44.998	318.148	1.0466	5.62631	0.625	1.77736
47.996	321.146	1.0720	5.78804	0.602	1.72770
48.000	321.150	1.0681	5.78712	0.606	1.72798
50.999	324.149	1.0925	5.94146	0.591	1.68309
53.991	327.141	1.1284	6.08549	0.561	1.64325
57.000	330.150	1.1617	6.22147	-	1.60734
57.001	330.151	1.1573	6.22310	0.568	1.60692
59.993	333.143	1.1959	6.34915	0.553	1.57501
59.998	333.148	1.1831	6.34642	0.545	1.57569

[a] Calculated by compiler.

[b] Total pressure, i.e., gas partial pressure plus saturation vapor pressure of solvent.

[c] Henry's law constant; $f_1 = kx_1$; units of atm/mole fraction (1 atm = 101.325kPa).

[d] $\delta = \alpha - 1$, where $\delta = {}^{32}k/{}^{34}k$, or the ratio of the Henry's constants for $^{16}O_2$ to $^{18}O_2$ solubilities.

[e] Mole fraction solubility at 101.325kPa partial pressure of gas.

T/K	$\Delta G°/cal\ mol^{-1}$	$\Delta H°/cal\ mol^{-1}$	$\Delta S°/cal\ mol^{-1}K^{-1}$	$\Delta C_p°/cal\ mol^{-1}K^{-1}$
283.15	5846.0	-3613	-33.41	52.03
298.15	6327.4	-2872	-30.85	46.93
313.15	6773.3	-2201	-28.66	42.54
328.15	7188.7	-1592	-26.76	38.74

Authors' recommended smoothing equations are:

1. $\ln(k/atm) = 3.71814 + 5.59617 \times 10^3 /(T/K) - 1.049668 \times 10^6 /(T/K)^2$; 273-373 K.

2. $\ln(k/atm) = -4.1741 + 1.3104 \times 10^4/(T/K) - 3.4170 \times 10^6/(T/K)^2 + 2.4749 \times 10^8/(T/K)^3$; above 373 K.

3. $\ln({}^{34}k/atm) = 3.71937 + 5595.45/(T/K) - 1.049624 \times 10^6/(T/K)^2$.

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Seawater

EVALUATOR:

Chen-Tung A. Chen
School of Oceanography
Oregon State University
Corvallis, OR 97331
U.S.A.

CRITICAL EVALUATION:

Many studies have been made of oxygen solubility in seawater (1-16). Unfortunately, among the early measurements (1-8) there exist serious discrepancies of as much as 4 per cent. These data often cover narrow salinity and temperature ranges, are less precise, and are sometimes subject to large systematic errors caused mainly by the loss of iodine and by the addition of oxygen from reagents (9-16). As a result, these early measurements will not be analyzed.

More recently, Carpenter (11) has made extremely careful measurements of oxygen solubility in pure water and seawater using the Winkler titration method. Subsequently, Green (10, 13) and Murray and Riley (16) also published oxygen solubility data in pure water and seawater using a similar method. The data of Carpenter and of Murray and Riley agree closely, the average difference being less than 0.01 ml/l. Green's data are of good quality but are approximately 0.1 ml/l higher than those of Carpenter and Murray and Riley in the low temperature range. Because of the excellent agreement between these two sets of data and a possible systematic error in Green's measurements (11), his data are listed in this study for comparison purposes only and are excluded from further analysis. Murray and Riley (16) also measured oxygen solubility in pure and saline waters using gasometric method. However, they neglected to correct their gasometric data for the gas dissolution effect on the volume of the aqueous phase (17). Because of this and because there are few gasometric data, these values are not included in the analysis, although they are listed in this study.

The determined values of oxygen solubility of Carpenter (11) and Murray and Riley (16) are all reported as the volume of oxygen per unit volume of water (ml/l). However, the methods of smoothing and representing the results are quite different. The results are also difficult to use because they have been tabulated, but not reported, in the form of equations. Weiss recognized this problem (17) and suggested the use of the following equation to represent the gas solubility data:

$$\ln C = A_1 + A_2(100/(T/K)) + A_3 \ln(T/100K) + A_4(T/100K) + S[B_1 + B_2(T/100K) + B_3(T/100K)^2] \ldots \quad (1)$$

where C may be either the solubility in ml (STP)/l or in ml (STP)/kg from water saturated air at a total pressure of one atmosphere, T is the Kelvin temperature, the A's and B's are constants, and S is the salinity in parts per thousand.

The first four terms of eq. (1) are obtained from the integrated form of the Van't Hoff equation (18). The salinity dependence is obtained from the commonly used Setchenow relation although the choice of ST and ST^2 terms seems to be somewhat arbitrary. Further, the S^2 term is not included although Carpenter found that it was needed (11).

Chen and Carpenter (19) have since re-analyzed the data of Carpenter (11) and Murray and Riley (16). The analyses were performed by first using these two sets of data separately and then combined. It was found in all three cases that the ST^2 term is not significant statistically and the precision of the fit improves by approximately 10 per cent after discarding the ST^2 term and replacing the ST term by S/T. The ST term was found to be insignificant while the S^2 term is, when the S/T term is included. This confirms the finding of Carpenter. It was also found that the $1/T^2$ term is not significant for the gas solubility in pure water, contrary to the finding of Benson and Krause (20, 21). The final equation generated from the combined data sets of Carpenter and Murray and Riley is:

continued on following page

COMPONENTS:	EVALUATOR:
(1) Oxygen; O_2; [7782-44-7] (2) Seawater	Chen-Tung A. Chen School of Oceanography Oregon State University Corvallis, OR 97331 U.S.A.

CRITICAL EVALUATION:

continued

$$\ln C = -1268.9782 + 36063.19/(T/K) + 220.1832 \ln (T/K) - 0.351299 (T/K) + S(6.229 \times 10^{-3} - 3.5912/(T/K)) + 3.44 \times 10^{-6} S^2 \quad (2)$$

where C is the solubility in ml/l at STP. The standard deviation of eq. (2) is ±0.012 ml/l.

Since the analytical precision of the oxygen determination has improved over the last few years, the concentrations of oxygen in the oceans are more and more frequently reported as ml or μmol per unit mass of seawater. To avoid the tedious work of computing the densities of seawater in order to change the units in routine use, we have also fit the data in the form of ml/kg and μmol/kg (17, 21, 22). The equation presented by Millero, Gonzalez and Ward (23) is used to calculate seawater densities. The best fit equations are as follows:

$$\ln C\ (\mathrm{ml/kg}) = -1286.2408 + 36607.82/(T/K) + 223.0650 \ln (T/K) - 0.354587 (T/K) + S(5.954 \times 10^{-3} - 3.7341/(T/K)) + 3.68 \times 10^{-6} S^2 \pm 0.012\ \mathrm{ml/kg} \quad (3)$$

$$\ln C\ (\mu\mathrm{mol/kg}) = -1282.8704 + 36619.96/(T/K) + 223.1396 \ln (T/K) - 0.354707 (T/K) + S(5.957 \times 10^{-3} - 3.7353/(T/K)) + 3.68 \times 10^{-6} S^2 \pm 0.52\ \mu\mathrm{mol/kg} \quad (4)$$

These equations are valid over the range of 9 to 35.5°C and 0 to 40‰ salinity. The factor of 22393 ml/mol was used to convert the volume of oxygen to moles.

The solubility of oxygen in marine brines has recently been investigated by Kinsman, Boardman and Borcsik (24) at 22 and 50°C up to 144 parts per thousand in chlorinity. The precision of the data probably was not much better than 4 per cent.

The effect of pressure upon the solubility of oxygen in seawater up to 102 atm has been measured by Enns, Scholander and Bradstreet (25). They reported that the equilibrium pressure increase was approximately 14 per cent at 100 atm hydrostatic pressure. They predicted that at 1000 atm the equilibrium partial pressure of oxygen would be increased nearly fourfold.

Carey and Gibson (26) measured the activity of dissolved oxygen based on its rate of reaction with the excited singlet state of pyrene-1-butyric acid and reported that it is not changed by hydrostatic pressures up to 1000 atm. They concluded that the partial pressure of dissolved oxygen will have the same relation to concentration at abyssal depths as at the surface. Carey thought it likely that neither of the above two papers gave the whole story on the pressure effect on oxygen solubility (Carey, personal communication, 1976). More recently, Taylor (27) measured the molar oxygen concentration in an artificial seawater medium in equilibrium with a high pressure oxygen-helium atmosphere. He concluded that at a partial pressure of oxygen of 1 atm or less, its concentration in the aqueous phase was adequately described by Henry's Law at total pressures of up to 600 atm. His work on seawater and pure water (28) seems to substantiate the results of Enns, Scholander and Bradstreet (25). Due to the scarcity of the data that are of satisfactory precision, meaningful equations cannot be derived

continued on following page

COMPONENTS:	EVALUATOR:
(1) Oxygen; O_2 [7782-44-7] (2) Seawater	Chen-Tung A. Chen School of Oceanography Oregon State University Corvallis, OR 97331 U.S.A.

CRITICAL EVALUATION:

continued

to represent the oxygen solubility at high salinities and high pressures. More measurements are clearly in order.

References

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24. Kinsman, D. J. J.; Boardman, M.; Borcsik, M. *Symp. Salt, 4th*, 1973, (Pub. 1974), *1*, 325-7.
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COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Seawater

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

ORIGINAL MEASUREMENTS:

Enns, T.; Scholander, P. F.; Bradstreet, E. D.

J. Phys. Chem. 1965, *69*, 389-91.

VARIABLES:

T/K = 274-298

P/MPa (hydrostatic) = 0-10

PREPARED BY:

Chen-Tung A. Chen

EXPERIMENTAL VALUES:

t/°C	T^a/K	P^b=0 (0 MPa)	P^b=34 atm (3.45 MPa)	P^b= 68 atm (6.89 MPa)	P^b=102 atm (10.34 MPa)
			Distilled Water		
0.5	273.7	682			789
25	298.2	734.5	771	805	839.5
25	298.2	781	819	855	892
25	298.2	359	373	390	410.5
25	298.2	443	464	484	508
			Seawater		
25	298.2	737	775	806	842

[a] Calculated by compiler.

[b] Hydrostatic pressure.

[c] The values in the table are the oxygen equilibrium pressures in units of mm Hg. The table shows the effect of hydrostatic pressure on the oxygen equilibrium pressure.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Water was gas-extracted before the experiment. Oxygen at the desired initial pressure was dissolved in it at controlled temperature. The equilibrium vessel was shaken for 0.5 to 1 hr during the oxygen uptake. The solution was then transferred to a syringe which has a teflon tubing attached to it. Pressure was then measured by a null point measurement of the pressure developed within the teflon tube.

SOURCE AND PURITY OF MATERIALS:

(1) No details given.

ESTIMATED ERROR:

REFERENCES:

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Seawater

ORIGINAL MEASUREMENTS:

Green, E. J.

Ph.D. thesis, Massachusetts Institute of Technology, 1965.

VARIABLES:

T/K = 274-308
Salinity

PREPARED BY:

Chen-Tung A. Chen

EXPERIMENTAL VALUES:

Chlorinity	t/°C	T^a/K	$10^3\alpha$/ cm(STP) cm^{-3} atm^{-1}	Chlorinity	t/°C	T^a/K	$10^3\alpha$/ cm(STP) cm^{-3} atm^{-1}
0	0.59	273.74	48.633	0	22.02	295.17	30.066
			48.598				29.938
			48.669				29.945
			48.661				30.026
			48.665				29.996
			48.618				29.981
0	5.03	278.18	43.118				29.913
			42.890				30.140
			42.932				30.072
			42.920				30.131
			42.972				30.071
			42.857				30.049
0	15.09	288.24	34.299				30.074
			34.228				30.083
			34.244				29.990
			34.208				30.092
			34.153				30.080
			34.356				30.103
0	22.02	295.17	30.061				30.156
			30.242	0	22.05	295.20	30.137
			30.177				30.090
			30.059				30.126
			30.086				30.061
							30.118
							30.101

continued on following page

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Distilled and seawater were simultaneously saturated with air with two 12-l round bottom long-neck flasks inclined at a 45° angle and arranged to rotate about their axes of symmetry. A thin film of water was drawn over the inside surface of the flask by its rotation. The reagents ($MnCl_2 \cdot 4H_2O$, NaI, NaOH, H_2SO_4) were added to the equilibrated water (after at least 8 hours of rotation) and the thiosulfate titration end point determined by the Amperometric technique using a Keithley microammeter. A modified Winkler method was used.

SOURCE AND PURITY OF MATERIALS:

ESTIMATED ERROR:

$\delta T/K = \pm 0.01$
δCl‰ < ±0.028%
$\delta\alpha/\alpha = \pm 0.0027$

REFERENCES:

1. Green, E.J., *Ph.D. thesis Massachusetts Institute of Technology*, 1965.
2. Green, E.J.; Carritt, D.E., *J. Mar. Res.* 1967, 25, 140.

COMPONENTS:

(1) Oxygen; O_2; 7782-44-7

(2) Seawater

EVALUATOR:

Green, E. J.

Ph.D. thesis, Massachusetts Institute of Technology, 1965.

CRITICAL EVALUATION:

continued

Chlorinity	t/°C	T^a/K	$10^3\alpha$/cm(STP)cm^{-3}atm^{-1}
0	24.92	298.07	28.494
			28.549
			28.730
			28.682
			28.670
			28.661
0	34.81	307.96	24.086
			24.129
			24.132
			24.181
			24.085
			24.199
6.349	22.02	295.17	28.099
			28.139
			28.165
			28.262
12.412	22.02	295.17	26.324
			26.263
			26.214
			26.269
			26.263
			26.245
17.419	5.03	278.18	34.860
			34.930
			34.890
			34.695
			34.723
			34.821
17.464	0.59	273.74	39.022
			39.092
			39.051
			39.099
			39.079
			39.132
17.487	22.02	295.17	24.961
			25.108
			25.091
17.551	15.09	288.24	28.177
			28.161
			28.206
			28.162
			28.203
			28.067
17.562	34.81	307.96	20.172
			20.197
			20.194
			20.231
			20.200
			20.246
17.632	24.92	298.07	23.652
			23.865
			23.901
			23.905
			23.856
			23.770
24.339	22.02	295.20	23.323
			23.375
			23.378
			23.391
30.804	22.02	295.20	21.965
			21.912
			21.874
			21.825
			21.930
			21.855

---

[a] Calculated by compiler.

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Seawater

ORIGINAL MEASUREMENTS:

Carpenter, J. H.

Limnol. Oceanog. 1966, *11*, 264-77.

VARIABLES:

T/K = 274-309
Chlorinity

PREPARED BY:

Chen-Tung A. Chen

EXPERIMENTAL VALUES:

Chlorinity /‰	t/°C	T^a/K	s^b / (ml/liter)	Chlorinity /‰	t/°C	T^a/K	s^b/ (ml/liter)
0.0	0.48	273.63	10.120	0.0	12.38	285.53	7.469
	0.52	273.67	10.088		12.40	285.55	7.476
	0.64	273.79	10.062		12.40	285.55	7.485
	5.02	278.17	8.898		12.41	285.56	7.465
	5.07	275.22	8.903		12.41	285.56	7.473
	5.08	275.23	8.898		12.43	285.58	7.462
	5.10	275.25	8.890		14.55	287.70	7.139
	5.11	275.26	8.875		14.72	287.87	7.116
	5.13	275.28	8.884		14.97	288.12	7.078
	5.18	278.33	8.862		14.99	288.14	7.079
	5.21	278.36	8.858		15.12	288.27	7.054
	9.85	283.00	7.894		15.14	288.29	7.057
	9.86	283.01	7.897		20.08	293.23	6.340
	9.89	283.04	7.899		20.10	293.25	6.344
	9.94	283.09	7.884		25.10	298.25	5.761
	10.10	283.25	7.863		25.35	298.50	5.734
	10.22	283.37	7.839		25.36	298.51	5.742
	11.68	284.83	7.584		29.80	302.95	5.301
	12.04	285.19	7.531		29.81	302.96	5.308
	12.36	285.51	7.483		34.76	307.91	4.867
	12.37	285.52	7.491		34.82	307.97	4.868

continued on following page

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The sample was contained in a plexiglass (perspex) box which was placed on a frame that could be rocked to mix air and liquid. The equilibrated water was transferred to a pyrex bottle and the reagents ($MnCL_2 \cdot 4H_2O$, NaI, NaOH, H_2SO_4) added. The resulting solution was then titrated with thiosulfate solution with the iodine endpoint detected by a Beckman DU spectrophotometer at 320 and 350 μm. The method was a modified Winkler method with a weight photometric titration. See references.

SOURCE AND PURITY OF MATERIALS:

(1) From air collected in the country 32 km west of Baltimore, MD. 20.94% oxygen.

ESTIMATED ERROR:

$\delta T/K = \pm 0.01$
$\delta S/S = \pm 0.001$, author's estimate

REFERENCES:

(1) Carpenter, J. H. *Limnol. Oceanog.* 1965, *10*, 135.
(2) Carpenter, J. H. *Limnol. Oceanog.* 1966, *11*, 264.
(3) Carritt, D. E.; Carpenter, J. H. *J. Mar. Res.* 1966, *24*, 286.

COMPONENTS:	EVALUATOR:
(1) Oxygen; O_2; [7782-44-7] (2) Seawater	Carpenter, J. H. *Limnol. Oceanog.* 1966, *11*, 264-77.

EXPERIMENTAL VALUES: continued

Chlorinity /‰	t/°C	T^a/K	S^b/ (ml/liter)	Chlorinity /‰	t/°C	T^a/K	S^b/ (ml/liter)
	35.43	308.58	4.597		0.62	273.77	8.331
4.99	35.45	308.60	4.596		0.55	273.70	8.315
	35.45	308.60	4.597		5.39	278.54	7.408
				15.00	5.37	278.52	7.401
	20.08	293.23	6.017		10.16	283.31	6.618
	20.09	293.24	6.017		10.20	283.35	6.613
	25.02	298.17	5.475		14.10	287.25	5.982
5.07	25.05	298.20	5.475		14.97	288.12	5.971
	30.04	303.19	5.008				
	30.09	303.24	4.992		20.15	293.30	5.396
	35.18	308.33	4.592		20.11	293.26	5.393
					25.24	298.39	4.924
	0.48	273.63	9.447		25.27	298.42	4.922
	0.49	273.64	9.443	15.18	29.99	303.14	4.542
	5.28	278.43	8.335		30.01	303.16	4.542
5.17	5.29	278.44	8.336		35.50	308.65	4.162
	10.15	283.30	7.398		35.50	308.65	4.162
	10.19	283.34	7.386		35.50	308.65	4.161
	14.94	288.09	6.663				
	14.95	288.10	6.654		0.41	273.56	7.863
					0.44	273.59	7.856
10.02	35.48	308.63	4.363	20.32	1.09	274.24	7.729
	35.56	308.71	4.361		9.88	283.03	6.292
					35.53	308.68	3.961
	0.60	273.75	8.886		35.58	308.73	3.963
	0.64	273.79	8.851				
	5.30	278.45	7.883		20.18	293.33	5.115
10.13	5.35	278.50	7.873		20.18	293.33	5.117
	10.17	283.32	6.994	20.37	25.23	298.38	4.688
	10.14	283.29	6.993		25.25	298.40	4.685
	15.02	288.17	6.288		29.98	303.13	4.300
					29.99	303.14	4.304
	20.12	293.27	5.666		29.99	303.14	4.304
	20.14	293.29	5.667				
10.49	25.19	298.34	5.154		5.34	278.49	6.919
	25.23	298.38	5.157		5.34	278.49	6.916
	29.97	303.12	4.753	20.88	10.18	283.33	6.196
	29.92	303.07	4.748		10.20	283.35	6.184
					14.97	288.12	5.602
					15.02	288.17	5.590

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[a] Calculated by compiler.

[b] Solubilities of oxygen in seawater assuming an oxygen volume of 22,400 ml/mol at STP. Observations were corrected by author to 101.325 kPa total pressure including water vapor and 20.94% oxygen excluding water vapor on the basis of individual gas analyses.

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Seawater

ORIGINAL MEASUREMENTS:

Murray, C. N.; Riley, J. P.

Deep-Sea Research, 1969, *16*, 311-20.

VARIABLES:

T/K = 279-301
Salinity

PREPARED BY:

Chen-Tung A. Chen

EXPERIMENTAL VALUES:

Physically determined values of oxygen solubility in ml/l (from an atmosphere of 20.94% O_2 and 100% relative humidity).

t/°C	T^a/K	Salinity/(‰)	O_2/(ml/l)
5.90	279.05	0.000	8.71
5.90	279.05	32.995	7.03
13.60	286.75	0.000	7.27
13.70	286.85	31.981	5.96
20.00	293.15	36.725	5.11
20.15	293.30	0.000	6.33
25.72	298.87	0.000	5.71
24.65	297.80	34.261	4.77
28.31	301.46	0.000	5.42

[a] Calculated by compiler.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Saturation of samples with oxygen was carried out by stirring at such a rate that a vortex of ~ 3 cm in length was formed. The ratio of the volume of seawater (measured by weight) gives the solubility.

SOURCE AND PURITY OF MATERIALS:

(1) > 99.9% purity.

ESTIMATED ERROR:

$\delta T/K = \pm 0.02$
δS‰ $= \pm 0.02$
$\delta O_2 = \pm 0.01$ ml/l

REFERENCES:

1. Murray, C. N.; Riley, J. P.; Wilson, T. R. S. *Deep-Sea Research*, 1969, *16*, 297.
2. Murray, C. N.; Riley, J. P. *Deep-Sea Research*, 1969, *16*, 311.

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Seawater

ORIGINAL MEASUREMENTS:

Murray, C. N.; Riley, J. P.

Deep-sea Research, 1969, *16*, 311-20.

VARIABLES:

T/K = 274-308
Salinity

PREPARED BY:

Chen-Tung A. Chen.

EXPERIMENTAL VALUES:

Chemically determined values of oxygen solubility in ml/l. (from an atmosphere of 20.94% O_2 and 100% relative humidity).

t/°C (T^a/K)	Salinity/ (‰)	O_2/ (ml/l)	t/°C (T^a/K)	Salinity/ (‰)	O_2/ (ml/l)
0.74 (273.89)	0.000	10.021	15.12 (288.27)	0.000	7.031
	5.962	9.622		10.090	6.618
	11.418	9.241		15.084	6.395
	19.999	8.743		20.774	6.172
	36.103	7.834		29.102	5.863
1.80 (274.95)	0.000	9.713	20.00 (293.15)	0.000	6.360
	7.520	9.249		10.090	5.971
	14.480	8.791		15.446	4.788
	24.459	8.232		28.781	5.362
	29.148	8.022		39.020	5.045
4.90 (278.05)	0.000	8.910	24.95 (298.10)	0.000	5.794
	11.577	8.281		8.712	5.464
	17.508	7.959		12.646	5.348
	25.870	7.571		22.169	5.098
	36.989	7.022		33.894	4.765
7.45 (280.60)	0.000	8.382	29.80 (302.95)	0.000	5.312
	9.680	7.891		8.682	5.064
	17.663	7.470		16.690	4.831
	25.243	7.140		25.435	4.611
	31.513	6.836		33.626	4.400
	37.882	6.561		39.120	4.254

continued on following page

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Air saturated sample was introduced at the top of a helix (diameter 7 cm; length 360 cm.) at a rate of ≈ 4 ml/min to ensure that the sample was saturated, but not supersaturated. Thiosulfate was used to titrate the solution after the reagents ($MnCl_2 \cdot 4H_2O$, NaI, NaOH, H_2SO_4) had been added. The end point was determined photometrically with an EEL Quantitrator fitted with an Ilford 608 filter. Starch was used as the end point indicator. Used a modified Winkler method. See references.

SOURCE AND PURITY OF MATERIALS:

(1) From air.

ESTIMATED ERROR:

$\delta T/K = \pm 0.02$
δS‰ $= \pm 0.02$%
$\delta O_2/(ml/l) = \pm 0.01$

REFERENCES:

1. Murry, C. N.; Riley, J. P.; Wilson, T. R. S. *Deep-Sea Research*, 1968, *15*, 237.
2. Murry, C. N.; Riley, J. P. *Deep-Sea Research* 1969, *16*, 311.

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Seawater

EVALUATOR:

Murray, C. N.; Riley, J. P.

Deep-Sea Research, 1969, 16,
311-20.

EXPERIMENTAL VALUES:

continued

t/°C (T^a/K)	Salinity/ (‰)	O_2 (ml/l)	t/°C (T^a/K)	Salinity (‰)	O_2/ (ml/l)
	0.000	7.887		0.000	4.862
	10.566	7.364		8.569	4.641
9.95	17.508	7.045	34.80	14.019	4.528
(283.10)	23.355	6.775	(307.95)	23.651	4.293
	31.935	6.445		34.205	4.067
	40.201	6.110			

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Artificial Seawater

ORIGINAL MEASUREMENTS:

Kinsman, D.J.J.; Boardman, M.; Borcsik, M.

Symp. Salt. 4th, 1973 (pub. 1973), 1, 325-7.

VARIABLES:

T/K = 293-323
Chlorinity

PREPARED BY:

Chen-Tung A. Chen

EXPERIMENTAL VALUES:

t/°C	T^a/K	Cl/‰	O_2^b (mg/kg water)
22.5	295.7	18.57	7.15
23.0	296.2	18.59	7.28
23.75	296.9	18.76	6.91
22.0	295.2	18.81	6.83
21.0	294.2	20.45	7.01
22.0	295.2	20.60	7.12
23.0	296.2	37.88	6.06
22.5	295.7	38.16	5.78
22.0	295.2	38.31	5.67
23.75	296.9	38.54	5.69
21.0	294.2	41.24	5.71
22.0	295.2	41.54	5.85
23.0	296.2	59.60	4.69
22.5	295.7	60.14	4.65
22.0	295.2	60.27	4.57
23.75	296.9	61.23	4.57
21.0	294.2	64.35	4.48
22.0	295.2	64.63	4.56
23.0	296.2	98.31	3.36
22.0	295.2	98.48	3.60
22.5	295.7	98.53	3.33
23.75	296.9	99.04	3.31
21.0	294.2	104.60	3.10
22.0	295.2	105.54	3.17
22.0	295.2	121.69	2.58
23.0	296.2	122.51	2.63
22.5	295.7	122.53	2.60
23.75	296.9	123.6	2.63
21.0	294.2	128.19	2.40
22.0	295.2	128.84	2.48

continued on following page

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Standard Winkler Method.

SOURCE AND PURITY OF MATERIALS:

Oxygen: air

Marine brines: unspecified

ESTIMATED ERROR:

$\delta T = 2°C$
$\delta O_2 < 4\%$

REFERENCES:

1. Kinsman, D. J. *Private communication*, 1981.

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Artificial Seawater

EVALUATOR:

Kinsman, D.J.J.; Boardman, M.;
Borcsik, M.

Symp. Salt. 4th, 1973 (pub. 1973),
1, 325-7.

CRITICAL EVALUATION: continued

Cl/‰	O_2 [b] (mg/kg water)	Cl/‰	O_2 [b] (mg/kg water)
t/°C = 50 (323K)			
18.20	5.03	96.08	2.63
18.90	4.94	97.04	2.61
20.25	4.98	104.14	2.55
20.74	4.90	104.80	2.55
24.29	4.78	111.47	2.48
25.80	4.73	118.34	2.34
27.85	4.63	119.96	2.27
38.43	4.22	121.45	2.08
39.67	4.20	127.85	2.14
41.14	4.18	128.67	2.09
41.21	4.196	137.13	1.88
51.85	3.80	140.79	1.89
54.89	3.73	144.35	1.79
58.52	3.59		
63.65	3.40		
64.45	3.32		
74.78	3.43		
65.69	3.35		
81.51	2.99		
84.13	2.88		
90.23	2.85		

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[a] Calculated by compiler.

[b] The oxygen partial pressure was 0.2 atm.

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Seawater

ORIGINAL MEASUREMENTS:

Taylor, C. D.

Undersea Biomed. Res. 1979, *6*, 147-54.

VARIABLES:

T/K = 293
P/MPa (Hydrostatic) = 1-61

PREPARED BY:

Chen-Tung A. Chen, R. Battino

EXPERIMENTAL VALUES:

Oxygen Partial Pressure/atm	Hydrostatic Pressure/atm	O_2/ (μmole/liter)
0.036 (3.6 kPa)[b]	80 (8.1 MPa)[c]	40
0.036 (3.6 kPa)	160 (16.2 MPa)	60
0.036 (3.6 kPa)	580 (58.8 MPa)	180
0.065 (6.6 kPa)	200 (20.3 MPa)	170
0.065 (6.6 kPa)	400 (40.5 MPa)	260
0.065 (6.6 kPa)	600 (60.8 MPa)	420
0.094 (9.5 kPa)	200 (20.3 MPa)	220
0.094 (9.5 kPa)	400 (40.5 MPa)	380
0.094 (9.5 kPa)	570 (57.8 MPa)	580
0.12 (12 kPa)	200 (20.3 MPa)	250
0.12 (12 kPa)	440 (44.6 MPa)	560
0.12 (12 kPa)	600 (60.8 MPa)	740
0.15 (15 kPa)	100 (10.1 MPa)	180
0.15 (15 kPa)	200 (20.3 MPa)	320
0.15 (15 kPa)	300 (30.4 MPa)	460

[a] Oxygen solubility values at 20 °C (293K) estimated from Figure 3 given in the paper. Data were presented as average of duplicate analyses.

[b] Calculated in kPa by compiler.

[c] Calculated in MPa by compiler.

continued on following page

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Air-equilibrated artificial seawater was contained in a polycarbonate vessel housed in a stainless steel pressure cylinder. Oxygen-helium mixture was used in flushing gas and the partial pressure of it was monitored by a membrane-covered oxygen polarographic electrode. Flushing was continued until the partial O_2 pressure remained constant for at least 5 minutes, then the aqueous and gaseous phases were allowed to equilibrate with stirring at 20 °C for at least two hours prior to analysis by the Winkler method using undecompressed subsamples. Details also given in reference 1.

SOURCE AND PURITY OF MATERIALS:

(1) Union Carbide, 99.5% purity

(2) Artificial seawater: 4% Seven Seas Marine Mix; 0.1% Tris-base; 0.05% ammonium sulfate; pH 7.2-7.4.

ESTIMATED ERROR:

$\delta O_2 < 12\%$, author's estimate

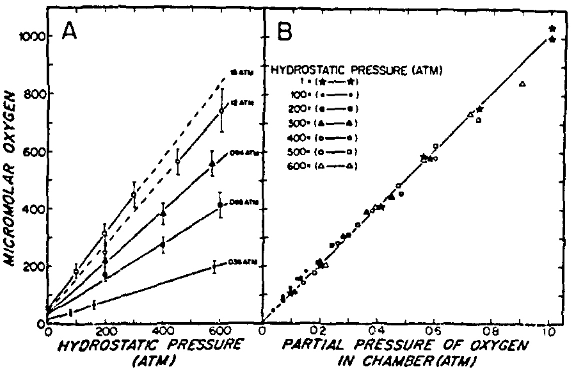
REFERENCES:

1. Taylor, C.D. *Appl. Environ. Microbiol.* 1979, *37*, 42-9.

COMPONENTS:	EVALUATOR:
(1) Oxygen; O_2; [7782-44-7] (2) Seawater	Taylor, C. D. *Undersea Biomed. Res.* <u>1979</u>, *6*, 147-54.

CRITICAL EVALUATION:

continued



Data presented only in graphical form. Solubilities determined at 20°C (293K). The solubility is given in micromoles of oxygen per liter of seawater. In A the oxygen partial pressure is given for each line. The error bars are estimated from duplicate analyses. The starred date points in B were obtained from separate experiments conducted in bottles. Oxygen partial pressures were determined using a membrane-covered oxygen polarographic electrode.

COMPONENTS:	EVALUATOR:
(1) Oxygen; O_2; [7782-44-7] (2) Electrolyte(s) (3) Water; H_2O; [7732-18-5]	H. L. Clever Department of Chemistry Emory University Atlanta, GA 30322 USA 1981, April

CRITICAL EVALUATION:

An Evaluation of the Solubility of Oxygen in Aqueous Electrolyte Solutions.

Not enough workers have measured the solubility of oxygen in any one aqueous electrolyte system over common ranges of concentration and temperature to recommend solubility values. Most of the available data are classed as tentative.

In order to have a common basis for comparison, where possible the solubility data have been converted to Setschenow salt effect parameters at an oxygen partial pressure of 101.325 kPa in the form

$$k_{sc\alpha}/dm^3\ mol^{-1} = (1/(c_2/mol\ dm^{-3}))\log(\alpha°/\alpha)$$

where c_2 is the electrolyte concentration in mol dm^{-3}, and $\alpha°$ and α are the Bunsen coefficients in pure water and electrolyte solution, respectively. The Ostwald coefficient ratio, $L°/L$, will give the same value, but the salt effect parameter is symbolized, k_{scL}. Both ratios are equivalent to a molar gas solubility ratio, $c_1°/c_1$, thus

$$k_{sc\alpha} = k_{scL} = k_{scc} = (1/(c_2/mol\ dm^{-3}))\ \log\ (c°_{1,sat}/c_{1,sat})$$

Other forms of the salt effect parameter will be found on the data sheets that follow this discussion. They include

$$k_{sms}/kg\ mol^{-1} = (1/(m_2/mol\ kg^{-1}))\log(s°/s)$$

$$k_{scx}/dm^3\ mol^{-1} = (1/(c_2/mol\ dm^{-3}))\log(x°/x)$$

$$k_{smx}/kg\ mol^{-1} = (1/(m_2/mol\ kg^{-1}))\log(x°/x)$$

where m_2 is the electrolyte molality, s°/s is the Kuenen coefficient ratio, and $x°/x$ is the mole fraction gas solubility ratio usually calculated with respect to all ions in the solution. The Kuenen coefficient, s, is referenced to 1 g of water whether it is for pure water or the electrolyte solution. Thus the s°/s ratio is equal to a gas molality ratio $m_1°/m_1$.
The density data required to convert the salt effect parameter from one form to another were taken from the *International Critical Tables*, McGraw-Hill Co., Inc., 1928, Vol. III.

The activity coefficient of the dissolved oxygen, y_1, is a function of the concentration of all solute species, which in the present systems are the electrolyte and the nonelectrolyte. At a given temperature log y_1 can be represented as a power series in c_1 and c_2

$$\log y_1 = \sum_{nm} k_{nm}\, c_1^n\, c_2^m$$

If it is assumed that for low concentrations of both nonelectrolyte, c_1, and electrolyte, c_2, the only important terms are the linear ones,

$$\log y_1 = k_1 c_1 + k_2 c_2$$

The expression has been experimentally verified for moderately dilute solutions in which there is no chemical interaction between the solute species.

The measurements of the nonelectrolyte solubility in pure water, $c^\circ_{1,\mathrm{sat}}$, and in a salt solution, $c_{1,\mathrm{sat}}$, give directly the activity coefficient of the nonelectrolyte. Long and McDevit (7) show that

$$\log(y_1/y^\circ_1) = \log(c^\circ_{1,\mathrm{sat}}/c_{1,\mathrm{sat}}) = \mathrm{k}_1(c_{1,\mathrm{sat}} - c^\circ_{1,\mathrm{sat}}) + \mathrm{k}_2\ c_2$$

And if the nonelectrolyte solubility values are low, as they generally are for a gas, the term in k_1 can be neglected, even though k_1 is similar in magnitude to k_2. Thus for low nonelectrolyte concentration

$$\log(y_1/y^\circ_1) = \log(c^\circ_{1,\mathrm{sat}}/c_{1,\mathrm{sat}}) = \mathrm{k}_2\ c_2$$

The solubility data which are evaluated in this section do not always meet the requirements set forth above. Thus, the experimental Setschenow salt effect parameters, $\mathrm{k_S}$, may not be equivalent to the theoretically important salt effect parameter, k_2.

A plot of $\log(\alpha^\circ/\alpha)$ *vs.* c_2 is usually linear over moderate concentrations of the electrolyte. However, curvature of the plot is often seen at above moderate concentrations, and in extreme cases one observes regions of both salting-out and salting-in over different concentration regions of the same isotherm, e.g. $O_2 + HNO_3 + H_2O$ at 333 K.

The salt effect parameters, $\mathrm{k_{sc\alpha}}/\mathrm{dm^3\ mol^{-1}}$, are presented by several methods in the evaluation.

In the first method $\mathrm{k_{sc\alpha}}$ values are calculated for each experimental determination, and a graph is prepared of $\mathrm{k_{sc\alpha}}$ *vs.* c_2. If the plot is linear and of zero slope, $\mathrm{k_{sc\alpha}}$ is taken to be independent of concentration. In such cases an average value of $\mathrm{k_{sc\alpha}}$ is given. If the plot is linear, but of non-zero slope, $\mathrm{k_{sc\alpha}}$ is fitted to a linear equation in c_2.

In the second method a graph is prepared of $\log(\alpha^\circ/\alpha)$ *vs.* c_2. A linear plot shows no concentration dependence of the salt effect parameter and the slope is $\mathrm{k_{sc\alpha}}$. Recently Yasunischi (33,34) has fitted such plots that show curvature to a function

$$\log(\alpha^\circ/\alpha) = \mathrm{k}^\circ_{\mathrm{sc\alpha}}\ c_2/(1 + \mathrm{k}'_{\mathrm{sc\alpha}}\ c_2)$$

In a sense the first method, in which the salt effect parameter is given by a linear function of concentration, $\mathrm{k_{sc\alpha}} = a + bc_2$, is equivalent to

$$\log(\alpha^\circ/\alpha) = (a + bc_2)c_2 = ac_2 + bc_2^2$$

however, the constants should be redetermined from the $\log(\alpha^\circ/\alpha)$ and c_2 data.

Salt effects on the solubility of oxygen have been studied at both large partial pressures of oxygen and at atmospheric pressure. In general $\mathrm{k_{sc\alpha}}$ values are calculated for only the atmospheric pressure measurements. An exception are the data of Bruhn, Gerlach, and Pawlek (17) who gave α/α° ratio's for their measurements at high pressure.

The use of a salt effect parameter of the Setschenow type should not be taken to mean that it is necessarily the best way to represent the salt effect data. It is used here as a convenient parameter in the comparison of data from several sources.

The solubility of oxygen in water was usually taken from the paper under evaluation for the calculation of the salt effect parameter. The reason for using the water solubility value of the author, rather than the recommended value from this volume, is that systematic errors in a given author's work may cancel in the α°/α ratio.

Studies of the solubility of oxygen in aqueous electrolyte solutions appear in over 30 papers. The seven papers which report salt effect data on oxygen solubility in four or more electrolyte solutions are discussed below. The papers which report data on only one or two systems are discussed with the system.

Geffcken (1) measured the solubility of oxygen in aqueous solutions of HCl, H_2SO_4, HNO_3, NaOH, NaCl, KOH, and K_2SO_4 at several concentrations up to about 2 mol dm^{-3}. His average values of the Ostwald coefficient of oxygen in water of 0.03630 at 288.15 K and 0.03080 at 298.15 K were used to calculate the k_{scL} values from his data. The k_{scL} values from his work usually show a small decrease in magnitude as the electrolyte concentration increases. In general Geffcken's measurement compare well with more modern measurements, and they are classed as tentative.

MacArthur (4) measured the solubility of atmospheric oxygen in fifteen aqueous electrolytes. He analyzed 250 cm^3 samples of air saturated solution for oxygen by a modified Winkler procedure. The salt effect parameters calculated from his data are equivalent to k_{scL} or $k_{sc\alpha}$ values. The solubility values may be in error by as much as 10 per cent. Some of the aqueous electrolyte density values appear to be in error. The salt effect parameters show more than average scatter as a function of electrolyte concentration. In spite of the defects, some of the salt effect values compare well with more modern measurements. The data are classed as doubtful or tentative depending on the system.

Eucken and Hertzberg (6) measured the Ostwald coefficient of the solubility of oxygen in aqueous solutions of $MgCl_2$, LiCl, NaCl, and KCl at several temperatures and two or three electrolyte concentrations up to about 2.5 mol kg^{-1}. Some doubt was cast on their work because of the poor agreement of their argon solubility values at 273.15 K with other workers values. However, the oxygen data appears reliable, and they are classed as tentative.

Bruhn, Gerlach and Pawlek (17) measured the solubility of oxygen in aqueous solutions of H_2SO_4, NH_4OH, $(NH_4)_2SO_4$, $CuSO_4$, $NiSO_4$, $CoSO_4$, and NaOH, usually at concentrations of 0.5, 1.0 and 1.5 mol dm^{-3}, under pressure and up to temperatures of 523 K. They did not measure the solubility of oxygen in water but they did their own evaluation of the oxygen solubility in water from literature data. They reported a Bunsen coefficient, $\alpha/cm^3(STP)cm^{-3}atm^{-1}$, and the $\alpha/\alpha°$ ratio where $\alpha°$ is the Bunsen coefficient in water. From the reported α and $\alpha/\alpha°$ values one can deduce the solubility values of oxygen in water used by them are:

T/K	$\alpha°/cm^3(STP)cm^{-3}atm^{-1}$	T/K	$\alpha°/cm^3(STP)cm^{-3}atm^{-1}$
298.15	0.02831	398.15	0.01775
323.15	0.02092	423.15	0.01959
348.15	0.01797	473.15	0.02690
373.15	0.01705	523.15	0.03782

The authors obtained smooth curves when they plotted $\alpha/\alpha°$ *vs.* c_2. However, the salt effect parameters, $k_{sc\alpha}/dm^3mol^{-1}$, calculated from the inverse of the $\alpha/\alpha°$ ratios scattered badly and do not appear to correlate well with either electrolyte concentration or temperature. Some of the scatter may be due to the choice of $\alpha°$ values, and some may be due to the difficulties encountered in making solubility measurements at high pressure. The tabulated values of $k_{sc\alpha}$ are the average of the measured values at all concentrations. The data are classed as tentative, however, they scatter more widely and are greater in magnitude than the values obtained by other workers.

Khomutov and Konnik (30) measured the solubility of oxygen from air, at 101 kPa (1 atm) at 298.15 K in forty four aqueous alkali metal salt solutions. They usually measured the oxygen solubility at 6 to 8 electrolyte concentrations up to either 0.5 or 1.2 mol dm^{-3}. The air saturated solutions were analyzed for oxygen by the Winkler method with an accuracy of ±0.05 mg dm^{-3}. The solubility of oxygen ranged from 2.8 to 8.15 mg dm^{-3} and the maximum error was stated to be ±1.8 per cent. They did not report numerical data, but they presented graphs of all 44 systems of log(solubility, mg dm^{-3}) *vs.* c_2. Except for the lithium salts, the linearity of the log (solubility) *vs.* c_2 plots was quite good. They did present a table of salt effect constants which appear to be the equivalent of $k_{sc\alpha}$ values. The salt effect parameters are classed as tentative.

Yasunischi (33, 34) measured the solubility of oxygen at a partial pressure of 101.325 kPa (1 atm) in 13 aqueous electrolyte solutions at temperatures of 288.15, 298.15 and 308.15 K and at electrolyte concentrations of about 1 to 6.4 mol dm^{-3} depending on the electrolyte. He used an apparatus similar to that of Horiuti. He tabulated both the solubility data and his value of k_{scL} from a fit to the log L°/L and c_2 data. When the log L°/L *vs.* c_2 showed a definite curvature he fitted the data to an empirical relation

$$\log(L°/L) = k°_{scL}\, c_2/(1 + k'_{scL}\, c_2)$$

The solubility values were calculated taking into account the vapor pressure of the solvent and the increase in solution volume due to the dissolved gas. The results are classed as tentative, but should be preferred over the data of others where there is a choice.

Oxygen solubility measurements have been reported in over 70 aqueous electrolyte systems. Unless otherwise stated, the salt effect parameters are for a one mole dm^{-3} electrolyte solution at an oxygen partial pressure of 101.325 kPa.

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

10(1) Oxygen + Hydrochloric acid [7647-01-0] + Water

Geffcken (1) measured the solubility of oxygen in aqueous hydrochloric acid at six acid concentrations up to 1.982 mol dm^{-3} at 288.15 and 298.15 K. The $k_{sc\alpha}$ values scatter with no definite trend with acid concentration. The average values are taken as the tentative values

T/K	288.15	298.15
$k_{sc\alpha}/dm^3 mol^{-1}$	0.0440	0.0307
standard deviation, σ	±0.0020	±0.0014

14(1) Oxygen + Sulfuric acid [7664-93-9] + Water

There are six reports on the solubility of oxygen in aqueous sulfuric acid solution. Three were carried out at atmospheric pressure near the turn of the century. Three were carried out at pressures up to 15 atm and reported in 1965 and 1967. Geffcken (1) measured the solubility of oxygen in ten solutions up to concentrations of 2.65 mol dm^{-3} at temperatures of 288.15 and 298.15 K. Christoff (2) made measurements in two solutions at 293.15 K and Bohr (3) made measurements of oxygen solubility in eight solutions at concentrations between 2.45 and 17.9 mol dm^{-3} at temperatures near 294 K. The three authors' data were converted to salt effect parameters, $k_{sc\alpha}$, which are given in the following table. The salt effect parameter values form a consistent pattern. The data are classed as tentative.

Bruhn, Gerlach, and Pawlek (17) measured the solubility of oxygen in 0.5, 1.0, and 1.5 mol dm^{-3} sulfuric acid solutions at five temperatures between 323 and 523 K. They report Bunsen coefficients and $\alpha/\alpha°$ ratios. The $\alpha/\alpha°$ values have been converted to $k_{sc\alpha}$ values. The average of the three values at each temperature are given in the table. The $k_{sc\alpha}$ values show little variation with temperature. There is some indication of a decrease in $k_{sc\alpha}$ value as the acid concentration increases, but the trend is obscured by the random scatter of the data. The data are classed as tentative.

Sulfuric Acid Concentration c_2/mol dm^{-3}	Salt Effect Parameters, $k_{sc\alpha}/dm^3\ mol^{-1}$			
	Geffcken 288.15 K	Christoff 293.15 K	Bohr 294.2 K[1]	Geffcken 298.15 K
0.245	0.134			0.115
0.264	0.120			0.114
0.489	0.109			0.099
0.509	0.103			0.098
0.915	0.102			0.085
0.948	0.105			0.087
1.474	0.100			0.088
1.756	0.102			0.083
2.45	---		0.082	---
2.476	0.090		---	---
2.647	0.092		---	0.078
4.45			0.068	
4.63		0.063	---	
5.35		---	0.063	
9.52		0.038	---	
10.2			0.041	
12.4			0.039	
14.8			0.030	
17.2			0.011	
17.9			0.003	

	Bruhn, Gerlach, and Pawlek				
	323 K	373 K	423 K	473 K	523 K
1.0	0.088	0.102	0.102	0.105	0.100
	±0.013	±0.010	±0.015	±0.023	---

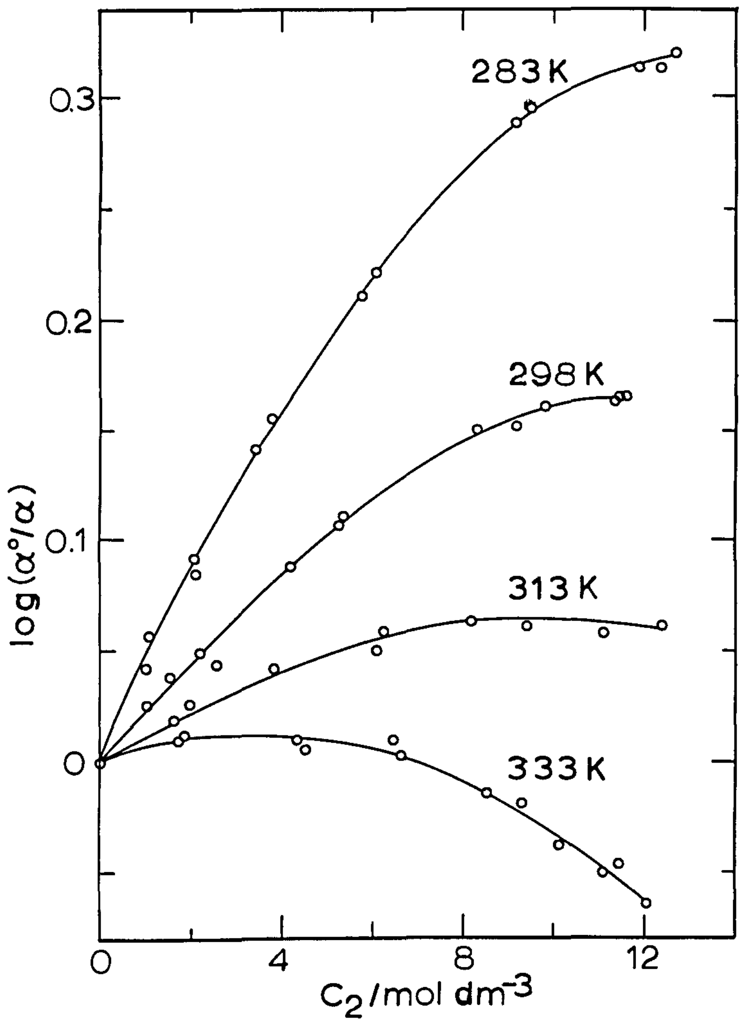
[1] Temperature ranges from 293.95 to 294.65, see data sheet.

Klyueva (19) and Turchinov (20) measured oxygen solubilities in aqueous sulfuric acid solution at several pressures. Klyueva measured the oxygen solubility at oxygen partial pressures of 2.5 and 10 atm at six temperatures between 323 and 473 K in water and at 10 atm in 0.0125 mol dm^{-3} sulfuric acid solution saturated with either Ni_3S_2, Cu_2S or Co_4S_3. The sulfuric acid metal sulfide solutions decrease the oxygen solubility to less than 50 per cent its solubility in water. The sulfide concentrations are not given. Turchinov (20) measured the oxygen solubility at oxygen partial pressures of 5, 10 and 15 atm at 383 K in four sulfuric acid solutions up to a concentration of 2.30 mol dm^{-3}. Values of $k_{sc\alpha}$ were calculated. At concentrations of 0.756 and 1.275 mol dm^{-3} H_2SO_4 the values scatter badly and they are much smaller than the values of Bruhn, Gerlach and Pawlek at similar temperatures. At the two higher acid concentrations the values of $k_{sc\alpha}$ are 0.111 ± 0.009 at 1.785 mol dm^{-3} and 0.214 ± 0.006 at 2.30 mol dm^{-3}. The first value agrees within experimental error with the Bruhn, *et al.* value, but the second value appears large for such a small increase in acid concentration.

18(1) Oxygen + Nitric acid [7697-37-2] + Water

Both Geffcken (1) and Pogrebnaya, Usov, Baranov, and Machigin (31) have measured the solubility of oxygen in aqueous nitric acid at an oxygen partial pressure near one atm (101 kPa). Geffcken made five to six measurements at acid concentrations up to near 2 mol dm^{-3} at 288.15 and 298.15 K. Pogrebnaya *et al.* made up to 13 measurements at acid concentrations up to 12.5 mol dm^{-3} at seven temperatures between 283.15 and 333.15 K.

Both data sets were converted to salt effect parameters, $k_{sc\alpha}$. The $\log(\alpha°/\alpha)$ *vs.* c_2 plots are reasonably linear up to concentrations of 3 to 4 mol dm^{-3} but show definite curvature at the larger acid concentrations. At 323 and 333 K the nitric acid salts-in oxygen starting at about 10 mol dm^{-3} and 8.5 mol dm^{-3} respectively. A graph of $\log(\alpha°/\alpha)$ *vs.* c_2 at temperatures of 283, 298, 313 and 333 K from the data of Pogrebnaya *et al.* (31) is shown.



Values of $k_{sc\alpha}$ to use at acid concentrations from 0 to 2 mol dm^{-3} acid are given below. All except the 288.15 K value were calculated from the data of Pogrebnaya *et al.* and they are classed as tentative.

T/K	$k_{sc\alpha}$/dm^3 mol^{-1}	T/K	$k_{sc\alpha}$/dm^3 mol^{-1}
283.15	0.0440	303.15	0.0175
288.15	0.0340[1]	313.15	0.0115
293.15	0.0255	323.15	0.0090
298.15	0.0240[2]	333.15	0.0050

[1] Geffcken's value.

[2] Geffcken's value is 0.0176.

Pogrebnaya *et al.* give one value of $k_{s\mu x}$ of 0.017 at 298.15 K. The solubility ratio $x°/x$ was calculated with respect to molecular nitric acid, HNO_3. Inspection of the data shows that $k_{s\mu x}$ values salt-in over most of the acid concentration range at both 323 and 333 K. The temperature coefficient of mole fraction solubility changes sign at about 16 mol percent nitric acid. At lower mole fractions oxygen solubility decreases with temperature, at higher nitric acid concentration oxygen solubility increases with temperature.

Another paper of Pogrebnaya, Usov, and Baranov (27) which may contain additional data was not available to us.

Other measurements of the solubility of oxygen in nitric acid solution were carried out at higher oxygen partial pressure. They are classed as tentative. In 1955 both Robertson, Mason and Corcoran (10) and Sprague (11) reported oxygen solubility in pure nitric acid and in nitric acid containing up to 31 weight per cent water. More recently Shapka and Atroshchenko (25, 29) and Pogrebnaya, Usov and Baranov (32) reported oxygen solubility in nitric acid solutions over wide ranges of composition, temperature and pressure. The data are presented on data sheets following this section. No attempt was made to treat the data in terms of salt effect parameters. The data of Pogrebnaya, Usov and Baranov (32) are preferred not because there is evidence they are more accurate, but because they cover the greatest range of concentration, temperature and pressure in one self-consistent study.

18(2) Oxygen + Nitric acid [7697-37-2] + Nitrogen dioxide/ Dinitrogen tetroxide

Both Robertson, Mason, and Corcoran (10) and Sprague report the solubility of oxygen in nitric acid containing NO_2/N_2O_4. The studies were carried out at different compositions and temperatures, and cannot be compared. Both are classed as tentative.

18(3) Oxygen + Ammonium hydroxide [1336-21-6] + Water

Bruhn, Gerlach, and Pawlek (17) measured the solubility of oxygen in aqueous solutions of ammonium hydroxide at concentrations of 2.87, 5.63 and 8.28 mol dm^{-3} at temperatures up to 423.15 K. Ammonium hydroxide shows only a small salt effect. The data shows no discernible trend with either concentration or temperature. The tentative salt effect parameter values are the average of the three values at each temperature.

T/K	323.15	348.15	373.15	423.15
$k_{sc\alpha}$/dm^{3}mol^{-1}	0.0063	0.0057	0.0088	0.0045
standard deviation, σ	±0.0012	±0.0027	±0.0033	±0.0013

18(4) Oxygen + Ammonium sulfate [7783-20-2] + Water

Bruhn, Gerlach, and Pawlek (17) measured the solubility of oxygen in aqueous ammonium sulfate solutions of concentrations 0.25, 0.75, 1.5 and 3.0 mol dm^{-3} at temperatures up to 473.15 K. The tentative salt effect parameter values are the average of the four values at each temperature. There is no discernible trend of the salt effect parameters with either concentration or temperature.

T/K	298.15	323.15	373.15	423.15	473.15
$k_{sc\alpha}/dm^3mol^{-1}$	0.212	0.196	0.203	0.193	0.198
standard deviation, σ	±0.021	±0.031	±0.035	±0.040	±0.036

18(5) Oxygen + Tetraethylammonium bromide [71-91-0] + Water

Morrison and Johnstone (9) measured the solubility of oxygen in water and in one mol kg^{-1} aqueous tetraethylammonium bromide solution at 298.15 K. The work is classed as tentative. The salt effect parameter is $k_{sms} = -0.046$ or $k_{smx} = -0.031$. The $k_{sc\alpha}$ value is probably of similar magnitude. Oxygen is salted-in.

29(1) Oxygen + Hydrated aluminum oxide [1333-84-6] + Water

The data of Shkol'nikova (13) are classed as tentative. The solubility of oxygen in water was not measured. No salt effect parameters were calculated for the colloidal solutions.

29(2) Oxygen + Aluminum chloride [7446-70-0] + Water

Yasunischi (34) measured the solubility of oxygen in 12 aqueous solutions of aluminum chloride up to 2.204 mol dm^{-3} at 298.15 K. The work is classed as tentative. The salt effect parameter shows a definite concentration dependence above 1.7 mol dm^{-3} $AlCl_3$. Yasunischi suggests that up to 1.7 mol dm^{-3}

$$\log(L°/L) = \log(\alpha°/\alpha) = (k_{sc\alpha}/dm^3mol^{-1})(c_2/mol\ dm^{-3}) = 0.274\ c_2$$

over the entire concentration range

$$\log(L°/L) = \log(\alpha°/\alpha) = 0.303\ c_2/(1 + 0.0859\ c_2)$$

29(3) Oxygen + Aluminum sulfate [10043-01-3] + Water

Yasunischi (34) measured the solubility of oxygen in nine aluminum sulfate solutions over the 0 to 0.812 mol dm^{-3} concentration range at 298.15 K. The work is classed as tentative. The salt effect parameter is independent of concentration and is $k_{sc\alpha} = k_{scL} = 0.745\ dm^3mol^{-1}$.

36(1) Oxygen + Copper (II) sulfate [7758-98-7] + Water

Bruhn, Gerlach, and Pawlek (17) measured the solubility of oxygen in aqueous copper (II) sulfate of 0.5, 1.0 and 1.5 mol dm^{-3} and temperatures up to 523 K. There is some tendency for the $k_{sc\alpha}$ value to decrease with concentration at each temperature. However, the tentative salt effect parameters below were obtained by averaging the values of the three concentrations.

T/K	298	323	373	423	473	523
$k_{sc\alpha}/dm^3mol^{-1}$	0.114	0.123	0.106	0.119	0.122	0.103
standard deviation, σ	±0.014	±0.018	±0.019	±0.018	±0.011	±0.003

39(1) Oxygen + Nickel sulfate [7786-81-4] + Water

Bruhn, Gerlach, and Pawlek (17) measured the solubility of oxygen in aqueous nickel sulfate at 0.5, 1.0 and 1.5 mol dm^{-3} and temperatures up to 423 K. There is a tendency of the salt effect parameters decreasing with concentration at most of the temperatures. However, the tentative salt effect parameters below were obtained by averaging the values at the three concentrations.

T/K	298	323	373	398	423
$k_{sc\alpha}/dm^3mol^{-1}$	0.113	0.116	0.112	0.115	0.122
standard deviation, σ	±0.013	±0.009	±0.025	±0.009	±0.020

40(1) Oxygen + Cobalt (II) sulfate [10124-43-3] + Water

Bruhn, Gerlach, and Pawlek (17) measured the solubility of oxygen in aqueous cobalt (II) sulfate at 0.5, 1.0 and 1.5 mol dm^{-3} at temperatures up to 423 K. There is a tendency of the salt effect parameter to decrease with concentration at each temperature. However, the salt effect parameters were obtained by averaging the values at the three concentrations.

T/K	298	323	373	398	423
$k_{sc\alpha}/dm^3mol^{-1}$	0.115	0.128	0.105	0.113	0.117
standard deviation, σ	±0.015	±0.022	±0.006	±0.025	---

41(1) Oxygen + Hydrated iron oxide [12259-21-1] + Water

The data of Shkol'nikova (13) are classed as tentative. She made no solubility measurements in pure water. No salt effect parameters were calculated for the colloidal solutions.

48(1) Oxygen + Manganese chloride ($MnCl_2$) [7773-01-5] + Water

48(2) Oxygen + Manganese sulfate ($MnSO_4$) [7785-87-7] + Water

Murray, Riley and Wilson (22) measured the solubility of oxygen in 2.69 mol dm^{-3} $MnCl_2$ and in 2.43 mol dm^{-3} $MnSO_4$ at 298.7 K. The two measurements were converted to tentative salt effect parameters of:

$$k_{sc\alpha} = 0.202 \text{ for } MnCl_2, \text{ and}$$

$$k_{sc\alpha} = 0.194 \text{ for } MnSO_4.$$

88(1) Oxygen + Uranyl fluoride (UO_2F_2) [13536-84-0] + Water

88(2) Oxygen + Uranyl sulfate (UO_2SO_4) [1314-64-3] + Water

88(3) Oxygen + Uranyl sulfate + Sulfuric acid + Copper (II) sulfate + Water

These systems were studied at high pressure. The evaluator made no attempt to convert the data into salt effect parameters. The data are classed as tentative.

Stephan, Hatfield, Peoples, and Pray (12) reported the solubility of oxygen in water and solutions containing 40, 100, and 243 g dm^{-3} of uranium as UO_2F_2 at temperatures of 373.15, 408.15, and 435.93 K over oxygen partial pressure ranges of 1.34 to 10.6 MPa.

Pray and Stephan (8), and Stephan, Hatfield, Peoples and Pray (12) reported the solubility of oxygen in water and in solutions containing 40, 100, and 243 g uranium as UO_2SO_4 at temperatures of 373.15, 408.15 and 435.93 K in both references and at additional temperatures of 477.59, 533.15, and 560.93 K in the second reference (12). The oxygen partial pressures ranged from 1.0 to 17.5 MPa. The complete data set appears in reference 12.

Anderson, Keeler and Klach (15) measured the solubility of oxygen in water and two solutions, one of which was 0.02 mol dm^{-3} UO_2SO_4, 0.005 mol dm^{-3} H_2SO_4 and 0.005 mol dm^{-3} $CuSO_4$. The second solution was 0.04 mol dm^{-3} UO_2SO_4, 0.01 mol dm^{-3} H_2SO_4 and 0.01 mol dm^{-3} $CuSO_4$. The authors saw no evidence of salting out by these relatively dilute solutions over the 373 to 573 K and 386 to 5190 kPa temperature and pressure ranges.

93(1) Oxygen + Magnesium chloride [7786-30-3] + Water

Both MacArthur (4) and Yasunischi (34) have measured the solubility of oxygen in aqueous $MgCl_2$ solutions at 298.15 K. Eucken and Hertzberg (6) made measurements at 273.15 and 293.15 K. Their measurements are summarized in the table below.

The Eucken and Hertzberg salt effect parameters show little scatter at each temperature. They are classed as tentative.

At 298.15 K MacArthur's values fall into two distinct regions, salting out more between 0 and 1 mol dm^{-3} than between 2 and 5 mol dm^{-3}. Yasunischi fitted his data up to 2.5 mol dm^{-3} to $\log(\alpha°/\alpha) = k_{sc\alpha}\,c_2$, and over the entire concentration range to $\log(\alpha°/\alpha) = k°_{sc\alpha}\,c_2/(1 + k'_{sc\alpha}\,c_2)$. MacArthur's data are classed as doubtful, and Yasunischi's data are classed tentative.

T/K	Number of Determinations[1]	Concentration Range, c_2/mol dm^{-3}	Salt Effect Parameters $k°_{sc\alpha}$/dm^{3}mol^{-1}	$k'_{sc\alpha}$/dm^{3}mol^{-1}
273.15	4	0 - 1.64	0.290	
293.15	4	0 - 1.84	0.267	
298.15	5	0 - 1	0.258[2]	
	3	2 - 5	0.211[2]	
298.15	8	0 - 2.5	0.200	
	11	0 - 3.9	0.222	0.0566

[1] Includes determination in pure water.

[2] MacArthur's values.

93(2) Oxygen + Magnesium sulfate [7487-88-9] + Water

Yasunischi (34) measured the solubility of oxygen in aqueous magnesium sulfate solutions up to concentrations of 2.608 mol dm^{-3} at temperatures of 288.15, 298.15 and 308.15 K. He found that $\log(\alpha°/\alpha)$ *vs.* c_2 was linear up to concentrations between 1.3 and 1.7 mol dm^{-3}. For the entire concentration range the data were better fitted by

$$\log(\alpha°/\alpha) = k°_{sc\alpha}\,c_2/(1 + k'_{sc\alpha}\,c_2)$$

The constants, which are classed as tentative, are summarized in the following table.

T/K	Number of Determinations[1]	Concentration Range, c_2/mol dm^{-3}	Salt Effect Parameters $k°_{sc\alpha}$/dm^{3}mol^{-1}	$k'_{sc\alpha}$/dm^{3}mol^{-1}
288.15	9	0 - 1.3	0.290	
	17	0 - 2.5	0.288	-0.0012
298.15	7	0 - 1.7	0.273	
	14	0 - 2.4	0.250	-0.0583
308.15	8	0 - 1.7	0.280	
	12	0 - 2.6	0.293	-0.0359

[1] Includes determination in pure water.

94(1) Oxygen + Calcium chloride [10043-52-4] + Water

Both MacArthur (4) and Yasunischi (34) measured the solubility of oxygen in aqueous calcium chloride solutions up to concentrations of 5 mol dm^{-3} at 298.15 K. MacArthur worked with air saturated solutions at 101 kPa (1 atm) while Yasunischi worked with oxygen at a partial pressure of 101 kPa (1 atm). The two data sets show similar features but the Yasunischi data are preferred because he made more measurements that showed less scatter. Their results are summarized in the following table.

T/K	Number of Determinations[1]	Concentration Range, c_2/mol dm^{-3}	Salt Effect Parameters	
			$k^{\circ}_{sc\alpha}/dm^3mol^{-1}$	$k'_{sc\alpha}/dm^3mol^{-1}$
298.15	3	0 - 1	0.191[2]	
	1	5	0.087[2]	
	11	0 - 2.7	0.204	
	14	0 - 4.5	0.226	0.0523

[1] Includes determination in pure water.

[2] MacArthur's values.

94(2) Oxygen + Calcium nitrate [10124-37-5] + Water

Yasunischi (34) measured the solubility of oxygen in seven aqueous calcium nitrate solutions at concentrations up to 2.4 mol dm^{-3} at 298.15 K. The tentative salt effect parameter is $k_{sc\alpha}/dm^3mol^{-1} = 0.194$.

96(1) Oxygen + Barium chloride [10361-37-2] + Water

MacArthur (4) measured the solubility of oxygen in four air saturated aqueous barium chloride solutions up to concentrations of 1 mol dm^{-3} at 298.15 K. Yasunischi (34) measured the solubility of oxygen in seven oxygen saturated solutions up to concentrations of 1.54 mol dm^{-3} at 298.15 K. The values of the salt effect parameters are

MacArthur $k_{sc\alpha}/dm^3mol^{-1} = 0.270$

Yasunischi $k_{sc\alpha}/dm^3mol^{-1} = 0.212$

The value of Yasunischi is preferred.

98(1) Oxygen + Lithium hydroxide [1310-65-2] + Water
98(2) Oxygen + Lithium fluoride [7789-24-4] + Water
98(3) Oxygen + Lithium chloride [7447-41-8] + Water
98(4) Oxygen + Lithium perchlorate [7791-03-9] + Water
98(5) Oxygen + Lithium bromide [7550-35-8] + Water
98(6) Oxygen + Lithium iodide [10377-51-2] + Water
98(7) Oxygen + Lithium sulfate [10377-48-7] + Water
98(8) Oxygen + Lithium nitrate [7790-69-4] + Water
98(9) Oxygen + Lithium carbonate [554-13-2] + Water

Khomutov and Konnik (30) measured the solubility of oxygen in the air saturated lithium salt solutions above at 298.15 K by a chemical method. The solubility values are presented graphically as log(solubility/mg dm^{-3}) *vs.* c_2/mol dm^{-3}, and the salt effect parameters, equivalent to $k_{sc\alpha}$, are tabulated.

In addition the solubility of oxygen in aqueous LiCl was measured by Eucken and Hertzberg (6) at 273.15 and 293.15 K and by MacArthur (4) at 298.15 K.

The most interesting feature of the solubility of oxygen in lithium salt solutions is the observation of Khomutov and Konnik of two linear regions of salt effects for the hydroxide, fluoride, chloride, perchlorate, bromide and nitrate of lithium. Between concentrations of 0 and about 0.07 mol dm^{-3} (0.01 for LiF) the lithium salts "salt-out" more than they do at concentrations between 0.15 and 1.2 mol dm^{-3}. Two of the salts, LiF and $LiNO_3$ "salt-out" in the low concentration region and "salt-in" in the high concentration region. LiI, Li_2SO_4 and Li_2CO_3 show a concentration independent salt effect parameter over the entire concentration range studied. This is a very interesting observation which deserves further study.

Neither Eucken and Hertzberg or MacArthur carried out studies at a low enough LiCl concentration to observe the effect. All of the results are summarized in the following table. At 298.15 K the results of Khomutov and Konnik are preferred over the result of MacArthur. All of the values are classed as tentative.

T/K	Electrolyte	Number of Determinations[1]	Range of Concentration, c_2/mol dm^{-3}	Salt Effect Parameter $k_{sc\alpha}/dm^3 mol^{-1}$
298.15	LiOH	4	0 - 0.07	0.332
		5	0.015 - 1.2	0.091
	LiF	3	0 - 0.01	0.725
		5	0.04 - 0.10	-0.385
273.15	LiCl	4	0 - 2.32	0.163[2]
293.15		4	0 - 1.94	0.140[2]
298.15		6	0 - 2	0.100[3]
		4	0 - 0.07	0.112
		6	0.15 - 1.2	0.070
298.15	$LiClO_4$	3	0 - 0.07	0.218
		5	0.15 - 1.2	0.066
	LiBr	4	0 - 0.07	0.252
		5	0.15 - 1.2	0.084
	LiI	6	0 - 0.65	0.163
	Li_2SO_4	7	0 - 1.2	0.244
	$LiNO_3$	(?)	0 - 0.07	0.196
		5	0.15 - 1.2	-0.040
	Li_2CO_3	7	0 - 0.12	0.254

[1] Includes value in pure water.

[2] Eucken and Hertzberg's values.

[3] MacArthur's value, there are two additional measurements at 3 and 4 mol dm^{-3} LiCl, for which $k_{sc\alpha}$ is 0.156 and 0.178 respectively. The two values are classed as doubtful.

99(1) Oxygen + Sodium hydroxide [1310-73-2] + Water

Geffcken (4), Khomutov and Konnik (30), and Yasunischi (34) measured the solubility of oxygen in aqueous NaOH solutions around room temperature, and Bruhn, Gerlach, and Pawlek (17) measured the solubility in 0.5, 1.0, and 1.5 mol dm^{-3} solutions at five temperatures between 323 and 523 K.

Recently Broden and Simonson (36) have measured the solubility of oxygen in water and in 0.01 and 0.10 mol dm^{-3} NaOH. Their results are presented by graphs and fitted equations. The results indicate that oxygen is salted-out more effectively by 0.01 and 0.10 mol dm^{-3} NaOH, in that the slope of log (α^0/α) *vs.* c_2 is much larger up to 0.1 than at higher molarities. This reinforces the observation of Khomutov and Konnik of a larger salt effect parameter for certain lithium salts at concentrations below 0.07 mol dm^{-3} than at larger concentrations. Broden and Simonson carried out their measurements at 323, 348, 373, 398, and 423 K and pressures of 1, 2, 3, 4, and 5 MPa.

The results are summarized below.

T/K	Salt Effect Parameter, $k_{sc\alpha}$/dm^3 mol^{-1}			
	Geffcken	Khomutov, Konnik	Yasunischi	Bruhn, Gerlach and Pawlek
288.15	0.190		0.158	
298.15	0.180	0.180	0.160	
308.15			0.167	
323				0.185
373				0.171
423				0.187
473				0.187
523				0.167

Yasunischi also fitted his data to the relationship

$$\log(\alpha°/\alpha) = k°_{sc\alpha}\ c_2/(1 + k'_{sc\alpha}\ c_2)$$

with the constants

T/K	$k°_{sc\alpha}$	$k'_{sc\alpha}$
288.15	0.171	0.0181
298.15	0.164	0.0049
308.15	0.181	0.0310

There is some concern that Yasunischi's parameters do not follow a more consistent pattern as the temperature increases. His data do cover a larger concentration range, up to 6.4 mol dm^{-3}, than do the data of the others. Geffcken's measurements go to 2 mol dm^{-3}, Khomutov and Konnik to 1.2 mol dm^{-3}, and Bruhn *et al.* are at 0.5, 1.0, and 1.5 mol dm^{-3}.

The data are classed as tentative with no reason to prefer one data set over another.

Broden and Simonson discuss in detail the salting out by NaOH at 373 K. The value of $k_{sc\alpha}$ in the limiting slope region from 0 to 0.1 mol dm^{-3} is 0.65 which is much larger than any of the values in the table above. They discuss in more detail the $NaHCO_3$ system which also exhibits the effect, and they point out that $NaNO_3$ does not show the effect, but gives a "normal" salt effect parameter at all concentrations.

99(2) Oxygen + Sodium fluoride [7681-49-4] + Water

Khomutov and Konnik (30) measured the solubility of oxygen in six aqueous sodium fluoride solutions at concentrations up to 0.6 mol dm^{-3} at 298.15 K. The salt effect parameter is $k_{sc\alpha}$/dm^3 mol^{-1} = 0.284. It is classed as tentative.

99(3) Oxygen + Sodium chloride [7647-14-5] + Water

Geffcken (1), MacArthur (4), Eucken and Hertzberg (6), and Khomutov and Konnik (30) report measurement of the solubility of oxygen in aqueous sodium chloride solution. Mishnina, Avdeeva, and Bozhovakaya (14) present an extensive table of smoothed solubility data for the system. The source of their data is not clear to us. Recently Cramer (35) made extensive measurements of the solubility of oxygen in aqueous sodium chloride and in several brines at high temperature and pressure. He reports Henry's constants in water and aqueous sodium chloride of 0.87, 2.97 and 5.69 mol kg^{-1} up to temperatures of 570 K. His Henry's constants are of the form K/MPa = $(P_1/\text{MPa})/X_1$. No attempt was made to convert his data into salt effect parameters.

The salt effect parameters are summarized in the following table. The values of Geffcken and of Eucken and Hertzberg agree well at 288.15 K. The values of Geffcken, of MacArthur, and of Khomutov and Konnik agree well at 298.15 K. The smoothed values of Mishnina *et al.* appear to be greater than the other values at all temperatures. Mishnina *et al.* did give values up to saturation, about 5.4 mol dm^{-3} NaCl. None of the experimental data known to us go above 2.5 mol dm^{-3}.

All of the data are classed as tentative with no preferance given to any one laboratories results. The data of Cramer appear to be very useful and deserve further analysis.

T/K	Salt Effect Parameter, $k_{sc\alpha}/dm^3\ mol^{-1}$				
	Geffcken	MacArthur	Eucken Hertzberg	Khomutov Konnik	Mishnina, Avdeeva Bozhovahoya
273.15			0.169		0.180
278.15					0.168
283.15					0.160
288.15	0.148		0.150		0.156
293.15			0.145		0.149
298.15	0.141	0.138	0.145	0.136	0.145
303.15					0.139

93(4) Oxygen + Sodium perchlorate [7601-89-0] + Water
93(5) Oxygen + Sodium bromide [7647-15-6] + Water
93(6) Oxygen + Sodium iodide [7681-82-5] + Water

Both Khomutov and Konnik (30) and MacArthur (4) measured the solubility of oxygen in air saturated solutions of the above solutions at 298.15 K by a chemical method. MacArthur measured solubilities only in the sodium bromide solutions. The salt effect parameters are given in the following table. All are classed as tentative, but Khomutov and Konnik's result is preferred for the sodium bromide solutions.

T/K	Electrolyte	Number of Determinations[1]	Concentration Range, c_2/dm^3mol^{-1}	Salt Effect Parameter $k_{sc\alpha}/dm^3mol^{-1}$
298.15	$NaClO_4$	8	0 - 1.2	0.160
	NaBr	8	0 - 1.2	0.131
		9	0 - 6	0.115[2]
	NaI	8	0 - 1.2	0.120

[1] Includes determination in pure water.

[2] MacArthur's value.

93(7) Oxygen + Sodium iodide [7681-82-5] +
Sodium hydroxide [1310-73-2] + Water

Murray, Riley and Wilson (22) measured the solubility of oxygen in concentrated solutions of NaI + NaOH at 298.65 K. A salt effect parameter was calculated for the combined electrolyte concentration.

T/K	NaI c_2/mol dm^{-3}	NaOH c_3/mol dm^{-3}	Total Concentration	Salt Effect Parameter $k_{sc\alpha}/dm^3\ mol^{-1}$
298.65	4	8	12	0.181
	6	10	16	0.129

The results appear consistent with the salt effect parameters for the two electrolytes determined at lower concentrations.

93(8) Oxygen + Sodium sulfite [7757-83-7] + Water

Gestrich and Pontow (28) measured the solubility of oxygen in aqueous solutions of a 38:1 ratio of Na_2SO_3 and $Na_2S_2O_5$ at concentrations up to 1.2 mol dm^{-3} and temperatures of 273.15, 288.15, 298.15, and 303.15 K. Yasunischi (33) estimated the solubility at 0.1 mol dm^{-3} intervals up to 1.0 mol dm^{-3} from his measurements of the solubility of oxygen in sodium sulfate and of nitrogen in sodium sulfite and sodium sulfate solutions. Both worker's results were recalculated as $k_{sc\alpha}/dm^3\ mol^{-1}$ values which are in the following table.

T/K	Salt Effect Parameter, $k_{sc\alpha}/dm^3\ mol^{-1}$	
	Gestrich, Pontow	Yasunischi
273.15	0.37	
288.15	0.39	
298.15	0.39	0.36
303.15	0.32	

The log(α°/α) *vs.* c_2 plots of Gestrich and Pontow show some scatter. Yasunischi's $k_{sc\alpha}$ values vary smoothly from a value of 0.43 at 0.1 mol dm^{-3} to the 0.36 value at 1.0 mol dm^{-3} Na_2SO_3. The system reacts slowly with oxygen. The results are classed as tentative.

99(9) Oxygen + Sodium sulfate [7757-82-6] + Water

MacArthur (4) and Khomutov and Konnik (30) have measured the solubility of oxygen in air saturated aqueous sodium sulfate at 298.15 K. Yasunischi (33) has measured the solubility of oxygen in the system at 288.15, 298.15, and 308.15 K. Linek and Mayrhoferova (24) have measured the solubility of oxygen in aqueous sodium sulfate solutions at 293.15 K.

Yasunischi found definite curvature in plots of log(L°/L). Agreement among the work on this system is not good. All of the data, summarized in the following table, are classed as tentative.

T/K	Number of Determinations[1]	Concentration Range, c_2/mol dm^{-3}	Salt Effect Parameter	
			$k^{\circ}_{sc\alpha}/dm^3mol^{-1}$	$k'_{sc\alpha}/dm^3mol^{-1}$
288.15	8	0 - 0.9	0.420	0.251
293.15	5	0 - 1.0	0.355[4]	
298.15	12	0 - 1.5	0.398	0.183
	5	0 - 0.5	0.325[2]	
	8	0 - 1.2	0.376[3]	
308.15	6	0 - 1.7	0.420	0.231

[1] Includes determination in pure water.

[2] MacArthur's value, another value at 1 mol dm^{-3} would have decreased the value to 0.29.

[3] Khomutov and Konnik's value. [4] Linek and Mayrhoferova's value.

99(10) Oxygen + Sodium sulfate [7757-82-6] + Sulfuric acid [7664-93-9] + Water

The single measurement of Kobe and Kenton (5) is classed as tentative.

99(11) Oxygen + Sodium sulfate [7757-82-6] + Sodium dithionite [7775-14-6] + Sodium hydroxide [1310-73-2] + Water

The work of Jhaveri and Sharma (21) on this system is classed as tentative.

99(12) Oxygen + Sodium nitrate [7631-99-4] + Water
99(13) Oxygen + Sodium phosphate [7601-54-9] + Water
99(14) Oxygen + Sodium bicarbonate [144-55-8] + Water
99(15) Oxygen + Sodium carbonate [497-19-8] + Water

Khomutov and Konnik (30), Yasunischi (34), and Broden and Simonson (36) report the solubility of oxygen in aqueous sodium nitrate solutions. Broden and Simonson do not observe larger salt effect parameters at low concentration than at high concentrations as they did for NaOH and $NaHCO_3$. Khomutov and Konnik's value accords better with Broden and Simonson's values than does the value of Yasunischi. All are classed as tentative.

The salt effect parameter for aqueous sodium phosphate of Khomutov and Konnik is classed as tentative.

Broden and Simonson (36) measured the solubility of oxygen in water and in 0.1 and 0.5 mol dm^{-3} sodium bicarbonate at five temperature between 323 and 423 K and at pressures of 1, 2, 3, 4, and 5 MPa. They find that the salt effect parameter is much larger in the 0 to 0.1 mol dm^{-3} $NaHCO_3$ region than the 0.5 mol dm^{-3} region. At 323 K the limiting value is about $k_{sc\alpha}/dm^3\ mol^{-1}$ 0.3 at all pressures, but it changes with pressure at higher temperatures. Between concentrations of 0.1 and 0.5 the value is more normal and averages about 0.14. Both the solubilities and the salt effect parameters are presented graphically in the paper.

Both Khomutov and Konnik (30) and Yasunischi (34) have measured the oxygen solubility in aqueous sodium carbonate solutions. The agreement between the two is poor. There is no reason to prefer one set of data over the other, and both are classed as tentative.

T/K	Electrolyte	Number of Determinations[1]	Concentration Range, c_2/mol dm^{-3}	Salt Effect Parameter $k_{sc\alpha}/dm^3\ mol^{-1}$
298.15	$NaNO_3$	8	0 - 1.2	0.124[2]
		9	0 - 5.1	0.109[3]
		4	0 - 1.0	0.110[4]
323		4	0 - 1.0	0.080[4]
373		4	0 - 1.0	0.065[4]
423				
298.15	Na_3PO_4	8	0 - 0.6	0.652[2]
288.15	Na_2CO_3	7	0 - 1.3	0.356[3]
298.15		10	0 - 2.1	0.338[3]
		7	0 - 1.0	0.464[4]
308.15		9	0 - 3	0.353[3]

[1] Includes determination in pure water.
[2] Khomutov and Konnik's values.
[3] Yasunischi's values
[4] Broden and Simonson's values.

99(1) Oxygen + Sodium acetate [127-09-3] + Water

Guseva, Konnik, Saifi, Kuz'min, and Mordukhovich (26) measured the solubility of oxygen in aqueous solutions and in 0.1 mol dm^{-3} sodium acetate solutions at various pH's between 0 and 14. The pH was adjusted by addition of small amounts of either KOH or H_2SO_4. The evaluator made no attempt to convert the results to salt effect parameters. The work is classed as tentative.

100(1) Oxygen + Potassium hydroxide [1310-58-3] + Water

The solubility of oxygen in aqueous potassium hydroxide has been reported from five laboratories. Geffcken (1) measured the solubility in four solutions at concentrations up to 1.17 mol dm^{-3} at 288.15 and 298.15 K. MacArthur (4) measured the solubility in solutions up to 4 mol dm^{-3} at 298.15 K. Knaster and Apel'baum (16) measured the solubility in 1, 4, 7 and 10 mol dm^{-3} KOH at temperatures of 244.15, 318.15, and 348.15 K. Shoor, Walker, and Gubbins (23) measured the solubility up to 16 mol dm^{-3} KOH at the temperatures 298.15, 313.15, 333.15, 353.15 and 373.15 K. Khomutov and Konnik (30) made measurements up to 0.8 mol dm^{-3} at 298.15 K.

The salt effect parameters are summarized in the following table.

T/K	Salt Effect Parameter, $k_{sc\alpha}$/dm^3 mol^{-1}				
	Geffcken	MacArthur	Knaster Apel'baum[1]	Shoor, Walker, Gubbins[2]	Khomutov, Konnik
288.15	0.190				
294.15			0.160		
298.15	0.177	0.130		0.180	0.176
313.15				0.168	
318.15			0.160		
333.15				0.159	
348.15			0.160		
353.15				0.157	
373.15				0.155	

[1] The evaluator's judgement of the data, which scatters as individual $k_{sc\alpha}$ values.

[2] Shoor *et al.* give their parameter as k_{scx}/dm^3 mol^{-1} = $(1/(c_2/\text{mol dm}^{-3})$ $\log(x°/x)$ where the $x°/x$ ratio is the mole fraction ratio. It may not differ much from the $\alpha°/\alpha$ ratio.

MacArthur's value should be rejected. The others are classed as tentative.

100(2) Oxygen + Potassium fluoride [7789-23-3] + Water

Khomutov and Konnik (30) measured the solubility of oxygen in six air saturated aqueous potassium fluoride solutions at concentrations up to 0.6 mol dm^{-3} at 298.15 K. The salt effect parameter, $k_{sc\alpha}$/dm^{3}mol^{-1} = 0.203 is classed as tentative.

100(3) Oxygen + Potassium chloride [7447-40-7] + Water

Four laboratories have reported on the solubility of oxygen in aqueous potassium chloride. MacArthur (4) and Khomutov and Konnik (30) measured the solubility of oxygen in air saturated solutions at concentrations up to 4 and to 1.2 mol dm^{-3} respectively at 298.15 K. Eucken and Hertzberg (6) measured the solubility up to concentrations of 2.56 and 1.52 mol dm^{-3} at 273.15 and 293.15 K, respectively. Yasunischi (34) made measurements up to concentrations of 4.1 mol dm^{-3} at 288.15, 298.15, and 308.15 K.

At concentrations below 3.2 mol dm^{-3} Yasunischi considered $\log(\alpha°/\alpha)$ *vs.* c_2 to be linear, however he gave a two constant equation to fit his data over the entire concentration range.

The salt effect parameters are summarized in the following table.

T/K	Salt Effect Parameter, $k_{sc\alpha}$/dm^3 mol^{-1}			
	MacArthur	Eucken, Hertzberg	Khomutov, Konnik	Yasunischi[1]
273.15		0.178		
288.15				0.106
293.15		0.151		
298.15	0.128		0.129	0.095
308.15				0.087

[1] For use up to 3.3 mol dm^{-3} KCl.

For the entire concentration range Yasunischi gives

T/K	Salt Effect Parameter	
	$k^\circ_{sc\alpha}$/dm^{3}mol^{-1}	$k'_{sc\alpha}$/dm^{3}mol^{-1}
288.15	0.105	-0.0022
298.15	0.103	0.0378
308.15	0.092	0.0291

The data clearly fall into two groups. The data of MacArthur, Eucken and Hertzberg, and Khomutov and Konnik make one self-consistent group. Yasunischi's data makes up the other group. At present neither group can be preferred. The data are classed as tentative.

100(4) Oxygen + Potassium perchlorate [7778-74-7] + Water
100(5) Oxygen + Potassium bromide [7758-02-3] + Water
100(6) Oxygen + Potassium iodide [7681-11-0] + Water

MacArthur (4) measured the solubility of oxygen in air saturated aqueous KBr and KI solutions, and Khomutov and Konnik (30) measured the solubility of oxygen in air saturated $KClO_4$, KBr and KI solutions. Both worked at a temperature of 298.15 K and analyzed the saturated solutions by a modified Winkler chemical method. Their results agree well, but the MacArthur measurements show more random scatter, thus the Khomutov and Konnik values are preferred. The MacArthur value of $k_{sc\alpha}$ for KI given below uses the six data points up to a concentration of 2 mol dm^{-3}. When the datum of the seventh determination at 5 mol dm^{-3} KI is added the $k_{sc\alpha}$ value increases to 0.101.

T/K	Electrolyte	Number of Determinations[1]	Concentration Range, c_2/mol dm^{-3}	Salt Effect Parameter $k_{sc\alpha}$/dm^3 mol^{-1}
298.15	$KClO_4$	8	0 - 0.12	0.150
	KBr	5	0 - 1.2	0.117
		4	0 - 4	0.123[2]
	KI	7	0 - 1.2	0.093
		7	0 - 5	0.092[2]

[1] Includes measurement in pure water.

[2] MacArthur's values.

100(7) Oxygen + Potassium sulfate [7778-80-5] + Water

Three laboratories report data on this system. Geffcken (1) made measurements at both 288.15 and 298.15 K temperatures. Both MacArthur (4) and Khomutov and Konnik report measurements at 298.15 K. Their results, obtained from the slope of log(α°/α) *vs.* c_2 plots, are in the table below.

The data are classed as tentative. At 298.15 K the agreement in the results of Geffcken and MacArthur may be misleading as MacArthur's individual data points scatter badly, while Geffcken's results fall on the line. There appears to be no reason to prefer either the Geffcken or the Khomutov and Konnik data.

T/K	Electrolyte	Number of Determinations[1]	Concentration Range, c_2/mol dm^{-3}	Salt Effect Parameter $k_{sc\alpha}$/dm^3 mol^{-1}
288.15	K_2SO_4	5	0 - 0.5	0.375[2]
298.15	K_2SO_4	4	0 - 0.5	0.345[2]
	K_2SO_4	4	0 - 0.5	0.345[3]
	K_2SO_4	5	0 - 0.6	0.297[4]

[1] Includes measurement in pure water.

[2] Geffcken

[3] MacArthur

[4] Khomutov and Konnik

100(8) Oxygen + Potassium nitrate [7757-79-1] + Water
100(9) Oxygen + Potassium phosphate [7778-53-2] + Water
100(10) Oxygen + Potassium carbonate [584-08-7] + Water

Khomutov and Konnik (30) measured the solubility of oxygen in air saturated potassium salt solutions at 298.15 K by a chemical method. They presented the solubility values on a graph and tabulated the salt effect parameter, which was equivalent to $k_{sc\alpha}$, for each salt. MacArthur (4) measured the solubility of oxygen in several air saturated potassium nitrate solutions at 298.15 K by a chemical method. The salt effect parameter of Khomutov and Konnik and of MacArthur for potassium nitrate agree within 3 per cent. The data for these solutions are classed as tentative.

T/K	Electrolyte	Number of Determinations[1]	Concentration Range, c_2/mol dm^{-3}	Salt Effect Parameter $k_{sc\alpha}$/dm^3 mol^{-1}
298.15	KNO_3	6	0 - 1.2	0.105
		5	0 - 2	0.102[2]
	K_3PO_4	7	0 - 0.6	0.507
	K_2CO_3	7	0 - 1.2	0.379

[1] Includes measurement in pure water.

[2] MacArthur's value.

101(1) Oxygen + Rubidium hydroxide [1310-82-3] + Water
101(2) Oxygen + Rubidium fluoride [13446-74-7] + Water
101(3) Oxygen + Rubidium chloride [7791-11-9] + Water
101(4) Oxygen + Rubidium perchlorate [13510-42-4] + Water
101(5) Oxygen + Rubidium bromide [7789-39-1] + Water
101(6) Oxygen + Rubidium iodide [7790-29-6] + Water
101(7) Oxygen + Rubidium sulfate [7488-54-2] + Water
101(8) Oxygen + Rubidium nitrate [13126-12-0] + Water

Khomutov and Konnik (30) measured the solubility of oxygen in air saturated rubidium salt solutions by a chemical method at 298.15 K. Their solubility values were presented on a graph and the salt effect parameter for each salt was tabulated. The salt effect parameters are classed as tentative. MacArthur (4) measured the solubility of oxygen in air saturated 0.125 mol dm^{-3} rubidium chloride at 298.15 K. The value of the salt effect parameter is classed as tentative. The salt effect parameter of Khomutov and Konnik for rubidium chloride solutions is preferred because they made measurements of the oxygen solubility in solutions of several RbCl concentrations with consistent results.

T/K	Electrolyte	Number of Measurements[1]	Concentration Range, c_2/mol dm^{-3}	Salt Effect Parameter $k_{sc\alpha}$/dm^3 mol^{-1}
298.15	RbOH	8	0 - 0.5	0.168
	RbF	8	0 - 0.5	0.146
	RbCl	7	0 - 0.5	0.120
		2	0 - 0.125	0.079[2]
	$RbClO_4$	8	0 - 0.1	0.150
	RbBr	7	0 - 0.5	0.104
	RbI	8	0 - 0.5	0.086
	Rb_2SO_4	8	0 - 0.3	0.290
	$RbNO_3$	5	0 - 0.5	0.096

[1] Includes measurement in pure water.

[2] MacArthur's value.

102(1) Oxygen + Cesium hydroxide [21351-79-1] + Water
102(2) Oxygen + Cesium fluoride [13400-13-0] + Water
102(3) Oxygen + Cesium chloride [7647-17-8] + Water
102(4) Oxygen + Cesium bromide [7787-69-1] + Water
102(5) Oxygen + Cesium iodide [7789-17-5] + Water
102(6) Oxygen + Cesium sulfate [10294-54-9] + Water
102(7) Oxygen + Cesium nitrate [7789-18-6] + Water

Khomutov and Konnik(30) measured the solubility of oxygen in air saturated cesium salt solutions by the Winkler chemical method at 298.15 K. Their solubility values were presented on a graph and the salt effect parameter for each salt was tabulated. MacArthur (4) measured the solubility of oxygen in air saturated 0.125 mol dm^{-3} cesium chloride solution by a chemical method at 298.15 K. The value is classed as tentative. The salt effect parameter of Khomutov and Konnik for cesium chloride solutions is preferred because they made more measurements over a range of salt concentrations with consistent results.

T/K	Electrolyte	Number of Measurements[1]	Concentration Range, c_2/mol dm^{-3}	Salt Effect Parameter $k_{sc\alpha}$/dm^3 mol^{-1}
298.15	CsOH	8	0 - 0.5	0.158
	CsF	8	0 - 0.5	0.114
	CsCl	8	0 - 0.5	0.098
		2	0 - 0.125	0.067[2]
	CsBr	6	0 - 0.5	0.078
	CsI	8	0 - 0.5	0.062
	Cs_2SO_4	9	0 - 0.45	0.225
	$CsNO_3$	6	0 - 0.5	0.066

[1] Includes measurement in pure water.

[2] MacArthur's value.

References:

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3. Bohr, C. *Z. Physik. Chem.* 1910, *71*, 47.
4. MacArthur, C. G. *J. Phys. Chem.* 1916, *20*, 495.
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    1979 , *82*, 487.

COMPONENTS:

(1) Oxygen, O_2; [7782-44-7]

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

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

ORIGINAL MEASUREMENTS:

Geffcken, G.

Z. Phys. Chem. 1904, *49*, 257-302.

VARIABLES:

T/K = 288-298
Concentration

PREPARED BY:

C. L. Young; R. Battino

EXPERIMENTAL VALUES:

T/K	Conc of acid/mol dm^{-3} (soln)	Ostwald coefficient, *L*
288.15	0.578	0.03431
	0.579	0.03410
	1.170	0.03217
	1.176	0.03209
	1.736	0.03069
	1.982	0.02988
298.15	0.578	0.02963
	0.578	0.02960
	1.170	0.02817
	1.176	0.02833
	1.736	0.02733
	1.982	0.02674

AUXILIARY INFORMATION

METHOD /APPARATUS/PROCEDURE:

Volumetric method using simple adsorption pipet and buret. Diagram and detailed description given in original paper.

SOURCE AND PURITY OF MATERIALS:

(1) Prepared by heating potassium chlorate and manganese dioxide. Washed with potassium hydroxide solution. Dried.

(3) Degassed.

ESTIMATED ERROR:

$\delta T/K = \pm 0.1$; $\delta L = \pm 1\%$.

(estimated by compiler).

REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Oxygen; O_2; [7782-44-7] (2) Sulfuric acid; H_2SO_4; [7664-93-9] (3) Water; H_2O; [7732-18-5]	Geffcken, G. *Z. Phys. Chem.* <u>1904</u>, *49*, 257-302.
VARIABLES:	**PREPARED BY:**
T/K = 288-298 Concentration	C.L. Young, R. Battino

EXPERIMENTAL VALUES:

T/K	Conc of acid/mol dm^{-3} (soln)	Ostwald coefficient, L
288.15	0.2445	0.03366
	0.2635	0.03375
	0.4885	0.03210
	0.5085	0.03217
	0.9480	0.02886
	0.9145	0.02930
	1.4735	0.02584
	1.7560	0.02399
	2.4755	0.02174
	2.6465	0.02067
298.15	0.2445	0.02887
	0.2635	0.02875
	0.4885	0.02757
	0.5085	0.02745
	0.9480	0.02545
	0.9145	0.02577
	1.4735	0.02285
	1.7560	0.02198
	2.6465	0.01918

AUXILIARY INFORMATION

METHOD /APPARATUS/PROCEDURE:

Volumetric method using simple adsorption pipet and buret. Diagram and detailed description given in original paper.

SOURCE AND PURITY OF MATERIALS:

(1) Prepared by heating potassium chlorate and manganese dioxide. Washed with potassium hydroxide solution. Dried.

(3) Degassed.

ESTIMATED ERROR:

$\delta T/K = \pm 0.1$; $\delta L = \pm 1\%$.
(estimated by compiler).

REFERENCES:

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

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

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

ORIGINAL MEASUREMENTS:

Christoff, A.

Z. Phys. Chem. 1906, *55*, 622-34.

VARIABLES:

T/K = 293.15
P/kPa = Atmospheric
H_2SO_4/wt % = 0 - 95.6

PREPARED BY:

M. E. Derrick
H. L. Clever

EXPERIMENTAL VALUES:

T/K	H_2SO_4/wt %	$m_{H_2SO_4}$/mol kg^{-1}	Ostwald Coefficient $L \times 10^2$
293.15	0.0	0.0	3.046
	35.82	5.690	1.561
	61.62	16.37	1.330
	95.6	222.	3.166

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The apparatus was an Ostwald type (1) with a lead capillary tube through which the gas flows to the absorption flask, the gas buret, and the gasometer.

The The acid solution was degassed by boiling under reflux. The author estimates a one per cent change in the acid concentration due to the degassing procedure. The adsorption flask was filled with solvent, the gas was introduced, and the system shaken until equilibrium was reached.

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. Prepared by heating $KClO_3$.

(2) Sulfuric acid.Merck (Darmstadt). Specific gravity 1.271,1.523, and 1.839 for 35.82, 61,61, and 95.6 wt per cent, respectively.

(3) Water. Distilled.

ESTIMATED ERROR:

$\delta T/K = 0.02$ for acid
$= 0.5$ for gas
Barometric fluctuations stated to be negligible.

REFERENCES:

1. Ostwald, W. *Lehrbuch der allgem. Chemie* (2 Aufl.), *1*, 615.

COMPONENTS:

(1) Oxygen; O_2; [7732-44-7]

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

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

ORIGINAL MEASUREMENTS:

Bohr, C.

Z. Physik. Chem. 1910, *71*, 47-50.

VARIABLES:

T/K = 294
P/kPa = 101.325
c/N = 0 - 36

PREPARED BY:

R. Battino

EXPERIMENTAL VALUES:

T/K[a]	Normality[b]	Ostwald Coeff.[c] 10^2L	Bunsen Coeff.[d] $10^2\alpha$
294.05	0.0	3.34	3.10
294.05	4.9	2.10	1.95
294.05	8.9	1.67	1.55
294.35	10.7	1.54	1.43
294.25	20.3	1.28	1.19
294.65	24.8	1.11	1.03
293.95	29.6	1.26	1.17
294.05	34.3	2.16	2.01
294.25	35.8	2.96	2.75

[a] Temperature reported to 0.1°C.

[b] Normality of sulfuric acid solution in g-equiv per liter.

[c] Ostwald coefficient calculated by compiler.

[d] Bunsen coefficient.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The absorption measuring apparatus is described in reference (1).

SOURCE AND PURITY OF MATERIALS:

No details given.

ESTIMATED ERROR:

$\delta\alpha/\alpha = \pm 0.03$, estimate by author.
Normality to 0.1, estimate by author.

REFERENCES:

1. Bohr, C. *Sauerstoffaufnahme des Blutfarbstoffes*, Kopenhagen 1895. *Jolin, Archiv f. (Anat. u.) Physiologie* 1889, 265.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Oxygen; O_2; [7782-44-7] (2) Sulfuric acid; H_2SO_4; [7664-93-9] (3) Water; H_2O; [7732-18-5]	Bruhn, G.; Gerlach, J.; Pawlek, F. *Z. Anorg. Allgem. Chem.* 1965, *337*, 68-79.

VARIABLES:	PREPARED BY:
T/K = 323-523 Concentration	C.L. Young

EXPERIMENTAL VALUES:

T/K	Conc of acid/mol l^{-1}	Bunsen coefficient, α/cm^3(STP)cm^{-3} atm^{-1}
323.15	0.5	0.01858
	1.0	0.0172
	1.5	0.0160
373.15	0.5	0.01499
	1.0	0.01379
	1.5	0.01205
423.15	0.5	0.01712
	1.0	0.01545
	1.5	0.01453
473.15	0.5	0.0234
	1.0	0.02193
523.15	0.5	0.0337

AUXILIARY INFORMATION

METHOD:/APPARATUS/PROCEDURE:

Static equilibrium cell. Similar to that described by Pray and Stephan (1). Composition of liquid determined by stripping solution of gas and estimating volumetrically.

SOURCE AND PURITY OF MATERIALS:

No details given.

ESTIMATED ERROR:

$\delta T/K = \pm 2$; $\delta\alpha = \pm 2\%$.

(estimated by compiler).

REFERENCES:

1. Pray, H.A.; Stephan, E.L. *Battelle Memorial Institute Report BMI-840*, 1953.

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

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

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

ORIGINAL MEASUREMENTS:

Turchinov, V.V.

Nauch. Tr., Irkutsk. Irkutsk. Gos. Nauch.-Issled. Inst. Redk. Tsvet. Metal., 1967, (16), 293-9.

Chem. Abstr. 1969, *70*, *61694Z*.

VARIABLES:

T/K = 383

P_{O_2}/MPa = 0.5-1.5

Concentration

PREPARED BY:

V. Katovic

EXPERIMENTAL VALUES:

$C_{H_2SO_4}$/ g ℓ^{-1}	mole ℓ^{-1}	$P^a_{O_2}$/atm	S^b
0	0	5	0.09
0	0	10	0.175
0	0	15	0.275
75	0.756	5	0.085
75	0.756	10	0.17
75	0.756	15	0.255
125	1.275	5	0.069
125	1.275	10	0.154
125	1.275	15	0.24
175	1.785	5	0.055
175	1.785	10	0.115
175	1.785	15	0.175
225	2.30	5	0.03
225	2.30	10	0.055
225	2.30	15	0.087

[a] Partial pressure of oxygen.

[b] Solubility of oxygen in ml (at standard temperature and pressure) per ml of solution at given pressure.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Sulfuric acid (400 ml) was degassed by bubbling with oxygen. The oxygen pressure was increased to desired value and the temperature was raised to 110°C. After stirring for 30 minutes, 20 ml of solution was transferred into a measuring device and cooled to room temperature. Volumes of oxygen and liquid were measured using burets.

SOURCE AND PURITY OF MATERIALS:

No details given.

ESTIMATED ERROR:

$\delta S/S = \pm 0.02$, author's estimate.

REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Oxygen; O_2; [7782-44-7] (2) Sulfuric acid; H_2SO_4; [7664-93-9] (3) Water; H_2O; [7732-18-5]	Klyueva, A.V. *Tr. Ural. Politekh. Inst.*, 1967, No. 155, 39-44. *Chem. Abstr.* 1969, 70, 23521e.

VARIABLES:	PREPARED BY:
T/K = 50-200 P/kPa = 202-1013	V. Katovic

EXPERIMENTAL VALUES:

Solubility of oxygen[a] in water

P_{O_2}[b]/atm	50°C (323K)	100°C (373K)	125°C (398K)	150°C (423K)	175°C (448K)	200°C (473K)
2	-	0.0118	0.00685	0.00593	-	-
5	0.02347	0.01436	0.00913	0.00926	0.00973	0.00973
10	-	0.02667	0.0131	0.01014	0.01134	0.01240

[a] Solubility of oxygen in mg O_2 per ml H_2O.

[b] Partial pressure of oxygen.

Solubility of oxygen[b] in 0.0125M sulfuric acid (P_{O_2}/10 atm)

Sulfide[a]	100°C (373K)	125°C (398K)	150°C (423K)	175°C (448K)	200°C (473)
Ni_3S_2	0.00917	0.00730	0.00561	0.00718	0.00633
Cu_2S	0.00956	0.00825	0.00621	0.0059	0.0057
Co_4S_3	0.00941	0.00653	0.0059	0.00483	0.00479

[a] Amounts not given.

[b] Solubility of oxygen in mg O_2 per ml solution.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:	SOURCE AND PURITY OF MATERIALS:
Oxygen was determined by the Winkler method.	No details given.
	ESTIMATED ERROR:
	REFERENCES:

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Nitric acid; HNO_3; [7697-37-2]

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

ORIGINAL MEASUREMENTS:

Geffcken, G.

Z. Phys. Chem. 1904, *49*, 257-302.

VARIABLES:

T/K = 288-298
Concentration

PREPARED BY:

C.L. Young ; R. Battino.

EXPERIMENTAL VALUES:

T/K	Conc of acid/mol dm^{-3} (soln)	Ostwald coefficient, *L*
288.15	0.492	0.03478
	0.494	0.03490
	1.00	0.03354
	1.008	0.03365
	1.88	0.03175
	1.901	0.03166
298.15	0.492	0.03021
	0.494	0.03016
	1.00	0.02954
	1.008	0.02964
	1.88	0.02853

AUXILIARY INFORMATION

METHOD /APPARATUS/PROCEDURE:

Volumetric method using simple adsorption pipet and buret. Diagram and detailed description given in original paper.

SOURCE AND PURITY OF MATERIALS:

(1) Prepared by heating potassium chlorate and manganese dioxide. Washed with potassium hydroxide solution. Dried.

(3) Degassed.

ESTIMATED ERROR:

$\delta T/K = \pm 0.1$; $\delta L = \pm 1\%$.
(estimated by compiler).

REFERENCES:

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Nitric acid; HNO_3; [7697-37-2]

(3) Nitrogen oxide; NO_2; [10102-44-0]

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

ORIGINAL MEASUREMENTS:

Robertson, G.D., Jr.; Mason, D.M.; Corcoran, W.H.

Ind. Eng. Chem. 1955, *47*, 1470-2.

VARIABLES:

T/K = 310.9 - 361.0
Pressure
Composition

PREPARED BY:

R. Battino

EXPERIMENTAL VALUES:

t/°C	T/K	$10^3\alpha$/mol dm^{-3} atm^{-1}
	HNO_3	
37.7	310.9	5.55
54.4	327.6	5.80
85 wt. per cent HNO_3 + 15 wt. per cent NO_2		
37.7	310.9	3.60
37.7	310.9	3.78
54.4	327.6	3.84
54.4	327.6	3.86
94 wt. per cent HNO_3 + 6 wt. per cent H_2O		
37.7	310.9	4.44
37.7	310.9	4.16
37.7	310.9	4.17
37.7	310.9	4.05
54.4	327.6	4.26
71.1	344.3	4.98
87.8	361.0	5.63

Henry's Law Constant $\alpha = \dfrac{[O_2]/\text{mol dm}^{-3}}{P_{O_2}/\text{atm}}$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

A sample of acid and oxygen was confined in a 3 mm i.d. precision-bore glass tube by Fluorolube S. The system was pressurized to ca. 40 atm by adjusting the volume and then agitated. The pressure was lowered to ca. 22 atm while continuing agitation. At equilibrium the solubility was determined from measurements of the liquid and gas phase volumes and the total pressure.

SOURCE AND PURITY OF MATERIALS:

(1) Commercial grade.

(2) Prepared as in reference 1.

(3) No details given.

ESTIMATED ERROR:

δP/atm = 0 ±0.005 (authors)

δT/K = ±0.05 (authors)

$\delta\alpha/\alpha$ = ±0.04 (compiler)

REFERENCES:

1. Reamer, H.H.; Corcoran, W.H.; Sage, B.H. *Ind. Eng. Chem.* 1953, *45*, 2699-704.

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Nitric acid; HNO_3; [7697-37-2]

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

ORIGINAL MEASUREMENTS:

Shapka, A.V.; Atroshchenko, A.V.

Izv. Vyssh. Ucheb. Zavod., Khim. Khim. Tekhnol. 1971, *14*, 1386-8.

Chem. Abstr. 1972, *76*, *28296u*.

VARIABLES:

T/K = 291-333
P/MPa = 1.1-5.2
Concentration

PREPARED BY:

V. Katovic

EXPERIMENTAL VALUES:

C_{HNO_3}/%	t/°C	T^a/K	P/atm 11	P/atm 21	P/atm 31	P/atm 41	P/atm 51
			S^b	S^b	S^b	S^b	S^b
30	18	291	0.182	0.422	0.606	0.780	1.044
30	18	291	0.199	0.422	0.609	0.771	1.002
30	40	313	0.140	0.417	0.565	0.720	0.879
30	40	313	0.173	0.417	0.602	0.712	0.890
30	60	333	0.142	9.335	0.507	0.626	0.788
30	60	333	0.142	0.335	0.523	0.680	0.885
50	18	291	0.280	0.372	0.681	0.870	1.130
50	18	291	0.331	0.529	0.760	0.986	1.183
50	40	313	0.183	0.424	0.699	0.806	0.988
50	40	313	0.218	0.434	0.644	0.803	0.914
50	60	333	0.398	0.596	0.806	0.908	1.027
50	60	333	0.398	0.600	0.708	0.906	1.016
60	18	291	0.37	0.530	0.733	0.935	1.019
60	18	291	0.34	0.527	0.737	0.960	0.975
60	40	313	0.468	0.427	0.827	0.991	1.200
60	40	313	0.370	0.454	0.750	1.000	1.090
60	60	333	0.315	0.630	0.840	0.980	0.910
60	60	333	0.320	0.620	0.770	0.910	0.943
70	18	291	0.276	0.464	0.750	1.070	1.180
70	18	291	0.312	0.490	0.785	1.080	1.220
70	40	313	0.274	0.590	0.820	0.970	1.020

continued on following page

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Solubilities determined by an apparatus described in the paper. The technique involved measuring volumes on burets.

SOURCE AND PURITY OF MATERIALS:

No details given.

ESTIMATED ERROR:

$\delta S/S = \pm 0.03$, compiler's estimate.

REFERENCES:

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Nitric acid; HNO_3; [7697-37-2]

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

EVALUATOR:

Shapka, A.V., Atroshchenko, A.V.

Izv. Vyssh. Ucheb. Zavod., Khim. Khim. Tekhnol. 1971, *14*, 1386-8.

Chem. Abstr. 1972, *76*, 28296u.

CRITICAL EVALUATION:

continued

$C_{HNO_3}/\%$	t/°C	T^a/K	P/atm 11	P/atm 21	P/atm 31	P/atm 41	P/atm 51
			S^b	S^b	S^b	S^b	S^b
70	40	313	0.310	0.710	0.880	0.975	1.000
70	60	333	0.346	0.590	0.900	1.120	1.390
70	60	333	0.346	0.620	0.900	1.160	1.270

[a] Calculated by compiler.

[b] Solubility in ℓ O_2(STP)/ℓ solution.

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Nitric acid; HNO_3; [7697-37-2]

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

ORIGINAL MEASUREMENTS:

Pogrebnaya, V.L.; Usov, A.P.; Baranov, A.V.; Machigin, A.A.

Izv. Vyssh. Uchebn. Zavod., Khim. Khim. Tekhnol. 1972, 15 (1), 16-20.

Chem. Abstr. 1972, 76, 132165m.

VARIABLES:

T/K = 283-333
P/kPa = 101
Concentration

PREPARED BY:

V. Katovic

EXPERIMENTAL VALUES:

Concentration of acid wt %	Concentration of acid mole %	Solubility of oxygen $10^3\alpha^a$	Solubility of oxygen $10^5x_1{}^b$
10°C			
0.0	0.0	38.1	3.07
6.1	1.8	34.5	2.80
6.5	2.0	33.9	2.75
12.2	3.8	30.9	2.53
12.3	3.8	31.4	2.57
19.4	6.4	27.5	2.29
21.3	7.2	26.7	2.23
30.6	11.2	23.5	2.03
32.1	11.9	22.9	1.98
44.8	18.8	19.6	1.79
46.2	19.7	19.3	1.78
55.3	26.1	18.5	1.81
57.1	27.5	18.5	1.83
58.4	28.6	17.8	1.78
20°C			
0.0	0.0	30.9	2.49
6.9	2.1	29.0	2.36
9.1	2.8	28.2	2.31
15.1	4.9	26.6	2.21
16.1	5.2	26.1	2.18

continued on following page

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Solubilities determined using an apparatus described in the paper.

SOURCE AND PURITY OF MATERIALS:

(1) Obtained by electrolysis.

(2) No details given.

ESTIMATED ERROR:

$\delta\alpha/\alpha$ = ±0.03, authors' estimate.

$\delta T/K$ = ±0.1

REFERENCES:

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Nitric acid; HNO_3; [7697-37-2]

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

EVALUATOR:

Pogrebnaya, V.L.; Usov, A.P.;
Baranov, A.V.; Machigin, A.A.

Izv. Vyssh. Uchebn. Zavod., Khim. Khim. Tekhnol. 1972, *15* (1), 16-20

Chem. Abstr. 1972, *76*, 132165m.

CRITICAL EVALUATION: continued

Concentration of acid		Solubility of oxygen	
wt %	mole %	$10^3\alpha^a$	$10^5x_1{}^b$
21.7	7.3	25.0	2.10
21.1	7.0	24.6	2.08
31.1	11.4	22.3	1.94
33.2	12.4	22.0	1.93
40.7	16.4	20.3	1.84
41.4	16.8	20.0	1.82
56.8	27.3	19.0	1.91
58.1	28.4	19.2	1.75
58.7	28.9	18.8	1.91
25°C			
0.0	0.0	28.5	2.29
6.6	2.0	26.8	2.19
9.4	2.9	26.1	2.15
12.8	4.0	25.5	2.11
15.0	4.7	25.8	2.08
23.4	8.0	23.3	1.98
28.5	10.2	22.3	1.93
28.7	10.3	22.1	1.91
41.7	17.0	20.2	1.85
45.3	19.1	20.1	1.87
47.9	20.8	19.7	1.86
53.8	24.9	19.6	1.93
54.2	25.3	19.5	1.93
54.8	25.7	19.5	1.94
30°C			
0.0	0.0	26.2	2.12
6.9	2.1	25.0	2.05
8.0	2.4	24.6	2.02
13.1	4.1	23.9	1.98
23.4	8.0	22.4	1.91
25.1	8.7	21.9	1.88
32.1	11.9	20.8	1.83
35.5	13.6	20.5	1.83
42.4	17.4	19.8	1.82
44.3	18.5	19.9	1.86
49.6	22.0	20.0	1.92
54.0	25.4	20.2	2.00
54.1	25.2	19.9	1.97
57.3	27.7	20.0	2.04
40°C			
0.0	0.0	23.0	1.86
9.6	2.9	22.1	1.83
10.3	3.2	21.9	1.81
12.0	3.7	21.7	1.81
20.4	6.8	21.0	1.79
20.9	7.0	20.9	1.78
21.5	7.3	20.6	1.76
32.4	12.0	20.5	1.81
33.1	12.4	20.1	1.79
41.5	16.8	19.9	1.84
46.7	20.0	20.0	1.90
53.3	24.6	20.1	2.00
57.8	28.1	21.0	2.16
58.3	28.5	20.0	2.13

continued on following page

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Nitric acid; HNO_3; [7697-37-2]

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

EVALUATOR:

Pogrebnaya, V.L.; Usov, A.P.;
Baranov, A.V.; Machigin, A.A.

Izv. Vyssh, Uchbn. Zavod., Khim. Khim. Tekhnol. 1972, 15 (1), 16-20.

Chem. Abstr. 1972, 76, 132165m.

CRITICAL EVALUATION:

continued

Concentration of acid wt %	mole %	Solubility of oxygen $10^3\alpha^a$	$10^5x_1{}^b$
	50°C		
0.0	0.0	21.0	1.71
5.9	1.8	20.6	1.70
7.2	2.2	20.5	1.69
14.3	4.6	20.0	1.68
14.9	4.8	20.5	1.73
22.7	7.7	20.2	1.74
23.4	8.0	20.0	1.73
33.4	12.5	19.8	1.77
34.3	13.0	19.5	1.76
35.1	13.4	19.7	1.78
52.3	23.9	21.0	2.09
53.4	24.7	20.7	2.08
57.6	28.0	21.3	2.21
58.8	29.0	22.2	2.33
	60°C		
0.0	0.0	19.4	1.59
10.6	3.3	19.0	1.59
11.4	3.6	18.9	1.59
22.1	7.5	19.4	1.68
24.7	8.6	19.0	1.66
25.6	8.9	19.2	1.68
34.8	13.2	19.0	1.72
35.3	13.5	19.3	1.76
43.9	18.3	20.1	1.92
47.2	20.4	20.3	1.97
50.4	22.5	21.2	2.11
54.5	25.5	21.8	2.23
55.9	26.6	21.6	2.23
58.3	28.6	22.5	2.37

[a] Bunsen coefficient.

[b] Mole fraction solubility at 101 kPa partial pressure of gas. Mole fraction is for O_2, HNO_3, and H_2O as components.

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Nitric acid; HNO_3; [7697-37-2]

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

ORIGINAL MEASUREMENTS:

Shapka, A. V.; Atroshchenko, A. V.

Zh. Prikl. Khim. 1973, *46*, 2759-61.

J. Appl. Chem. USSR (Engl. trans.) 1973, *46*, 2915-7.

VARIABLES:

T/K - 291-332

P/bar = 11-52

Concentration

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	P[a]/bar	Conc.[b] of nitric acid, %	Solubility[c]		P[a]/bar	Conc.[b] of nitric acid, %	Solubility[c]
291.15	11.1	80	0.41	313.15	41.5	90	2.37
	21.1		0.84		51.7		2.93
	31.4		1.27	333.15	11.1		0.74
	41.5		1.70		21.1		1.35
	51.7		2.12		31.4		1.96
313.15	11.1		0.47		41.5		2.58
	21.1		0.96		51.7		3.18
	31.4		1.44	291.15	11.1	98	0.97
	41.5		1.92		21.1		1.80
	51.7		2.40		31.4		2.63
333.15	11.1		0.57		41.5		3.45
	21.1		1.05		51.7		4.27
	31.4		1.55	313.15	11.1		1.10
	41.5		2.17		21.1		2.0
	51.7		2.70		31.4		2.89
291.15	11.1	90	0.57		41.5		3.78
	21.1		1.05		51.7		4.65
	31.4		1.55	333.15	11.1		1.35
	41.5		2.03		21.1		2.35
	51.7		2.51		31.4		3.34
313.15	11.1		0.67		41.5		4.32
	21.1		1.24		51.7		5.29
	31.4		1.80				

Continued on following page

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Static cell fitted with stirrer. Oxygen admitted at pressure of 100 atmospheres with periodic stirring. Pressure reduced to required pressure and solution rapidly stirred. After equilibration liquid sample withdrawn and analysed volumetrically. Details in source.

SOURCE AND PURITY OF MATERIALS:

No details given.

ESTIMATED ERROR:

$\delta T/K = \pm 1$; $\delta P/\text{bar} = \pm 0.3$; $\delta\alpha = \pm 2\%$

(estimated by compiler).

REFERENCES:

COMPONENTS:	EVALUATOR:
(1) Oxygen; O_2; [7782-44-7] (2) Nitric acid; HNO_3; [7797-37-2] (3) Water; H_2O; [7732-18-5]	Shapka, A.V.; Atroshchenko. A.V. *Zh. Prikl. Khim.* 1973, *46*, 2759-61. *J. Appl. Chem. USSR (Engl. trans.)* 1973, *46*, 2915-7.

CRITICAL EVALUATION: continued

[a] Pressure reported as 11, 21, 31, 41, 51 atm.

[b] Although the authors do not identify the %, it appears to be wt %.

[c] Solubility is in dm^3 (STP) dm^{-3} at the pressure of the measurement. Divide by the pressure (in atm) to obtain the Bunsen coefficient.

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Nitric acid; HNO_3; [7697-37-2]

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

ORIGINAL MEASUREMENTS:

Pogrebnaya, V. L.; Usov, A. P.; Baranov, A. V.

Zhur. Prikl. Khim. 1977, *50*, 12-16.
J. Appl. Chem. USSR (Engl. trans.) 1977, *50*, 10-13.

VARIABLES:

T/K = 293-353
P/bar = 10-61
Composition

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	P^a/bar	Conc. of nitric acid, wt-%	Solubility^b	T/K	P^a/bar	Conc. of nitric acid, wt-%	Solubility^b
293.15	10.1	11	0.215	333.15	10.1	11	0.154
	20.2		0.477		20.2		0.343
	30.4		0.703		30.4		0.509
	40.5		0.924		40.5		0.683
	50.7		1.169		50.7		0.848
	60.8		1.374		60.8		1.003
303.15	10.1		0.209	353.15	10.1		0.165
	20.2		0.426		20.2		0.316
	30.4		0.633		30.4		0.484
	40.5		0.838		40.5		0.629
	50.7		1.022		50.7		0.796
	60.8		1.226		60.8		0.911
313.15	10.1		0.198	293.15	10.1	21	0.227
	20.2		0.398		20.2		0.439
	30.4		0.578		30.4		0.659
	40.5		0.764		40.5		0.840
	50.7		0.948		50.7		1.058
	60.8		1.11		60.8		1.264
323.15	10.1		0.192	303.15	10.1		0.185
	20.2		0.376		20.2		0.414
	30.4		0.535		30.4		0.581
	40.5		0.705		40.5		0.775
	50.7		0.892		50.7		0.951
	60.8		1.049				

Continued on following page

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Static cell of 1 l capacity fitted with electromagnetic stirrer. Temperature measured with mercury thermometer and pressure with a Bourdon gauge. Liquid sample analysed by stripping out oxygen and measuring amount volumetrically. Details in source.

SOURCE AND PURITY OF MATERIALS:

No details given.

ESTIMATED ERROR:

$\delta T/K = \pm 0.2$; $\delta P/\text{bar} = \pm 0.3$;

$\delta\alpha = \pm 4\%$ (estimated by compiler).

REFERENCES:

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Nitric acid; HNO_3; [7697-37-2]

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

ORIGINAL MEASUREMENTS:

Pogrebnaya, V. L.; Usov, A. P.; Baranov, A. V.

Zhur. Prikl. Khim. 1977, *50*, 12-16.

J. Appl. Chem. USSR (Engl. trans.) 1977, *50*, 10-13

EXPERIMENTAL VALUES: continued

T/K	P^a/bar	Conc. of nitric acid, wt-%	Solubility^b	T/K	P^a/bar	Conc. of nitric acid, wt-%	Solubility^b
303.15	60.8	21	1.135	353.15	50.7	30	0.826
313.15	10.1		0.189		60.8		1.002
	20.2		0.371	293.15	10.1	42	0.190
	30.4		0.566		20.2		0.367
	40.5		0.579		30.4		0.538
	50.7		0.724		40.5		0.708
	60.8		1.099		50.7		0.888
323.15	10.1		0.168		60.8		1.069
	20.2		0.353	303.15	10.1		0.186
	30.4		0.550		20.2		0.354
	40.5		0.687		30.4		0.533
	50.7		0.859		40.5		0.698
	60.8		1.062		50.7		0.896
333.15	10.1		0.168		60.8		0.988
	20.2		0.383	313.15	10.1		0.178
	30.4		0.529		20.2		0.354
	40.5		0.686		30.4		0.529
	50.7		0.840		40.5		0.698
	60.8		0.976		50.7		0.896
353.15	10.1		0.179		60.8		0.988
	20.2		0.335	323.15	10.1		0.185
	30.4		0.495		20.2		0.355
	40.5		0.661		30.4		0.527
	50.7		0.833		40.5		0.718
	60.8		0.966		50.7		0.886
293.15	10.1	30	0.237		60.8		1.014
	20.2		0.406	333.15	10.1		0.177
	30.4		0.602		20.2		0.370
	40.5		0.806		30.4		0.515
	50.7		0.978		40.5		0.703
	60.8		1.164		50.7		0.891
303.15	10.1		0.186		60.8		1.036
	20.2		0.381	353.15	10.1		0.211
	30.4		0.588		20.2		0.383
	40.5		0.777		30.4		0.572
	50.7		0.931		40.5		0.793
	60.8		1.078		50.7		0.896
313.15	10.1		0.244		60.8		1.056
	20.2		0.402	293.15	10.1	53	0.200
	30.4		0.561		20.2		0.369
	40.5		0.719		30.4		0.527
	50.7		0.886		40.5		0.689
	60.8		1.053		50.7		0.886
323.15	10.1		0.209		60.8		1.039
	20.2		0.374	303.15	10.1		0.186
	30.4		0.539		20.2		0.365
	40.5		0.722		30.4		0.536
	50.7		0.895		40.5		0.671
	60.8		1.007		50.7		0.861
333.15	10.1		0.165		60.8		1.033
	20.2		0.350	313.15	10.1		0.195
	30.4		0.547		20.2		0.394
	40.5		0.691		30.4		0.561
	50.7		0.858		40.5		0.714
	60.8		1.037		50.7		0.856
353.15	10.1		0.179		60.8		1.048
	20.2		0.353	323.15	10.1		0.207
	30.4		0.513		20.2		0.389
	40.5		0.682				

Continued on following page

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Oxygen; O_2; [7782-44-7] (2) Nitric acid; HNO_3; [7697-37-2] (3) Water; H O; [7732-18-5]	Pogrebnaya, V. L.; Usov, A. P.; Baranov, A. V. *Zhur. Prikl. Khim.* 1977, *50*, 12-16. *J. Appl. Chem. USSR (Engl. trans.)* 1977, *50*, 10-13

EXPERIMENTAL VALUES: continued

T/K	*P*/bar[a]	Conc. of nitric acid, wt-%	Solubility[b]		*P*/bar[a]	Conc. of nitric acid, wt-%	Solubility[b]
323.15	30.4	53	0.581	313.15	20.2	85	0.85
	40.5		0.731		30.4		1.48
	50.7		0.945		40.5		1.69
	60.8		1.078		50.7		1.94
333.15	10.1		0.204		60.8		2.20
	20.2		0.396	323.15	10.1		0.66
	30.4		0.604		20.2		0.89
	40.5		0.787		30.4		1.307
	50.7		0.969		40.5		1.748
	60.8		1.078		50.7		2.133
293.15	10.1	70	0.225		60.8		2.538
	20.2		0.425	333.15	20.2		0.99
	30.4		0.631		30.4		1.460
	40.5		0.839		40.5		1.950
	50.7		1.057		50.7		2.379
	60.8		1.243		60.8		2.780
303.15	10.1		0.234	353.15	20.2		1.101
	20.2		0.448		30.4		1.619
	30.4		0.671		40.5		2.116
	40.5		0.856	293.15	10.1	99	0.761
	50.7		1.082		20.2		1.498
	60.8		1.289		30.4		2.191
313.15	10.1		0.259		40.5		3.017
	20.2		0.513		50.7		3.594
	30.4		0.764		60.8		4.398
	40.5		0.970	303.15	10.1		0.741
	50.7		1.174		20.2		1.539
	60.8		1.443		30.4		2.246
323.15	10.1		0.255		40.5		2.994
	20.2		0.526		50.7		3.219
	30.4		0.792		60.8		4.481
	40.5		1.048	313.15	10.1		0.789
	50.7		1.309		20.2		1.709
	60.8		1.508		30.4		2.391
333.15	20.2		0.557		40.5		3.119
	30.4		0.829		50.7		3.841
	40.5		1.070		60.8		4.739
	50.7		1.320	323.15	10.1		0.847
	60.8		1.576		20.2		1.776
353.15	10.1		0.311		30.4		2.516
	20.2		0.688		40.5		3.452
	30.4		1.011		50.7		4.273
	60.8		1.774		60.8		4.774
293.15	20.2	85	0.75	333.15	10.1		0.877
	30.4		1.086		20.2		1.733
	40.5		1.438		30.4		2.451
	50.7		1.794		40.5		3.503
	60.8		2.154		50.7		4.191
303.15	20.2		0.74		60.8		4.993
	30.4		1.17	353.15	10.1		0.984
	40.5		1.45		20.2		1.895
	50.7		1.82		30.4		2.793
	60.8		2.23				

[a] Pressure in original paper as 10, 20, 30, 40, 50, 60 atm.

[b] Solubility is in liters of O_2 per liter of solution under the oxygen pressure listed.

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Nitric acid; HNO_3; [7697-37-2]

(3) Dinitrogen Tetroxide; N_2O_4; [10544-72-6]

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

ORIGINAL MEASUREMENTS:

Sprague, R.W.

Ind. Eng. Chem. 1955, *47*, 2396-8.

VARIABLES:

Composition

T/K = 298

PREPARED BY:

R. Battino

EXPERIMENTAL VALUES:

All measurements at 25°C

$\%HNO_3$	$\%N_2O_4$	$\%H_2O$	$10^2\alpha$/cm^3 (STP) cm^{-3} atm^{-1}	10^2/cm^3(STP) O_2 g^{-1}	10^3/moles O_2 lit^{-1} atm^{-1}	10^4/moles O_2 g^{-1} atm^{-1}
100	0	0	6.59	4.37	2.94	1.95
93.94	0	6.06	4.57	3.08	2.04	1.37
90.10	0	9.90	2.99	2.03	1.33	0.904
85.15	0	14.85	1.86	1.27	0.828	0.566
80.97	0	19.03	1.58	1.08	0.703	0.483
69.11	0	30.89	1.99	1.42	0.886	0.632
92.52	7.48	0	6.59	4.30	2.94	1.92
88.69	11.31	0	6.00	3.72	2.67	1.66
85.64	14.36	0	4.26	2.68	1.90	1.20
79.99	20.01	0	3.82	2.44	1.71	1.09
0	0	100	2.3			

[a] All compositions are in weight per cent.

[b] α is the Bunsen coefficient.

[c] In the fifth column g refers to grams of solvent or solution.

[d] The sixth and seventh columns are Henry's law constants in the units indicated.

[e] All values are the author's.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

A borosilicate glass cell of volume ca. 25cm^3 and with graduated end sections was used. A sample of acid was weighed into the cell and frozen solid. A magnetically-driven stirrer sealed in glass did the stirring. The liquids were confined over perfluorinated kerosine. Gas was introduced. Pressures were read on a Heise gage to 0.5 psi, and volumes to ±0.001 cm^3. After equilibration the solubility was determined by measuring the pressure and the gas and liquid volumes.

SOURCE AND PURITY OF MATERIALS:

(1) "Used directly from the cylinder."

(2) Prepared by low-pressure distillation from potassium nitrate and concentrated sulfuric acid and condensed at dry ice-alcohol temperature.

(3) Prepared by the method of Whittaker et al. (1).

(4) Distilled. 1 to 2 ppm conductive materials.

ESTIMATED ERROR:

$\delta\alpha/\alpha = \pm 0.2$ (compiler's estimates).

REFERENCES:

1. Whittaker, A.G.; Sprague, R.W.; Skolnik, S.; Smith, G.B.L. *J. Am. Chem. Soc.* 1952, *74*, 4794-7.

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Ammonium hydroxide; NH_4OH;
[1336-21-6]

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

ORIGINAL MEASUREMENTS:

Bruhn, G.; Gerlach, J.; Pawlek, F.

Z. Anorg. Allgem. Chem. 1965, 337, 68-79.

VARIABLES:

T/K = 323-423

PREPARED BY:

C.L. Young

EXPERIMENTAL VALUES:

T/K	Conc of hydroxide/mol l^{-1}	Bunsen coefficient, α/cm^3(STP)cm^{-3} atm^{-1}
323.15	2.87	0.02025
	5.63	0.01908
	8.28	0.01840
348.15	2.87	0.01765
	5.63	0.01619
	8.28	0.01593
373.15	2.87	0.01570
	5.63	0.01575
	8.28	0.01469
423.15	2.87	0.01918
	5.63	0.01833
	8.28	0.01760

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Static equilibrium cell. Similar to that described by Pray and Stephan (1). Composition of liquid determined by stripping solution of gas and estimating volumetrically.

SOURCE AND PURITY OF MATERIALS:

No details given.

ESTIMATED ERROR:

$\delta T/K = \pm 2$; $\delta\alpha = \pm 2\%$.
(estimated by compiler).

REFERENCES:

1. Pray, H.A.; Stephan, E.L. *Batteller Memorial Institute Report BMI-840*, 1953.

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Sulfuric acid, Ammonium salt; $(NH_4)_2SO_4$; [7783-20-2]

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

ORIGINAL MEASUREMENTS:

Bruhn, G.; Gerlach, J.; Pawlek, F.

Z. *Anorg. Allgem. Chem.* 1965, *337*, 68-79.

VARIABLES:

T/K - 298-473
Concentration

PREPARED BY:

C.L. Young

EXPERIMENTAL VALUES:

T/K	Conc of salt/mol l^{-1}	α^a/cm^3(STP) cm^3 atm^{-1}
298.15	0.25	0.0248
	0.75	0.0195
	1.5	0.0133
	3.0	0.0081
323.15	0.25	0.0186
	0.75	0.0148
	1.5	0.0095
	3.0	0.0072
373.15	0.25	0.0149
	0.75	0.0131
	1.5	0.0082
	3.0	0.0050
423.15	0.75	0.01429
	1.5	0.00865
	3.0	0.00656
473.15	1.5	0.01241
	3.0	0.00812

[a] Bunsen coefficient.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Static equilibrium cell. Similar to that described by Pray and Stephan (1). Composition of liquid determined by stripping solution of gas and estimating volumetrically.

SOURCE AND PURITY OF MATERIALS:

No details given.

ESTIMATED ERROR:

$\delta T/K = \pm 2$; $\delta\alpha = \pm 2\%$.

(estimated by compiler).

REFERENCES:

1. Pray, H.A.; Stephan, E.L. *Battelle Memorial Institute Report BMI-840*, 1953.

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Aluminum chloride; $AlCl_3$; [7446-70-0]

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

ORIGINAL MEASUREMENTS:

Yasunishi, A.

Kagadu Kogaku Rombunshu 1978, *4*, 185-9.

VARIABLES:

$T/K = 298.15$
O_2 $P/kPa = 101.325$
$c_3/mol\ dm^{-3} = 0 - 2.204$

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

T/K	Aluminum chloride $c_3/mol\ dm^{-3}$	Ostwald Coefficient L
298.15	0.0	0.03114[1]
	0.309	0.02532
	0.365	0.02465
	0.599	0.02107
	0.606	0.02102
	0.724	0.01971
	0.831	0.01840
	1.182	0.01460
	1.524	0.01188
	1.696	0.01074
	1.732	0.01058
	1.897	0.01012
	2.204	0.00887

[1] Value from reference 1.

Up to a concentration of 1.7 mol dm^{-3} $AlCl_3$ the data correlates with the Setschenow equation $\log(L_o/L) = 0.274\ c_3$. Over the entire concentration range the empirical equation $\log(L_o/L) = 0.303\ c_3/(1 + 0.0859\ c_3)$ correlates the data better.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The apparatus and procedure are described in reference (1). A Horiuti type apparatus is used.

The aqueous salt solution is degassed by boiling under reflux and under vacuum.

The gas phase volume and the solvent volume are measured by displacement of mercury.

Dry gas is intermittently added until equilibrium is attained. At that time the total pressure in the dissolution vessel and the gas volume remaining in the buret are recorded.

The salt solution concentration and density are determined after the solubility measurement. The salt solution vapor pressure is either taken from the literature or estimated. A correction for the increase of the liquid volume by the dissolved gas is made.

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. High purity grade stated to be 99.995 per cent.

(2) Aluminum chloride.

(3) Water. No information.

ESTIMATED ERROR:

REFERENCES:

1. Yasunishi, A. *J. Chem. Eng. Jpn.* 1977, *10*, 89.

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Aluminum sulfate; $Al_2(SO_4)_3$; [10043-01-3]

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

ORIGINAL MEASUREMENTS:

Yasunishi, A.

Kagaku Kogaku Rombunshu 1978, *4*, 185-9.

VARIABLES:

$T/K = 298.15$

O_2 $P/kPa = 101.325$

$c_3/mol\ dm^{-3} = 0 - 0.812$

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

T/K	Aluminum sulfate $c_3/mol\ dm^{-3}$	Ostwald Coefficient L
298.15	0.0	0.03114[1]
	0.138	0.02466
	0.236	0.02115
	0.378	0.01639
	0.430	0.01528
	0.501	0.01340
	0.643	0.01024
	0.674	0.00964
	0.812	0.00766

[1] From reference 1.

The author correlated the data with the Setschenow equation $\log(L_0/L) = 0.745\ c_3$.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The apparatus and procedure are described in reference (1). A Horiuti type apparatus is used.

The aqueous salt solution is degassed by boiling under reflux and under vacuum.

The gas phase volume and the solvent volume are measured by displacement of mercury.

Dry gas is intermittently added until equilibrium is attained. At that time the total pressure in the dissolution vessel and the gas volume remaining in the buret are recorded.

The salt solution concentration and density are determined after the solubility measurement. The salt solution vapor pressure is either taken from the literature or estimated. A correction for the increase of the liquid volume by the dissolved gas is made.

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. High purity grade stated to be 99.995 per cent.

(2) Aluminum sulfate.

(3) Water. No information.

ESTIMATED ERROR:

REFERENCES:

1. Yasunishi, A.
J. Chem. Eng. Jpn. 1977, *10*, 89.

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Hydrates aluminum oxide; $Al_2O_3 \cdot xH_2O$; [1333-84-2]

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

ORIGINAL MEASUREMENTS:

Shkol'nikova, R. I.

Uch. Zap. Leningr. Gos. Univ., Ser. Khim. Nauk. 1959, Nr. *18*, 64-86.

Chem. Abstr. 1961, *55*, 25443b.

VARIABLES:

T/K= 293.15 - 313.15
P/kPa= 101.325
Al_2O_3/Wt %= 0.1 - 0.42

PREPARED BY:

A. L. Cramer
H. L. Clever

EXPERIMENTAL VALUES:

T/K	Al_2O_3/Wt %	Bunsen Coefficient $\alpha \times 10^3$
293.15	0.1	31.0
	0.35	28.7
	0.42	26.0
303.15	0.1	26.5
	0.35	26.5
	0.42	21.0
313.15	0.1	23.1
	0.35	23.1
	0.42	16.5

The enthalpy of solution of oxygen was calculated from the temperature coefficient of the Bunsen coefficient. It is 2780, 2680, 3250, and 4150 cal mol^{-1} in water, and 0.1, 0.35, and 0.42 wt % Al_2O_3 respectively.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The apparatus and procedure of Lannung were modified (1).

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. Source not given. Stated to be 99.98 - 99.99 per cent.

(2) Aluminum oxide. No information.

(3) Water. No. information.

ESTIMATED ERROR:

REFERENCES:

1. Lannung, A.
J. Am. Chem. Soc. 1930, *52*, 68.

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Sulfuric acid, copper (2+) salt (1:1); $CuSO_4$; [7758-98-7]

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

ORIGINAL MEASUREMENTS:

Bruhn, G.; Gerlach, J.; Pawlek, F.

Z. Anorg. Allgem. Chem. 1965, *337*, 68-79.

VARIABLES:

T/K = 298-523
Concentration

PREPARED BY:

C.L. Young

EXPERIMENTAL VALUES:

T/K	Conc of salt/mol l^{-1}	$\alpha^a/cm^3(STP)\ cm^3\ atm^{-1}$
298.15	0.5	0.02440
	1.0	0.02193
	1.5	0.01991
323.15	0.5	0.01775
	1.0	0.01585
	1.5	0.01449
373.15	0.5	0.01491
	1.0	0.01299
	1.5	0.01270
423.15	0.5	0.01670
	1.0	0.01511
	1.5	0.01366
473.15	0.5	0.02330
	1.0	0.01988
	1.5	0.01844
523.15	0.5	0.03355
	1.0	0.02970
	1.5	0.02680

[a] Bunsen coefficient.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE

Static equilibrium cell. Similar to that described by Pray and Stephan (1). Composition of liquid determined by stripping solution of gas and estimating volumetrically.

SOURCE AND PURITY OF MATERIALS:

No details given.

ESTIMATED ERROR:

$\delta T/K = \pm 2$; $\delta\alpha = \pm 2\%$.

(estimated by compiler)

REFERENCES:

1. Pray, H.A.; Stephan, E.L. *Batelle Memorial Institute Report BMI-840,* 1953.

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Sulfuric acid, nickel(2+) salt (1:1); $NiSO_4$; [7786-81-4]

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

ORIGINAL MEASUREMENTS:

Bruhn, G.; Gerlach, J.; Pawlek, F.

Z. Anorg. Allgem. Chem. 1965, *337*, 68-79.

VARIABLES:

T/K = 298-423
Concentration

PREPARED BY:

C.L. Young

EXPERIMENTAL VALUES:

T/K	Conc of salt/mol l^{-1}	α^a/cm^3(STP) cm^3 atm^{-1}
298.15	0.5	0.02450
	1.0	0.02175
	1.5	0.02006
323.15	0.5	0.01830
	1.0	0.01571
	1.5	0.01447
373.15	0.5	0.01450
	1.0	0.01336
	1.5	0.01240
398.15	0.5	0.01565
	1.0	0.01329
	1.5	0.01215
423.15	0.5	0.01661
	1.0	0.01492
	1.5	0.01370

[a] Bunsen coefficient.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Static equilibrium cell. Similar to that described by Pray and Stephan (1). Composition of liquid determined by stripping solution of gas and estimating volumetrically.

SOURCE AND PURITY OF MATERIALS:

No details given.

ESTIMATED ERROR:

$\delta T/K = \pm 2$; $\delta\alpha = \pm 2\%$.

(estimated by compiler).

REFERENCES:

1. Pray, H.A.; Stephan, E.L.; *Battelle Memorial Institute Report BMI-840*, 1953

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Sulfuric acid, cobalt salt; $CoSO_4$; [10124-43-3]

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

ORIGINAL MEASUREMENTS:

Bruhn, G.; Gerlach, J; Pawlek, F.

Z. Anorg. Allgem. Chem. 1965, *337*, 68-79.

VARIABLES:

T/K - 298-423

Concentration

PREPARED BY:

C.L. Young

EXPERIMENTAL VALUES:

T/K	Conc of salt/mol l^{-1}	α^a/cm^3(STP) cm^3 atm^{-1}
298.15	0.5	0.02448
	1.0	0.02150
	1.5	0.02020
323.15	0.5	0.01772
	1.0	0.01521
	1.5	0.01467
373.15	0.5	0.01520
	1.0	0.01320
	1.5	0.01190
398.15	0.5	0.01513
	1.0	0.01355
	1.5	0.01308
423.15	0.5	0.01712

[a] Bunsen coefficient

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Static equilibrium cell. Similar to that described by Pray and Stephan (1). Composition of liquid determined by stripping solution of gas and estimating volumetrically.

SOURCE AND PURITY OF MATERIALS:

No details given.

ESTIMATED ERROR:

$\delta T/K = \pm 2$; $\delta\alpha = \pm 2\%$.

(estimated by compiler).

REFERENCES:

1. Pray, H.A.; Stephan, E.L. *Battelle Memorial Institute Report BMI-840*, 1953.

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Hydrated iron oxide; $Fe_2O_3 \cdot xH_2O$; [12259-21-1]

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

ORIGINAL MEASUREMENTS:

Shkol'nikova, R. I.

Uch. Zap. Leningr. Gos. Univ., Ser. Khim. Nauk. 1959, Nr. *18*, 64-86.

Chem. Abstr. 1961, *55*, 25443b.

VARIABLES:

T/K = 293.15 - 313.15
P/kPa = 101.325
Fe_2O_3/wt % = 0.1 - 0.8

PREPARED BY:

A. L. Cramer
H. L. Clever

EXPERIMENTAL VALUES:

T/K	Fe_2O_3/Wt %	Bunsen Coefficient $\alpha \times 10^3$
293.15	0.1	30.1
	0.5	29.6
	0.8	27.9
303.15	0.1	25.3
	0.5	21.5
	0.8	20.1
313.15	0.1	21.3
	0.5	16.1
	0.8	13.0

The enthalpy of solution of oxygen was calculated from the temperature coefficient of the Bunsen coefficient. It is 2780, 2970, 5560, and 6970 cal mol^{-1} in water, and 0.1, 0.5, and 0.8 wt % Fe_2O_3 respectively.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The apparatus and procedure of Lannung were modified (1).

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. Source not given. Stated to be 99.98 - 99.99 per cent.

(2) Iron oxide. No information.

(3) Water. No information.

ESTIMATED ERROR:

REFERENCES:

1. Lannung, A.
   J. Am. Chem. Soc. 1930, *52*, 68.

COMPONENTS:

(1) Oxygen; O_2: [7782-44-7]

(2) Manganous sulphate; $MnSO_4 \cdot 4H_2O$; [7785-87-7]

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

ORIGINAL MEASUREMENTS:

Murray, C.N.; Riley, J.P.;
Wilson, T.R.S.

Deep-Sea Research 1968, *15*, 237-8.

VARIABLES:

T/K = 323.7

PREPARED BY:

R. Battino

EXPERIMENTAL VALUES:

t/°C	T/K	$10^3\alpha/cm^3(STP)cm^{-3}atm^{-1}$	10^3L	10^6x_1
	Manganous sulphate (480 g $MnSO_4 \cdot 4H_2O/\ell$)			
25.5	298.7	9.52	11.28	7.67
	Manganous chloride (600 g $MnCl_2 \cdot 4H_2O/\ell$); [13446-34-9]			
25.5	298.7	8.03	9.51	6.47
		(320 g NaOH + 600 g NaI)/ℓ		
25.5	298.7	0.19	0.23	0.16
		(400 g NaOH + 900 g NaI)/ℓ		
25.5	298.7	0.24	0.28	0.19

α = Bunsen coefficient.

L = Ostwald coefficient; calculated by compiler.

x_1 = mole fraction solubility at 101.325 kPa partial pressure of gas; calculated by compiler. Calculated for undissociated salts.

NaOH; [1310-73-2] - NaI; [7681-82-5]

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Used the Ben-Naim and Baer (1) apparatus. A liquid-saturated gas is dissolved in the stirred solution. The volume dissolved is determined on a gas buret. Measurement is done at constant pressure.

SOURCE AND PURITY OF MATERIALS:

No details given

ESTIMATED ERROR:

$\delta\alpha/\alpha$ = ±0.01 for first two solutions and ±0.1 for last two solutions. Estimate by compiler.

REFERENCES:

1. Ben-Naim, A.; Baer, S. *Trans. Faraday Soc.* 1963, *59*, 2735-8.

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Uranium, difluorodioxo-, (Uranyl fluoride); UO_2F_2; [13536-84-0]

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

ORIGINAL MEASUREMENTS:

Stephan, E. L.; Hatfield, N. S.; Peoples, R. S.; Pray. H. A. H.

Battelle Memorial Institute Report BMI-1067, 1956.

VARIABLES:

T/K = 373-436
P/bar = 16-106
Concentration

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	g Uranium per liter	$P^{\dagger}$/bar	Solubility*	T/K	g Uranium per liter	$P^{\dagger}$/bar	Solubility*
373.15	40	25.5	0.406	373.15	100	21.7	0.530
		25.5	0.418			65.5	0.91
		25.5	0.413			65.5	0.899
		39.6	0.62			65.5	0.91
		39.6	0.590			65.5	0.91
		39.6	0.644			96.2	1.26
		66.2	0.973			95.5	1.30
		66.2	0.975			95.5	1.31
		66.2	0.985		243	17.9	0.203
		66.2	1.02			19.0	0.222
		104.8	1.58			19.7	0.231
		104.8	1.545			31.7	0.323
		104.8	1.51			33.4	0.368
		104.8	1.54			33.4	0.372
	100	21.7	0.313			67.6	0.750
		21.7	0.318			67.6	0.715
		21.7	0.315			67.6	0.730
		21.7	0.534			67.6	0.740
		21.7	0.493			105.8	1.095
		21.7	0.515			105.8	1.090

* ml oxygen at 1 atmosphere and 273.15 K/g of solution.

$P^{\dagger}$ partial pressure of oxygen.

continued on following page

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Gas and liquid equilibrated for 18 hours. Pressure measured with Bourdon gauge and temperature measured with thermocouple. Composition of liquid estimated by volumetric method. Details in source. Partial pressure estimated by subtracting vapor pressure from total pressure.

SOURCE AND PURITY OF MATERIALS:

No details given.

ESTIMATED ERROR:

δT/K = ±0.6; δP/bar = ±0.3;

δ(Solubility) = ±3% (estimated by compiler).

REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Oxygen; O_2; [7782-44-7] (2) Uranium, difluorodioxo-, (Uranyl fluoride); UO_2F_2; [13536-84-0] (3) Water; H_2O; [7732-18-5]	Stephan, E. L.; Hatfield, N. S.; Peoples, R. S.; Pray, H. A. H. *Battelle Memorial Institute Report BMI-1067*, 1956.

EXPERIMENTAL VALUES: continued

T/K	g Uranium per liter	$P^\dagger$/bar	Solubility*	T/K	g Uranium per liter	$P^\dagger$/bar	Solubility*
373.15	243	105.8	1.120	435.93	40	16.2	0.34
		105.8	1.100			19.3	0.376
408.15	40	18.3	0.28			19.3	0.384
		18.3	0.32			33.1	0.61
		18.3	0.29			33.1	0.635
		30.3	0.489			33.1	0.67
		30.3	0.465			33.1	0.647
		30.3	0.480			33.8	0.665
		62.1	0.982			60.0	1.12
		62.1	1.00			60.0	1.17
		62.1	0.96			60.0	1.12
		62.1	0.97			60.9	1.21
		98.9	1.485			60.9	1.16
		98.9	1.58			61.3	1.16
		98.9	1.51			94.7	1.80
	100	20.3	0.271			97.5	1.93
		20.3	0.281			99.0	1.93
		20.3	0.31		100	15.9	0.28
		20.0	0.281			15.9	0.248
		34.1	0.540			15.9	0.285
		33.8	0.505			15.9	0.252
		33.8	0.510			33.1	0.56
		33.8	0.507			33.8	0.515
		66.2	0.969			33.8	0.56
		66.2	0.940			34.5	0.58
		66.8	0.949			60.3	1.0
		97.6	1.393			60.3	0.998
		97.6	1.380			60.3	1.02
		97.6	1.390			82.7	1.43
		97.6	1.390			84.5	1.42
	243	23.4	0.260			85.8	1.48
		24.8	0.291			87.9	1.51
		23.4	0.272		243	21.0	0.306
		33.8	0.405			22.4	0.33
		34.1	0.408			22.4	0.295
		34.1	0.416			22.4	0.31
		33.8	0.405			37.2	0.54
		65.5	0.74			37.6	0.55
		65.2	0.76			37.6	0.53
		65.2	0.765			63.8	0.91
		95.5	1.06			63.8	0.84
		95.5	1.06			63.8	0.925
		95.5	1.10			63.8	0.84
435.93	40	13.4	0.283			100.0	1.40
		14.1	0.276			100.3	1.30
		16.2	0.31			102.4	1.33
		16.2	0.32				

* ml oxygen at 1 atmosphere and 273.15 K/g of solution.

$P^\dagger$ partial pressure of oxygen.

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Dioxosulfatouranium (Uranyl sulfate); UO_2SO_4; [1314-64-3]

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

ORIGINAL MEASUREMENTS:

Pray, H.A.; Stephan, E.F.

U. S. Atomic Energy Commission 1953, *BMI-840.*

VARIABLES:

T/K = 373 - 436

P/MPa = 0.96 - 10.5

PREPARED BY:

R. Battino

EXPERIMENTAL VALUES:

P_{O_2}/psia	$P_{O_2}{}^a$/MPa	s^b	$10^4x_1{}^{a,c}$	P_{O_2}/psia	$P_{O_2}{}^a$/MPa	s^b
Water.	212°F	(373K)		$40 gU/dm^3$	212°F	(373K)
332	2.29	0.380	3.06	277	1.91	0.290
355	2.45	0.435	3.50	287	1.98	0.290
374	2.58	0.465	3.74	295	2.03	0.310
453	3.12	0.550	4.42	310	2.14	0.320
489	3.37	0.570	4.59	621	4.28	0.643
500	3.45	0.650	5.23	643	4.43	0.672
526	3.63	0.665	5.35	664	4.58	0.685
671	4.63	0.870	7.00	918	6.33	0.965
808	5.57	0.995	8.00	955	6.58	0.975
887	6.11	1.130	9.09	988	6.81	1.020
933	6.43	1.180	9.49	1020	7.03	1.060
1292	8.91	1.600	12.87	1337	9.22	1.400
1335	9.20	1.600	12.87	1386	9.56	1.370
1410	9.72	1.820	14.64	1447	9.98	1.560

[a] Calculated by compiler.

[b] Solubility in units of ml O_2(STP)/g of solvent or solution.

[c] Mole fraction solubility at partial pressure of oxygen indicated. Henry's constant is 6897(±240)MPa/mole fraction or 6.807×10^4atm/mole fraction.

continued on following page

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

A sample of saturated solution is withdrawn from a stainless steel pressurized and thermostatted autoclave and analyzed for the dissolved gas content. Details and a drawing are given in the paper.

SOURCE AND PURITY OF MATERIALS:

No details given.

ESTIMATED ERROR:

$\delta S/S = \pm 0.03$, compiler's estimate.

REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Oxygen; O_2; [7782-44-7] (2) Dioxosulfatouranium (Uranyl sulfate); UO_2SO_4; [1314-64-3] (3) Water; H_2O; [7732-18-5]	Pray, H.A.; Stephan, E.F. *U. S. Atomic Energy Commission* 1953, BMI-840.

continued

100g U/dm^3 212°F (373K)

P_{O_2}/psia	$P^a_{O_2}$/MPa	S^b
348	2.40	0.345
354	2.44	0.350
360	2.48	0.370
367	2.53	0.348
387	2.67	0.368
640	4.41	0.565
650	4.48	0.551
665	4.58	0.570
676	4.66	0.585
985	6.79	0.935
1010	6.96	0.915
1044	7.20	1.010
1363	9.40	1.260
1400	9.65	1.180
1434	9.89	1.32

243g U/dm^3 212°F (373K)

P_{O_2}/psia	$P^a_{O_2}$/MPa	S^b
505	3.48	0.338
516	3.56	0.340
538	3.71	0.360
663	4.57	0.435
685	4.72	0.480
743	5.12	0.490
760	5.24	0.468
1070	7.38	0.670
1084	7.47	0.730
1235	8.51	0.800
1277	8.80	0.800
1365	9.41	0.868

Water 275°F (408K)

P_{O_2}/psia	$P^a_{O_2}$/MPa	S^b	$10^4x_1^{a,c}$
510	3.52	0.655	5.04
525	3.62	0.645	4.97
555	3.83	0.685	5.28
590	4.07	0.73	5.62
1090	7.51	1.42	10.94
1145	7.89	1.45	11.17
1173	8.09	1.51	11.63
1180	8.13	1.60	12.32
1195	8.24	1.60	12.32
1215	8.38	1.55	11.94

100g U/dm^3 275°F (408K)

P_{O_2}/psia	$P^a_{O_2}$/MPa	S^b
575	3.96	0.540
595	4.10	0.555
617	4.25	0.60
1288	8.88	1.23
1310	9.03	1.21
1334	9.20	1.25

40g U/dm^3 275°F (408K)

P_{O_2}/psia	$P^a_{O_2}$/MPa	S^b
489	3.37	0.535
500	3.45	0.565
533	3.67	0.555
561	3.87	0.585
700	4.83	0.765
738	5.09	0.83
764	5.27	0.83
1033	7.12	1.16
1056	7.28	1.185
1074	7.40	1.22
1440	9.93	1.61
1468	10.12	1.58
1495	10.31	1.675
1522	10.49	1.66

243g U/dm^3 275°F (408K)

P_{O_2}/psia	$P^a_{O_2}$/MPa	S^b
538	3.71	0.398
563	3.88	0.398
585	4.03	0.400
600	4.14	0.400
1278	8.81	0.86
1305	9.00	0.87
1352	9.32	0.88

[a] Calculated by compiler.

[b] Solubility in units of ml O_2(STP)/g of solvent or solution.

[c] Mole fraction solubility at partial pressure of oxygen indicated. Henry's constant is 6995(±232)MPa/mole fraction or 6.904×10^4 atm/mole fraction.

continued on following page

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Oxygen; O_2; [7782-44-7] (2) Dioxosulfatouranium (Uranyl sulfate); UO_2SO_4; [1314-64-3] (3) Water; H_2O; [7732-18-5]	Pray, H.A.; Stephan, E.F. *U. S. Atomic Energy Commission* 1953, BMI-840.

continued

P_{O_2}/psia	$P^a_{O_2}$/MPa	S^b	$10^4 x_1^{a,c}$
Water.	325°F	(436K)	
195	1.34	0.303	2.44
195	1.34	0.306	2.46
195	1.34	0.314	2.53
530	3.65	0.830	6.68
560	3.86	0.880	7.08
600	4.14	0.905	7.28
950	6.55	1.41	11.34
950	6.55	1.42	11.42
960	6.62	1.51	12.15
1410	9.72	2.12	17.06
1440	9.93	2.28	18.34
100g U/dm^3	325°F	(436K)	
139	0.96	0.174	
145	1.00	0.177	
150	1.03	0.179	
333	2.30	0.396	
352	2.43	0.351	
550	3.79	0.614	
575	3.96	0.596	
605	4.17	0.669	
782	5.39	0.842	
866	5.97	0.865	
975	6.72	0.996	
1020	7.03	1.081	
1030	7.10	1.061	
1333	9.19	1.451	
1331	9.18	1.410	
1363	9.40	1.400	
1431	9.87	1.432	

P_{O_2}/psia	$P^a_{O_2}$/MPa	S^b
40g U/dm^3	325°F	(436K)
146	1.01	0.171
304	2.10	0.339
279	1.92	0.327
392	2.70	0.471
448	3.09	0.576
474	3.27	0.638
593	4.09	0.755
609	4.20	0.814
709	4.89	0.951
719	4.96	0.925
758	5.23	1.001
939	6.47	1.335
984	6.78	1.301
993	6.85	1.390
1300	8.96	1.765
1320	9.10	1.770
1346	9.28	1.716
1468	10.12	1.920
1475	10.17	1.850
1514	10.44	1.85
1520	10.48	1.98
243g U/dm^3	325°F	(436K)
599	4.13	0.457
610	4.21	0.436
631	4.35	0.445
666	4.59	0.515
1355	9.34	0.954
1378	9.50	0.955
1409	9.71	0.984
1436	9.90	1.00

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[a] Calculated by compiler.

[b] Solubility in units of ml O_2(STP)/g of solvent or solution.

[c] Mole fraction solubility at partial pressure of oxygen indicated. Henry's constant is 5537 (±158)MPa/mole fraction or 5.465 x 10^4 atm/mole fraction.

[d] Solution concentrations given as grams of uranium per liter of solution.

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Uranium, dioxo[sulfato(2-)-O-]-, (Uranyl sulfate); UO_2SO_4; [1314-64-3]

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

ORIGINAL MEASUREMENTS:

Stephan, E. L.; Hatfield, N. S.; Peoples, R. S.; Pray, H. A. H.

Battelle Memorial Institute Report BMI-1067, 1956.

VARIABLES:

T/K - 373-561
P/bar = 10-175
Concentration

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	g Uranium per liter	$P^{\dagger}$/bar	Solubility*	T/K	g Uranium per liter	$P^{\dagger}$/bar	Solubility*
373.15	40	19.1	0.290	373.15	100	26.7	0.368
		19.8	0.290			44.1	0.565
		20.3	0.310			44.8	0.551
		21.4	0.320			45.9	0.570
		42.8	0.643			46.6	0.585
		44.3	0.672			67.9	0.935
		45.8	0.685			69.6	0.915
		63.3	0.965			72.0	1.010
		65.8	0.975			94.0	1.26
		68.1	1.020			96.5	1.18
		70.3	1.060			98.9	1.32
		92.2	1.400			148.2	1.80
		95.6	1.370			150.0	1.85
		99.8	1.560			165.8	1.95
		137.6	2.04			170.0	1.97
		141.0	2.08			175.5	2.10
	100	24.0	0.345		243	34.8	0.338
		24.4	0.350			35.6	0.340
		24.8	0.370			37.1	0.360
		25.3	0.348			44.5	0.430

* ml of oxygen at 1 atmosphere and 273.15 K/g of solution.

$P^{\dagger}$ partial pressure of oxygen.

continued on following page

AUXILIARY INFORMATION

METHOD /APPARATUS/PROCEDURE:

Gas and liquid equilibrated for 18 hours. Pressure measured with Bourdon gauge and temperature measured with thermocouple. Composition of liquid estimated by volumetric method. Details in source. Partial pressure estimated by subtracting vapor pressure from total pressure.

SOURCE AND PURITY OF MATERIALS:

No details given.

ESTIMATED ERROR:

$\delta T/K = \pm 0.6$; $\delta P/bar = \pm 0.3$;

δ(Solubility) = ±3% (estimated by compiler).

REFERENCES:

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Uranium, dioxo[sulfato(2-)-O-]-, (Uranyl sulfate); UO_2SO_4; [1314-64-3]

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

ORIGINAL MEASUREMENTS:

Stephan, E. L.; Hatfield, N. S.; Peoples, R. S.; Pray, H. A. H.

Battelle Memorial Institute Report *BMI-1067*, 1956.

EXPERIMENTAL VALUES:

continued

T/K	g Uranium per liter	$P^{\dagger}$/bar	Solubility*	T/K	g Uranium per liter	$P^{\dagger}$/bar	Solubility*
373.15	243	44.8	0.450	408.15	234	20.3	0.234
		45.7	0.435			53.7	0.585
		47.2	0.480			56.1	0.630
		51.2	0.490			74.7	0.812
		73.8	0.670			76.5	0.815
		74.7	0.730			91.3	0.980
		83.1	0.790			93.0	0.970
		85.2	0.800			99.6	1.06
		88.0	0.800			100.9	1.00
		94.1	0.868			103.0	1.07
		109.3	0.990			119.6	1.21
		112.0	1.00			120.9	1.22
		128.6	1.13			129.2	1.28
		133.4	1.23			131.3	1.31
		135.5	1.16			148.5	1.44
		136.5	1.20			150.0	1.43
		139.6	1.22			152.0	1.50
		141.0	1.23	435.93	40	10.1	0.171
		154.0	1.32			30.9	0.576
		156.2	1.36			32.7	0.638
		158.2	1.38			40.9	0.755
408.15	40	33.7	0.535			42.0	0.814
		34.5	0.565			48.9	0.951
		36.7	0.555			49.6	0.925
		38.7	0.585			52.3	1.001
		48.3	0.765			64.7	1.335
		50.9	0.830			67.8	1.301
		52.7	0.830			68.5	1.390
		71.2	1.160			89.6	1.770
		72.8	1.185			89.6	1.765
		74.0	1.220			91.0	1.770
		99.3	1.610			91.3	1.76
		101.2	1.580			94.7	1.87
		103.1	1.675			101.2	1.920
		104.9	1.660			104.8	1.980
		144.4	2.320			115.4	2.260
		147.2	2.400			117.5	2.240
	100	39.6	0.540			118.9	2.270
		41.0	0.555			120.2	2.220
		42.5	0.600			123.0	2.260
		88.8	1.23			130.9	2.320
		90.3	1.21			132.7	2.340
		92.0	1.25			146.4	2.48
		120.9	1.64			150.6	2.54
		123.6	1.69			158.9	2.61
		126.4	1.71			158.9	2.61
		148.2	1.95			161.6	2.67
		148.7	1.94			163.0	2.55
		159.5	2.03			176.8	2.74
		162.2	2.10		100	9.6	0.174
		166.4	2.12			10.0	0.177
	234	18.6	0.231			10.3	0.179

* ml of oxygen at 1 atmosphere and 273.15 K/g of solution.

$P^{\dagger}$ partial pressure of oxygen.

continued on following page

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Uranium, dioxo[sulfato(2-)-O-]- [1314-64-3]

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

ORIGINAL MEASUREMENTS:

Stephan, E. L.; Hatfield, N. S.; Peoples, R. S.; Pray, H. A. H.

Battelle Memorial Institute Report BMI-1067, 1956.

EXPERIMENTAL VALUES:

continued

T/K	g Uranium per liter	$P^{\dagger}$/bar	Solubility*	T/K	g Uranium per liter	$P^{\dagger}$/bar	Solubility*
435.93	100	23.0	0.396	435.93	243	157.5	1.65
		37.9	0.614			158.9	1.73
		39.6	0.596	477.59	40	7.8	0.29
		41.7	0.669			8.5	0.31
		53.9	0.842			9.2	0.33
		59.7	0.865			22.3	0.69
		67.2	0.996			23.0	0.72
		70.3	1.081			24.3	0.74
		71.0	1.061			37.4	1.12
		91.8	1.451			38.5	1.14
		91.8	1.410			40.9	1.14
		94.0	1.400			51.9	1.48
		98.7	1.432			54.7	1.55
		123.7	1.88			76.0	1.76
		126.8	1.91			80.9	1.80
		128.5	1.83			113.3	2.34
		149.2	2.04			115.3	2.30
		152.0	2.14			117.4	2.38
		155.4	2.16			136.0	2.60
		156.1	2.08			140.2	2.66
		159.2	2.10			147.1	2.83
		162.3	2.21			151.2	2.88
	243	15.4	0.22			154.6	2.93
		16.8	0.239		100	45.4	1.04
		38.9	0.508			46.4	1.06
		40.3	0.52			58.7	1.29
		41.6	0.534			60.9	1.30
		54.1	0.70			62.9	1.44
		55.4	0.68			86.4	1.67
		56.8	0.705			87.8	1.70
		75.8	0.90			102.2	1.84
		77.5	0.94			103.6	1.85
		80.3	0.97			120.9	1.96
		83.4	1.02			125.0	2.04
		85.1	1.03			128.4	2.08
		92.7	1.06			132.0	2.20
		94.0	1.11			148.4	2.24
		100.2	1.18			150.9	2.34
		102.3	1.18			151.9	2.31
		103.7	1.23			154.0	2.34
		105.1	1.21			159.5	2.48
		105.1	1.28		243	27.4	0.49
		105.8	1.22			28.1	0.48
		106.5	1.22			29.2	0.51
		109.1	1.34			45.0	0.78
		110.6	1.30			64.3	1.10
		114.0	1.27			65.7	1.05
		116.1	1.32			74.0	1.12
		130.6	1.46			76.7	1.17
		132.7	1.50			85.7	1.22
		153.7	1.65			88.5	1.31
		155.4	1.67				

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* ml of oxygen at 1 atmosphere and 273.15 K/g of solution.

$P^{\dagger}$ partial pressure of oxygen.

continued on following page

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Uranium, dioxo[sulfato(2-)-O-]-, (Uranyl sulfate; UO_2SO_4; [1314-64-3]

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

ORIGINAL MEASUREMENTS:

Stephan, E. L.; Hatfield, N. S.; Peoples, R. S.; Pray, H. A. H.

Battelle Memorial Institute Report *BMI-1067*, 1956.

continued

EXPERIMENTAL VALUES:

T/K	g Uranium per liter	$P^{\dagger}$/bar	Solubility*	T/K	g Uranium per liter	$P^{\dagger}$/bar	Solubility*
477.59	243	120.2	1.49	533.15	100	86.8	1.77
		122.2	1.54			90.9	1.84
		138.8	1.64			94.4	1.84
		140.2	1.66			115.1	2.22
		142.2	1.64			116.5	2.14
		163.4	1.77			139.2	2.44
		164.8	1.81			142.0	2.42
		165.7	1.78			146.1	2.42
533.15	40	6.1	0.296			147.5	2.42
		6.8	0.30			150.2	2.50
		7.5	0.36		243	18.5	0.58
		8.2	0.41			19.2	0.62
		17.3	0.98			20.6	0.64
		17.9	0.97			37.9	0.84
		17.9	0.96			39.9	0.90
		18.5	1.00			42.0	0.97
		26.1	1.24			49.6	1.00
		27.2	1.30			52.0	1.05
		28.5	1.34			54.4	1.14
		29.2	1.36			57.8	1.16
		33.0	1.39			60.6	1.18
		33.4	1.39			74.4	1.25
		35.4	1.47			76.1	1.26
		51.0	1.68			77.8	1.24
		53.4	1.69			85.4	1.36
		69.9	1.98			96.5	1.48
		74.0	2.05			97.8	1.51
		74.7	2.00			110.9	1.50
		95.8	2.27			111.6	1.60
		99.9	2.38			133.7	1.66
		101.3	2.48			135.1	1.73
		104.0	2.46			136.2	1.75
		110.9	2.61	560.93	40	8.6	0.65
		118.5	2.66			10.3	0.73
		120.6	2.70			11.0	0.79
		121.3	2.78			14.1	1.03
		122.0	2.74			15.5	1.12
		122.0	2.78			16.2	1.17
	100	10.3	0.45			31.4	1.81
		12.1	0.50			32.1	1.96
		18.9	0.815			43.4	2.15
		19.6	0.854			44.8	2.21
		22.0	0.92			46.5	2.21
		30.3	1.19			74.1	2.36
		31.6	1.27			78.9	2.49
		33.7	1.32			80.3	2.52
		49.6	1.54			83.1	2.62
		53.0	1.61			93.4	2.70
		55.1	1.62			94.8	2.72
		64.7	1.66			125.1	3.12
		66.8	1.71			126.5	3.24

---

* ml of oxygen at 1 atmosphere and 273.15 K/g of solution.

$P^{\dagger}$ partial pressure of oxygen.

continued on following page

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Uranium, dioxo[sulfato(2-)-O-]-, (Uranyl sulfate); UO_2SO_4; [1314-64-3]

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

ORIGINAL MEASUREMENTS:

Stephan, E. L.; Hatfield, N. S.; Peoples, R. S.; Pray, H. A. H.

Battelle Memorial Institute Report BMI-1067, 1956.

EXPERIMENTAL VALUES:

continued

T/K	g Uranium per liter	$P^\dagger$/bar	Solubility*	T/K	g Uranium per liter	$P^\dagger$/bar	Solubility*
560.93	40	127.9	3.28	560.93	100	60.3	1.95
		129.3	3.28			62.1	1.85
		133.4	3.23			76.9	1.91
	100	11.4	0.76			79.3	2.03
		12.4	0.81			82.4	2.06
		22.4	1.37			101.0	2.14
		23.8	1.47			104.5	2.22
		24.5	1.53			107.2	2.22
		41.0	1.71			122.4	2.38
		42.4	1.82			126.5	2.42
		59.0	1.88			130.7	2.51

* ml of oxygen at 1 atmosphere and 273.15 K/g of solution.

$P^\dagger$ partial pressure of oxygen.

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Uranyl Sulfate; UO_2SO_4; [1314-64-3]

(3) Copper Sulfate; $CuSO_4$; [7758-98-7]

(4) Sulfuric Acid; H_2SO_4; [7664-93-9]

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

ORIGINAL MEASUREMENTS:

Anderson, C.J.; Keeler, R.A.; Klach, S.J.

J. Chem. Eng. Data 1962, *7*, 290-4.

VARIABLES:

$T/K = 373-573$
$P/MPa = 0.4-5.2$

PREPARED BY:

R. Battino

EXPERIMENTAL VALUES:

t/°C	T^a/K	$10^4x_1{}^b$	$P_{O_2}{}^c$/psia	$10^{-5}K^d$
		Water		
125	398	2.46	246 (1.70)^h	10.0
150	423	2.55	226 (1.56)	8.86
200	473	3.65	210 (1.45)	5.75
100	373	3.77	385 (2.65)	10.2
150	423	3.69	341 (2.35)	9.24
		Uranyl Sulfate Solution A^e		
250	523	13.5	534 (3.68)	3.95
300	573	16.3	343 (2.36)	2.10
250	523	17.2	733 (5.05)	4.25
275	548	20.5	622 (4.29)	3.03
300	573	22.9	508 (3.50)	2.22
250	523	14.6	753 (5.19)	5.14
275	548	20.1	702 (4.84)	3.49
300	573	23.5	623 (4.30)	2.65
100	373	0.980	100 (0.689)	10.2
125	398	0.763	76.3 (0.526)	10.0
150	423	0.65	56 (0.386)	8.6
100	373	3.47	350 (2.41)	10.1
125	398	3.40	316 (2.18)	9.30
150	423	2.89	246 (1.70)	8.50

continued on following page

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Kr/^{85}Kr stock mixture and O_2 are added separately to a thermostatted stainless steel vessel containing about 275 cm^3 of solution. At equilibrium both liquid and vapor were sampled and the krypton in each phase was determined by counting the ^{85}Kr tag. No details were given on how the oxygen solubilities were calculated.

SOURCE AND PURITY OF MATERIALS:

No details given.

ESTIMATED ERROR:

$\delta K/K = \pm 0.03$, compiler's estimate.
$\delta T/K = \pm 2$

REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Oxygen; O_2; [7782-44-7] (2) Uranyl Sulfate; UO_2SO_4;[1314-64-3] (3) Copper Sulfate; $CuSO_4$;[7758-98-7] (4) Sulfuric Acid; H_2SO_4;[7664-93-9] (5) Water; H_2O; [7732-18-5]	Anderson, C.J.; Keeler, R.A.; Klach, S.J. *J. Chem. Eng. Data* <u>1962</u>, *7*, 290-4.

continued

t/°C	T[a]/K	10^4x_1[b]	P_{O_2}[c]/psia	$10^{-5}K$[d]
		Uranyl Sulfate Solution B[f]		
100	373	3.209	335.3 (2.31)[h]	10.45
150	423	3.88	341 (2.35)	8.80
250	523	8.04	283 (1.95)	3.52
300	573	9.59	233 (1.61)	2.43
100	373	3.400	340.3 (2.35)	10.01
150	423	3.92	331 (2.28)	8.45
250	523	8.27	283 (1.95)	3.42
300	573	10.9	238 (1.64)	2.19
100	373	3.529	365.3 (2.52)	10.35
150	423	4.30	376 (2.59)	8.74
250	523	10.2	329 (2.26)	3.23
300	573	14.7	258 (1.78)	1.75
250	523	7.92	248 (1.71)	3.13
300	573	10.0	193 (1.33)	1.93
		Mean Values[g]		
100	373			10.2
125	398			9.75
150	423			8.66
200	473			5.75
250	523			3.45
300	573			2.10

[a] Calculated by compiler.

[b] Mole fraction solubility at 1 psia partial pressure of gas.

[c] Oxygen partial pressure in psia.

[d] Henry's law constant in psia per mole fraction.

[e] Solution A: 0.02 mol dm^{-3} uranyl sulfate, 0.005 mol dm^{-3} copper sulfate, 0.005 mol dm^{-3} sulfuric acid.

[f] Solution B: 0.04 mol dm^{-3}uranyl sulfate, 0.01 mol dm^{-3} copper sulfate, 0.01 mol dm^{-3} sulfuric acid.

[g] Mean values of Henry's law constant for water <u>and</u> the two sulfate solutions.

[h] Pressure in parentheses in MPa, calculated by compiler.

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Magnesium chloride; $MgCl_2$; [7786-30-3]

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

ORIGINAL MEASUREMENTS:

MacArthur, C. G.

J. Phys. Chem. 1916, *20*, 495-502.

VARIABLES:

$T/K = 298.15$

O_2 $P/kPa = \sim 21.2$ (O_2 in air at one atm)

$c_3/mol\ dm^{-3} = 0 - 5$

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

T/K	Magnesium Chloride $c_3/mol\ dm^{-3}$	Solution density[1] $\rho/g\ cm^{-3}$	Solubility[2] cm^3 (STP) O_2 per dm^3	Setschenow Constant[3] k_s
298.15	0.0	1.000	5.78	-
	0.125	1.011	5.35	0.269
	0.25	1.022	5.04	0.238
	0.5	1.044	4.37	0.243
	1	1.085	3.18	0.260
	2	1.160	2.22	0.208
	4	1.284	0.78	0.217
	5	1.343	0.54	0.206

[1] The author calculated the densities from data in the *International Critical Tables*. Use the density values with caution, some of them appear to be in error.

[2] The solubility in water is about 3 per cent smaller than the presently accepted value.

[3] The Setschenow constant (salt effect parameter) is calculated from $k_s = (1/c_3) \log$ (Solubility in water/Solubility in solution).

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The solutions were thermostated in tall cylinder open to the air. They were shaken by hand several times a day for a period of four days.

A sample of 250 cm^3 was analyzed for oxygen by a modified Winkler method.

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. Air at one atm.

(2) Magnesium chloride. No information.

(3) Water. No information.

ESTIMATED ERROR:

The solubility values may be in 5 to 10 per cent error. The salt concentrations above one mol dm^{-3} may be in error by 10 per cent.

REFERENCES:

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Magnesium Chloride; $MgCl_2$; [7786-30-3]

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

ORIGINAL MEASUREMENTS:

Eucken, A.; Hertzberg, G.

Z. Physik. Chem. 1950, *195*, 1 - 23.

VARIABLES:

T/K = 273.15, 293.15

P/kPa = 101.325

m_{MgCl_2}/mol kg^{-1} = 0 - 1.93

PREPARED BY:

P. L. Long
H. L. Clever

EXPERIMENTAL VALUES:

T/K	Magnesium Chloride mol kg^{-1} H_2O	Ostwald Coefficient L	Setschenow Constant $k = (1/m)\log(L^o/L)$
273.15	0	0.0490	-
	0.49	0.0358	0.280
	1.13	0.0234	0.284
	1.70	0.0163	0.281
293.14	0	0.0332	-
	0.65	0.0225	0.260
	1.24	0.0158	0.259
	1.93	0.0107	0.255

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Gas absorption. The apparatus consists of a gas buret and an adsorption flask connected by a capillary tube. The whole apparatus is shaken. The capillary tube is a 2m-long glass helix. An amount of gas is measured at STP and placed in the gas buret. After shaking, the difference from the original amount of gas placed in the gas buret is determined.

SOURCE AND PURITY OF MATERIALS:

Components. Neither source nor purity given.

ESTIMATED ERROR:

$\delta L/L = 0.01$

REFERENCES:

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Magnesium chloride; $MgCl_2$; [7786-30-3]

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

ORIGINAL MEASUREMENTS:

Yasunishi, A.

Kagaku Kogaku Rombunshu 1978, *4*, 185-9.

VARIABLES:

$T/K = 298.15$

O_2 $P/kPa = 101.325$

$c_3/mol\ dm^{-3} = 0 - 3.872$

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

T/K	Magnesium chloride $c_3/mol\ dm^{-3}$	Ostwald Coefficient L
298.15	0.0	0.03114[1]
	0.336	0.02676
	0.546	0.02383
	0.599	0.02368
	1.178	0.01841
	1.778	0.01363
	2.126	0.01171
	2.485	0.00987
	2.871	0.00857
	3.304	0.00740
	3.872	0.00635

[1] Value from reference 1.

The author correlated the data with the Setschenow equation $\log(L_o/L) = 0.200\ c_3$ at concentration up to 2.5 mol dm^{-3} $MgCl_2$. For the entire concentration range he correlated the data with the empirical equation $\log(L_o/L) = 0.222\ c_3/(1 + 0.0566\ c_3)$.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The apparatus and procedure are described in reference (1). A Horiuti type apparatus is used.

The aqueous salt solution is degassed by boiling under reflux and under vacuum.

The gas phase volume and the solvent volume are measured by displacement of mercury.

Dry gas is intermittently added until equilibrium is attained. At that time the total pressure in the dissolution vessel and the gas volume remaining in the buret are recorded.

The salt solution concentration and density are determined after the solubility measurement. The salt solution vapor pressure is either taken from the literature or estimated. A correction for the increase of the liquid volume by the dissolved gas is made.

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. High purity grade stated to be 99.995 per cent.

(2) Magnesium chloride.

(3) Water. No information.

ESTIMATED ERROR:

REFERENCES:

1. Yasunishi, A. *J. Chem. Eng. Jpn.* 1977, *10*, 89.

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Magnesium sulfate; $MgSO_4$; [7487-88-9]

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

ORIGINAL MEASUREMENTS:

Yasunishi, A.

Kagaku Kogaku Rombunshu 1978, *4*, 185-9.

VARIABLES:

T/K = 288.15 - 308.15

O_2 P/kPa = 101.325

$c_3/\text{mol dm}^{-3}$ = 0 - 2.608

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

For the entire concentration range the data correlated better with the empirical equation $\log(L_o/L) = AC_3/(1 + BC_3)$ with the values:

T/K	$A/\text{dm}^3\ \text{mol}^{-1}$	$B/\text{dm}^3\ \text{mol}^{-1}$
288.15	0.288	-0.0012
298.15	0.250	-0.0583
308.15	0.293	-0.0359

continued on following page

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The apparatus and procedure are described in reference (1). A Horiuti type apparatus is used.

The aqueous salt solution is degassed by boiling under reflux and under vacuum.

The gas phase volume and the solvent volume are measured by displacement of mercury.

Dry gas is intermittently added until equilibrium is attained. At that time the total pressure in the dissolution vessel and the gas volume remaining in the buret are recorded.

The salt solution concentration and density are determined after the solubility measurement. The salt solution vapor pressure is either taken from the literature or estimated. A correction for the increase of the liquid volume by the dissolved gas is made.

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. High purity grade stated to be 99.995 per cent.

(2) Magnesium sulfate.

(3) Water. No information.

ESTIMATED ERROR:

REFERENCES:

1. Yasunishi, A.
   J. Chem. Eng. Jpn. 1977, *10*, 89.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Oxygen; O_2; [7782-44-7] (2) Magnesium sulfate; $MgSO_4$; [7487-88-9] (3) Water; H_2O; [7732-18-5]	Yasunishi, A. *Kagaku Kogaku Rombunshu* <u>1978</u>, *4*, 185-9.

EXPERIMENTAL VALUES: continued

T/K	Magnesium sulfate c_3/mol dm^{-3}	Ostwald Coefficient L
288.15	0.0	0.03643[1]
	0.280	0.03065
	0.364	0.02867
	0.581	0.02481
	0.617	0.02384
	1.082	0.01777
	1.213	0.01605
	1.228	0.01611
	1.239	0.01584
	1.314	0.01504
	1.500	0.01386
	1.746	0.01131
	2.102	0.00881
	2.130	0.00860
	2.431	0.00701
	2.450	0.00712
	2.456	0.00699
298.15	0.0	0.03114[1]
	0.172	0.02786
	0.284	0.02609
	0.583	0.02150
	0.994	0.01671
	1.302	0.01368
	1.422	0.01284
	1.742	0.01058
	1.784	0.01000
	2.007	0.00847
	2.120	0.00773
	2.156	0.00752
	2.291	0.00667
	2.339	0.00640
308.15	0.0	0.02764[1]
	0.306	0.02235
	0.577	0.01896
	0.580	0.01875
	0.672	0.01753
	0.711	0.01746
	1.218	0.01270
	1.422	0.01113
	1.728	0.00918
	2.096	0.00672
	2.351	0.00570
	2.608	0.00463

[1] Values from reference 1.

The author correlated the data with the Setschenow equation $\log(L_0/L)=KC_3$ at concentrations below 1.3, 1.7, and 1.7 mol dm^{-3} and temperatures of 288.15, 298.15 and 308.15 K respectively. The values of K are:

T/K	K/dm^3 mol^{-1}
288.15	0.290
298.15	0.273
308.15	0.280

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Calcium nitrate; $Ca(NO_3)_2$; [10124-37-5]

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

ORIGINAL MEASUREMENTS:

Yasunishi, A.

Kagaku Kogaku Rombunshu 1978, *4*, 185-9.

VARIABLES:

$T/K = 298.15$

O_2 $P/kPa = 101.325$

$c_3/mol\ cm^{-3} = 0 - 2.416$

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

T/K	Calcium nitrate $c_3/mol\ dm^{-3}$	Ostwald Coefficient L
298.15	0.0	0.03114[1]
	0.514	0.02457
	0.694	0.02295
	1.031	0.01976
	1.496	0.01595
	1.513	0.01593
	2.040	0.01253
	2.416	0.01059

[1] Value from reference 1.

The author correlated the data with the Setschenow equation $\log(L_o/L) = 0.194\ c_3$.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The apparatus and procedure are described in reference (1). A Horiuti type apparatus is used.

The aqueous salt solution is degassed by boiling under reflux and under vacuum.

The gas phase volume and the solvent volume are measured by displacement of mercury.

Dry gas is intermittently added until equilibrium is attained. At that time the total pressure in the dissolution vessel and the gas volume remaining in the buret are recorded.

The salt solution concentration and density are determined after the solubility measurement. The salt solution vapor pressure is either taken from the literature or estimated. A correction for the increase of the liquid volume by the dissolved gas is made.

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. High purity grade stated to be 99.995 per cent.

(2) Calcium nitrate.

(3) Water. No information.

ESTIMATED ERROR:

REFERENCES:

1. Yasunishi, A.
J. Chem. Eng. Jpn. 1977, *10*, 89.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Oxygen; O_2; [7782-44-7] (2) Calcium chloride; $CaCl_2$; [10043-52-4] (3) Water; H_2O; [7732-18-5]	MacArthur, C. G. *J. Phys. Chem.* 1916, *20*, 495-502.

VARIABLES:	PREPARED BY:
$T/K = 298.15$ O_2 $P/kPa = \sim 21.2$ (O_2 in air at one atm) $c_3/mol\ dm^{-3} = 0 - 5$	H. L. Clever

EXPERIMENTAL VALUES:

T/K	Calcium Chloride $c_3/mol\ dm^{-3}$	Solution density[1] $\rho/g\ cm^{-3}$	Solubility[2] cm^3 (STP) O_2 per dm^3	Setschenow Constant[3] k_s
298.15	0.0	1.000	5.78	-
	0.25	1.022	5.08	0.224
	1	1.084	3.71	0.193
	5	1.34	2.14	0.087

[1] The author calculated the densities from data in the *International Critical Tables*. Use the density values with caution, some of them appear to be in error.

[2] The solubility in water is about 3 per cent smaller than the presently accepted value.

[3] The Setschenow constant (salt effect parameter) is calculated from $k_s = (1/c_3)$ log (Solubility in water/Solubility in solution).

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The solutions were thermostated in tall cylinder open to the air. They were shaken by hand several times a day for a period of four days.

A sample of 250 cm^3 was analyzed for oxygen by a modified Winkler method.

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. Air at one atm.

(2) Calcium chloride. No information.

(3) Water. No information.

ESTIMATED ERROR:

The solubility values may be in 5 to 10 per cent error. The salt concentrations above one mol dm^{-3} may be in error by 10 per cent.

REFERENCES:

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Calcium chloride; $CaCl_2$; [10043-52-4]

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

ORIGINAL MEASUREMENTS:

Yasunishi, A.

Kagaku Kogaku Rombunshu 1978, *4*, 185-9.

VARIABLES:

$T/K = 298.15$

O_2 $P/kPa = 101.325$

$c_3/mol\ dm^{-3} = 0 - 4.489$

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

T/K	Calcium chloride $c_3/mol\ dm^{-3}$	Ostwald Coefficient L
298.15	0.0	0.03114[1]
	0.397	0.02510
	0.624	0.02364
	0.806	0.02171
	1.263	0.01721
	1.271	0.01668
	1.521	0.01501
	1.696	0.01367
	2.069	0.01192
	2.282	0.01067
	2.706	0.00894
	3.724	0.00597
	4.123	0.00561
	4.489	0.00490

[1] Value from reference 1.

The author correlated the data with the Setschenow equation $\log(L_o/L) = 0.204\ c_3$ up to concentration of 2.7 mol dm^{-3} $CaCl_2$. For the entire concentration range he correlated the data with the empirical equation $\log(L_o/L) = 0.226\ c_3/(1 + 0.0523\ c_3)$.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The apparatus and procedure are described in reference (1). A Horiuti type apparatus is used.

The aqueous salt solution is degassed by boiling under reflux and under vacuum.

The gas phase volume and the solvent volume are measured by displacement of mercury.

Dry gas is intermittently added until equilibrium is attained. At that time the total pressure in the dissolution vessel and the gas volume remaining in the buret are recorded.

The salt solution concentration and density are determined after the solubility measurement. The salt solution vapor pressure is either taken from the literature or estimated. A correction for the increase of the liquid volume by the dissolved gas is made.

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. High purity grade stated to be 99.995 per cent.

(2) Calcium chloride.

(3) Water. No information.

ESTIMATED ERROR:

REFERENCES:

1. Yasunishi, A. *J. Chem. Eng. Jpn.* 1977, *10*, 89.

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Barium chloride; $BaCl_2$; [10361-37-2]

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

ORIGINAL MEASUREMENTS:

MacArthur, C. G.

J. Phys. Chem. 1916, *20*, 495-502.

VARIABLES:

T/K = 298.15

O_2 P/kPa = ∿ 21.2 (O_2 in air at one atm)

c_3/mol dm^{-3} = 0 - 1

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

T/K	Barium Chloride c_3/mol dm^{-3}	Solution density[1] ρ/g cm^{-3}	Solubility[2] cm^3 (STP) O_2 per dm^3	Setschenow Constant[3] k_s
298.15	0.0	1.000	5.78	-
	0.125	1.019	5.40	0.236
	0.25	1.042	5.04	0.238
	0.5	1.082	4.27	0.263
	1	1.177	3.10	0.271

[1] The author calculated the densities from data in the *International Critical Tables.* Use the density values with caution, some of them appear to be in error.

[2] The solubility in water is about 3 per cent smaller than the presently accepted value.

[3] The Setschenow constant (salt effect parameter) is calculated from $k_s = (1/c_3)$ log (Solubility in water/Solubility in solution).

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The solutions were thermostated in tall cylinder open to the air. They were shaken by hand several times a day for a period of four days.

A sample of 250 cm^3 was analyzed for oxygen by a modified Winkler method.

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. Air at one atm.

(2) Barium chloride. No information.

(3) Water. No information.

ESTIMATED ERROR:

The solubility values may be in 5 to 10 per cent error. The salt concentrations above one mol dm^{-3} may be in error by 10 per cent.

REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Oxygen; O_2; [7782-44-7] (2) Barium chloride; $BaCl_2$; [10361-37-2] (3) Water; H_2O; [7732-18-5]	Yasunishi, A. *Kagaku Kogaku Rombunshu* 1978, *4*, 185-9.
VARIABLES:	**PREPARED BY:**
T/K = 298.15 O_2 P/kPa = 101.325 c_3/mol dm^{-3} = 0 - 1.536	H. L. Clever

EXPERIMENTAL VALUES:

T/K	Barium chloride c_3/mol dm^{-3}	Ostwald Coefficient L
298.15	0.0	0.03114[1]
	0.270	0.02726
	0.530	0.02363
	0.738	0.02202
	0.913	0.02008
	1.168	0.01744
	1.324	0.01654
	1.536	0.01458

[1] Value from reference 1.

The author correlated the data by the Setschenow equation $\log(L_o/L) = 0.212\ c_3$.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The apparatus and procedure are described in reference (1). A Horiuti type apparatus is used.

The aqueous salt solution is degassed by boiling under reflux and under vacuum.

The gas phase volume and the solvent volume are measured by displacement of mercury.

Dry gas is intermittently added until equilibrium is attained. At that time the total pressure in the dissolution vessel and the gas volume remaining in the buret are recorded.

The salt solution concentration and density are determined after the solubility measurement. The salt solution vapor pressure is either taken from the literature or estimated. A correction for the increase of the liquid volume by the dissolved gas is made.

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. High purity grade stated to be 99.995 per cent.

(2) Barium chloride.

(3) Water. No information.

ESTIMATED ERROR:

REFERENCES:

1. Yasunishi, A.
J. Chem. Eng. Jpn. 1977, *10*, 89.

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Lithium chloride; LiCl; [7447-41-8]

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

ORIGINAL MEASUREMENTS:

MacArthur, C. G.

J. Phys. Chem. 1916, *20*, 495-502.

VARIABLES:

$T/K = 298.15$
O_2 $P/kPa = \sim 21.2$ (O_2 in air at one atm)
$c_3/\text{mol dm}^{-3} = 0 - 4$

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

T/K	Lithium chloride $c_3/\text{mol dm}^{-3}$	Solution density[1] $\rho/\text{g cm}^{-3}$	Solubility[2] cm^3(STP) O_2 per dm^3	Setschenow Constant[3] k_s
298.15	0.0	1.000	5.78	-
	0.125	1.0004	5.63	0.091
	0.25	1.0035	5.49	0.089
	0.5	1.0091	5.17	0.097
	1	1.021	4.59	0.100
	2	1.044	3.63	0.101
	3	1.113	1.97	0.156
	4	1.22	1.12	0.178

[1] The author calculated the densities from data in the *International Cirtical Tables*. Use the density values with caution, some of them appear to be in error.

[2] The solubility in water is about 3 per cent smaller than the presently accepted value.

[3] The Setschenow constant (salt effect parameter) is calculated from $k_s = (1/c_3) \log$ (Solubility in water/Solubility in solution)

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The solutions were thermostated in tall cylinder open to the air. They were shaken by hand several times a day for a period of four days.

A sample of 250 cm^3 was analyzed for oxygen by a modified Winkler method.

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. Air at one atm.

(2) Lithium chloride. No information.

(3) Water. No information.

ESTIMATED ERROR:

The solubility values may be in 5 to 10 per cent error. The salt concentrations above one mol dm^{-3} may be in error by 10 per cent.

REFERENCES:

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Lithium Chloride; LiCl; [7447-41-8]

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

ORIGINAL MEASUREMENTS:

Eucken, A.; Hertzberg, G.

Z. Physik. Chem. 1950, *195*, 1 - 23.

VARIABLES:

T/K = 273.15, 293.15

P/kPa = 101.325

$m_{LiCl}/mol\ kg^{-1}$ = 0 - 2.32

PREPARED BY:

P. L. Long

H. L. Clever

EXPERIMENTAL VALUES:

T/K	Lithium Chloride mol kg^{-1} H_2O	Ostwald Coefficient L	Setschenow Constant $k = (1/m)\log(L^o/L)$
273.15	0	0.0490	-
	0.58	0.0397	0.159
	1.64	0.0334	0.161
	2.32	0.0211	0.155
293.15	0	0.0332	-
	0.37	0.0295	0.140
	0.88	0.0251	0.137
	1.94	0.0182	0.135

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Gas absorption. The apparatus consists of a gas buret and an adsorption flask connected by a capillary tube. The whole apparatus is shaken. The capillary tube is a 2m-long glass helix. An amount of gas is measured at STP and placed in the gas buret. After shaking, the difference from the original amount of gas placed in the gas buret is determined.

SOURCE AND PURITY OF MATERIALS:

Components. Neither source nor purity given.

ESTIMATED ERROR:

$\delta L/L = 0.01$

REFERENCES:

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Alkali metal hydroxides; LiOH, NaOH, KOH, RbOH, and CsOH

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

ORIGINAL MEASUREMENTS:

Khomutov, N. E.; Konnik, E. I.

Zh. Fiz. Khim. 1974, *48*, 620-5.

Russ. J. Phys. Chem. 1974, *48*, 359-62.

VARIABLES:

T/K = 298.15
O_2 P/kPa = ∿21 (air at 1 atm)
c_3/mol dm^{-3} = 0 - 1.2

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

T/K	Maximum Salt Concentration c_3/mol dm^{-3}	Number of Experimental Points	Salt Effect Parameter $k = (1/c_3)\log(S^0/S)$
	Lithium hydroxide; LiOH; [1310-65-2]		
298.15	1.2	9	(0.332 to 0.091)[1]
	Sodium hydroxide; NaOH; [1310-73-2]		
298.15	1.2	7	0.180
	Potassium hydroxide; KOH; [1310-58-3]		
298.15	0.8	7	0.176
	Rubidium hydroxide; RbOH; [1310-82-3]		
298.15	0.5	7	0.168
	Cesium hydroxide; CsOH; [21351-79-1]		
298.15	0.5	7	0.158

[1] Lithium hydroxide salts out. The salting out is linear in logS from 0 to about 0.07 mol dm^{-3} (k = 0.332) and linear above about 0.12 mol dm^{-3} (k = 0.091).

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Air, saturated with water vapor from the salt solution, is bubbled for several hours through 500 cm^3 of solution.

Three samples are taken and analyzed by the Winkler chemical method.

The solubility unit is mg dm^{-3} at the normal oxygen partial pressure in air of 0.21 atm. The solubility in water is 8.15 mg dm^{-3}.

The results are presented graphically as log S *vs.* dm^{-3}. The slope is given as the salt effect parameter (Sechenow constant) k.

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. Air treated to free from dust and any foreign gases.

(2) Salts. No information.

(3) Water. No information.

ESTIMATED ERROR:

$\delta T/K = 0.1$
δS/mg dm^{-3} = 0.05
Max error in S is 1.8 per cent.

REFERENCES:

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Alkali metal fluorides; LiF, NaF, KF, RbF, and CsF

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

ORIGINAL MEASUREMENTS:

Khomutov, N. E.; Konnik, E. I.

Zh. Fiz. Khim. 1974, *48*, 620-5.

Russ. J. Phys. Chem. 1974, *48*, 359-62.

VARIABLES:

T/K = 298.15

O_2 P/kPa = ∿21 (air at 1 atm)

c_3/mol dm^{-3} = 0 - 0.6

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

T/K	Maximum Salt Concentration c_3/mol dm^{-3}	Number of Experimental Points	Sechenow Constant $k = (1/c_3)\log(S^0/S)$
	Lithium fluoride; LiF; [7789-24-4]		
298.15	0.10	8	(0.725 to -0.385)[1]
	Sodium fluoride; NaF; [7681-49-4]		
298.15	0.6	6	0.284
	Potassium fluoride; KF; [7789-23-3]		
298.15	0.6	5	0.203
	Rubidium fluoride; RbF; [13446-74-7]		
298.15	0.5	7	0.146
	Cesium fluoride; CsF; [13400-13-0]		
298.15	0.5	7	0.114

[1] Lithium fluoride salts out bewteen 0 and 0.02 mol dm^{-3} (k = 0.725) and salts in above 0.04 mol dm^{-3} (k = -0.385).

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Air (dust free and foreign gas free), saturated with water vapor from the salt solution, is bubbled for several hours through 500 cm^3 of solution.

Three samples are taken and analyzed by the Winkler chemical method. For fluoride solutions a stoichimetric amount of boric acid was added before anaylsis to bind the fluoride as tetrafuoroborate ion.

The solubility unit is mg dm^{-3} at the normal oxygen partial pressure in air of 0.21 atm. The solubility in water is 8.15 mg dm^{-3}.

The results are presented graphically as log S *vs.* c_3. The slope is given as the salt effect parameter (Sechenow constant) k.

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. Air treated to free from dust and any foreign gases.

(2) Salts. No information.

(3) Water. No information.

ESTIMATED ERROR:

$\delta T/K = 0.1$

$\delta S/\text{mg dm}^{-3} = 0.05$

Max error in S 1.8 per cent.

REFERENCES:

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Alkali metal chlorides; LiCl, NaCl, KCl, RbCl, and CsCl

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

ORIGINAL MEASUREMENTS:

Khomutov, N. E.; Konnik, E. I.

Zh. Fiz. Khim. 1974, *48*, 620-5.

Russ. J. Phys. Chem. 1974, *48*, 359-62.

VARIABLES:

T/K= 298.15
O_2 P/kPa= ∿21 (air at 1 atm)
c_3/mol dm^{-3}= 0 - 1.2

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

T/K	Maximum Salt Concentration c_3/mol dm^{-3}	Number of Experimental Points	Salt Effect Parameter $k = (1/c_3)\log(S^0/S)$
Lithium chloride; LiCl; [7447-41-8]			
298.15	1.2	9	(0.112 to 0.070)[1]
Sodium chloride; NaCl; [7647-14-5]			
298.15	1.2	7	0.136
Potassium chloride; KCl; [7447-40-7]			
298.15	1.2	6	0.129
Rubidium chloride; RbCl; [7791-11-9]			
298.15	0.5	7	0.120
Cesium chloride; CsCl; [7647-17-8]			
298.15	0.5	7	0.098

[1] Lithium chloride salts out linearly from 0 to about 0.1 mol dm^{-3} (k = 0.112) and above 0.2 mol dm^{-3} (k = 0.070).

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Air, saturated with water vapor from the salt solution, is bubbled for several hours through 500 cm^3 of solution.

Three samples are taken and analyzed by the Winkler chemical method.

The solubility unit is mg dm^{-3} at the normal oxygen partial pressure in air of 0.21 atm. The solubility in water is 8.15 mg dm^{-3}.

The results are presented graphically as log S *vs.* c_3. The slope is given as the salt effect parameter (Sechenow constant) k.

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. Air treated to free from dust and any foreign gases.

(2) Salts. No information.

(3) Water. No information.

ESTIMATED ERROR:

$\delta T/K = 0.1$
$\delta S/mg\ dm^{-3} = 0.05$
Max error in S is 1.8 per cent

REFERENCES:

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Alkali metal bromides, LiBr, NaBr, KBr, RbBr, and CsBr

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

ORIGINAL MEASUREMENTS:

Khomutov, N. E.; Konnik, E. I.

Zh. Fiz. Khim. 1974, *48*, 620-5.

Russ. J. Phys. Chem. 1974, *48*, 359-62.

VARIABLES:

$T/K = 298.15$
O_2 $P/kPa = \sim 21$ (air at 1 atm)
$c_3/mol\ dm^{-3} = 0 - 1.2$

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

T/K	Maximum Salt Concentration $c_3/mol\ dm^{-3}$	Number of Experimental Points	Salt Effect Parameter $k = (1/c_3)\log(S^0/S)$
	Lithium bromide; LiBr; [7550-35-8]		
298.15	1.2	10	(0.252 to 0.084)[1]
	Sodium bromide; NaBr; [7647-15-6]		
298.15	1.2	7	0.131
	Potassium bromide; KBr; [7758-02-3]		
298.15	1.2	6	0.117
	Rubidium bromide; RbBr; [7789-39-1]		
298.15	0.5	7	0.104
	Cesium bromide; CsBr; [7787-69-1]		
298.15	0.5	7	0.078

[1] Lithium bromide salts out linearly between 0 and about 0.07 mol dm^{-3} (k = 0.252) and above about 0.15 mol dm^{-3} (k = 0.084).

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Air, saturated with water vapor from the salt solution, is bubbled for several hours through 500 cm^3 of solution.

Three samples are taken and analyzed by the Winkler chemical method.

The solubility unit is mg dm^{-3} at the normal oxygen partial pressure in air of 0.21 atm. The solubility in water is 8.15 mg dm^{-3}.

The results are presented graphically as log S *vs.* c_3. The slope is given as the salt effect parameter (Sechenow constant) k.

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. Air treated to free from dust and any foreign gases.

(2) Salts. No information.

(3) Water. No information.

ESTIMATED ERROR:

$\delta T/K = 0.1$
$\delta S/mg\ dm^{-3} = 0.05$
Max error in S is 1.8 per cent.

REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Oxygen; O_2; [7782-44-7] (2) Alkali metal iodides; LiI, NaI, KI, RbI, and CaI (3) Water; H_2O; [7732-18-5]	Khomutov, N. E.; Konnik, E. I. *Zh. Fiz. Khim.* 1974, *48*, 620-5. *Russ. J. Phys. Chem.* 1974, *48*, 359-62.
VARIABLES:	PREPARED BY:
T/K = 298.15 O_2 P/kPa = ∿21 (air at 1 atm) c_3/mol dm^{-3} = 0 - 1.2	H. L. Clever

EXPERIMENTAL VALUES:

T/K	Maximum Salt Concentration c_3/mol dm^{-3}	Number of Experimental Points	Salt Effect Parameter $k = (1/c_3)\log(S^0/S)$
Lithium iodide; LiI; [10377-51-2]			
298.15	0.6	5	0.163
Sodium iodide; NaI; [7681-82-5]			
298.15	1.2	7	0.120
Potassium iodide; KI; [7681-11-0]			
298.15	1.2	6	0.093
Rubidium iodide; RbI; [7790-29-6]			
298.15	0.5	7	0.086
Cesium iodide; CsI; [7789-17-5]			
298.15	0.5	7	0.062

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Air, saturated with water vapor from the salt solution, is bubbled for several hours through 500 cm^3 of solution.

Three samples are taken and analyzed by the Winkler chemical method.

The solubility unit is mg dm^{-3} at the normal oxygen partial pressure in air of 0.21 atm. The solubility in water is 8.15 mg dm^{-3}.

The results are presented graphically as log S *vs.* c_3. The slope is given as the salt effect parameter (Sechenow constant) k.

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. Air treated to free from dust and any foreign gases.

(2) Salts. No information.

(3) Water. No information.

ESTIMATED ERROR:

$\delta T/K = 0.1$
$\delta S/mg\ dm^{-3} = 0.05$
Max error in S is 1.8 per cent.

REFERENCES:

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Alkali metal perchlorates; $LiClO_4$, $NaClO_4$, $KClO_4$, and $RbClO_4$

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

ORIGINAL MEASUREMENTS:

Khomutov, N. E.; Konnik, E. I.

Zh. Fiz. Khim. 1974, *48*, 620-5.

Russ. J. Phys. Chem. 1974, *48*, 359-62.

VARIABLES:

$T/K = 298.15$
O_2 $P/kPa = \sim 21$ (air at 1 atm)
$c_3/mol\ dm^{-3} = 0 - 1.2$

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

T/K	Maximum Salt Concentration $c_3/mol\ dm^{-3}$	Number of Experimental Points	Salt Effect Parameter $k = (1/c_3)\log(S^0/S)$
Lithium perchlorate; $LiClO_4$; [7791-03-9]			
298.15	1.2	7	(0.218 to 0.066)[1]
Sodium perchlorate; $NaClO_4$; [7601-89-0]			
298.15	1.2	7	0.160
Potassium perchlorate; $KClO_4$; [7778-74-7]			
298.15	0.12	7	0.150
Rubidium perchlorate; $RbClO_4$; [13510-42-4]			
298.15	0.10	7	0.138

[1] Lithium perchlorate salts out. The salting out is linear in logS up to about 0.07 mol dm^{-3} (k = 0.218) and linear above 0.15 mol dm^{-3} (k = 0.066).

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Air, saturated with water vapor from the salt solution, is bubbled for several hours through 500 cm^{-3} of solution.

Three samples are taken and analyzed by the Winkler chemical method.

The solubility unit is mg dm^{-3} at the normal oxygen partial pressure in air of 0.21 atm. The solubility in water is 8.15 mg dm^{-3}.

The results are presented graphically as log S *vs.* dm^{-3}. The slope is given as the salt effect parameter (Sechenow constant) k.

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. Air treated to free from dust and any foreign gases.

(2) Salts. No information.

(3) Water. No information.

ESTIMATED ERROR:

$\delta T/K = 0.1$
$\delta S/mg\ dm^{-3} = 0.05$
Max error in S is 1.8 per cent.

REFERENCES:

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Dialkali metal sulfates; Li_2SO_4, Na_2SO_4, K_2SO_4, Rb_2SO_4, and Cs_2SO_4

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

ORIGINAL MEASUREMENTS:

Khomutov, N. E.; Konnik, E. I.

Zh. Fiz. Khim. 1974, *48*, 620-5.

Russ. J. Phys. Chem. 1974, *48*, 359-62.

VARIABLES:

$T/K = 298.15$

O_2 $P/kPa = \sim 21$ (air at 1 atm)

$c_3/mol\ dm^{-3} = 0 - 1.2$

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

T/K	Maximum Salt Concentration $c_3/mol\ dm^{-3}$	Number of Experimental Points	Salt Effect Parameter $k = (1/c_3)\log(S^0/S)$
Dilithium sulfate; Li_2SO_4; [10377-48-7]			
298.15	1.2	6	0.244
Disodium sulfate; Na_2SO_4; [7757-82-6]			
298.15	1.2	7	0.376
Dipotassium sulfate; K_2SO_4; [7778-80-5]			
298.15	0.6	5	0.297
Dirubidium sulfate; Rb_2SO_4; [7488-54-2]			
298.15	0.3	7	0.290
Dicesium sulfate; Cs_2SO_4; [10294-54-9]			
298.15	0.45	8	0.255

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Air, saturated with water vapor from the salt solution, is bubbled for several hours through 500 cm^3 of solution.

Three samples are taken and analyzed by the Winkler chemical method.

The solubility unit is mg dm^{-3} at the normal oxygen partial pressure in air of 0.21 atm. The solubility in water is 8.15 mg dm^{-3}.

The results are presented graphically as log S *vs.* dm^{-3}. The slope is given as the salt effect parameter (Sechenow constant) k.

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. Air treated to free from dust and any foreign gases.

(2) Salts. No information.

(3) Water. No information.

ESTIMATED ERROR:

$\delta T/K = 0.1$

$\delta S/mg\ dm^{-3} = 0.05$

Max error in S is 1.8 per cent.

REFERENCES:

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Alkali metal nitrates; $LiNO_3$ $NaNO_3$, KNO_3, $RbNO_3$, and $CsNO_3$

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

ORIGINAL MEASUREMENTS:

Khomutov, N. E.; Konnik, E. I.

Zh. Fiz. Khim. 1974, *48*, 620-5.

Russ. J. Phys. Chem. 1974, *48*, 359-62.

VARIABLES:

T/K= 298.15

O_2 P/kPa= ∿21 (air at 1 atm)

c_3/mol dm^{-3}= 0 - 1.2

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

T/K	Maximum Salt Concentration c_3/mol dm^{-3}	Number of Experimental Points	Salt Effect Parameter $k = (1/c_3)\log(S^0/S)$
	Lithium nitrate; $LiNO_3$; [7790-69-4]		
298.15	1.2	7	(0.196 to -0.040)[1]
	Sodium nitrate; $NaNO_3$; [7631-99-4]		
298.15	1.2	6	0.124
	Potassium nitrate; KNO_3; [7757-79-1]		
298.15	1.2	6	0.105
	Rubidium nitrate; $RbNO_3$; [13126-12-0]		
298.15	0.5	6	0.096
	Cesium nitrate; $CsNO_3$; [7789-18-6]		
298.15	0.5	6	0.066

[1] Lithium nitrate salts out between 0 and about 0.10 mol dm^{-3} (k = 0.196); it salts in at concentrations above about 0.15 mol dm^{-3} (k = -0.040).

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Air, saturated with water vapor from the salt solution, is bubbled for several hours through 500 cm^3 of solution.

Three samples are taken and analyzed by the Winkler chemical method.

The solubility unit is mg dm^{-3} at the normal oxygen partial pressure in air of 0.21 atm. The solubility in water is 8.15 mg dm^{-3}.

The results are presented graphically as log S *vs.* c_3. The slope is given as the salt effect parameter (Sechenow constant) k.

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. Air treated to free from dust and any foreign gases.

(2) Salts. No information.

(3) Water. No information.

ESTIMATED ERROR:

$\delta T/K = 0.1$

δS/mg dm^{-3} = 0.05

Max error in S is 1.8 per cent.

REFERENCES:

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Dialkali metal carbonates; Li_2CO_3, Na_2CO_3, and K_2CO_3

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

ORIGINAL MEASUREMENTS:

Khomutov, N. E.; Konnik, E. I.

Zh. Fiz. Khim. 1974, *48*, 620-5.

Russ. J. Phys. Chem. 1974, *48*, 359-62.

VARIABLES:

T/K = 298.15
O_2 P/kPa = ∿21 (air at 1 atm)
c_3/mol dm^{-3} = 0 - 1.2

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

T/K	Maximum Salt Concentration c_3/mol dm^{-3}	Number of Experimental Points	Salt Effect Parameter $k = (1/c_3)\log(S^0/S)$
Dilithium carbonate; Li_2CO_3; [554-13-2]			
298.15	0.12	6	0.254
Disodium carbonate; Na_2CO_3; [497-19-8]			
298.15	1.0	6	0.464
Dipotassium carbonate; K_2CO_3; [584-08-7]			
298.15	1.2	7	0.379

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Air, saturated with water vapor from the salt solution, is bubbled for several hours through 500 cm^3 of solution.

Three samples are taken and analyzed by the Winkler chemical method.

The solubility unit is mg dm^{-3} at the normal oxygen partial pressure in air of 0.21 atm. The solubility in water is 8.15 mg dm^{-3}.

The results are presented graphically as log S *vs*. dm^{-3}. The slope is given as the salt effect parameter (Sechenow constant) k.

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. Air treated to free from dust and any foreign gases.

(2) Salts. No information.

(3) Water. No information.

ESTIMATED ERROR:

$\delta T/K = 0.1$
$\delta S/\text{mg dm}^{-3} = 0.05$
Max error in S is 1.8 per cent.

REFERENCES:

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Sodium chloride; NaCl; [7647-14-5]

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

ORIGINAL MEASUREMENTS:

Geffcken, G.

Z. Phys. Chem. 1904, *49*, 257-302.

VARIABLES:

T/K = 288-298
Concentration

PREPARED BY:

C.L. Young; R. Battino

EXPERIMENTAL VALUES:

T/K	Conc of salt/mol dm^{-3} (soln)	Ostwald coefficient, *L*
288.15	0.530	0.03045
	0.535	0.03052
	1.020	0.02601
	1.034	0.02557
	1.880	0.01898
	1.890	0.01904
	1.921	0.01869
298.15	0.530	0.02598
	0.535	0.02604
	1.020	0.02226
	1.034	0.02202
	1.890	0.01663
	1.921	0.01654

AUXILIARY INFORMATION

METHOD /APPARATUS/PROCEDURE:

Volumetric method using simple adsorption pipet and buret. Diagram and detailed description given in original paper.

SOURCE AND PURITY OF MATERIALS:

(1) Prepared by heating potassium chlorate and manganese dioxide. Washed with potassium hydroxide solution. Dried.

(3) Degassed.

ESTIMATED ERROR:

$\delta T/K = \pm 0.1$; $\delta L = \pm 1\%$.

(estimated by compiler).

REFERENCES:

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Sodium chloride; NaCl; [7647-14-5]

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

ORIGINAL MEASUREMENTS:

MacArthur, C. G.

J. Phys. Chem. 1916, *20*, 495-502.

VARIABLES:

$T/K = 298.15$

O_2 $P/kPa = \sim 21.2$ (O_2 in air at one atm)

$c_3/mol\ dm^{-3} = 0 - 4$

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

T/K	Sodium Chloride $c_3/mol\ dm^{-3}$	Solution density[1] $\rho/g\ cm^{-3}$	Solubility[2] cm^3 (STP) O_2 per dm^3	Setschenow Constant[3] k_s
298.15	0.0	1.000	5.78	-
	0.125	1.0022	5.52	0.160
	0.25	1.0067	5.30	0.151
	0.5	1.017	4.92	0.140
	1	1.038	4.20	0.139
	2	1.075	3.05	0.139
	3	1.112	2.24	0.137
	4	1.149	1.62	0.138

[1] The author calculated the densities from data in the *International Critical Tables.* Use the density values with caution, some of them appear to be in error.

[2] The solubility in water is about 3 per cent smaller than the presently accepted value.

[3] The Setschenow constant (salt effect parameter) is calculated from $k_s = (1/c_3) \log$ (Solubility in water/Solubility in solution).

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The solutions were thermostated in tall cylinder open to the air. They were shaken by hand several times a day for a period of four days.

A sample of 250 cm^3 was analyzed for oxygen by a modified Winkler method.

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. Air at one atm.

(2) Sodium chloride. No information.

(3) Water. No information.

ESTIMATED ERROR:

The solubility values may be in 5 to 10 per cent error. The salt concentrations above one mol dm^{-3} may be in error by 10 per cent.

REFERENCES:

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Sodium Chloride; NaCl; [7647-14-5]

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

ORIGINAL MEASUREMENTS:

Eucken, A.; Hertzberg, G.

Z. Physik. Chem. 1950, *195*, 1 - 23.

VARIABLES: T/K = 273.15 - 298.15
P/kPa = 101.325
$m_{NaCl}/\text{mol kg}^{-1}$ = 0 - 2.49

PREPARED BY:

P. L. Long
H. L. Clever

EXPERIMENTAL VALUES:

T/K	Sodium Chloride mol kg^{-1} H_2O	Ostwald Coefficient L	Setschenow Constant $k = (1/m)\log(L^o/L)$
273.15	0	0.0490	-
	0.48	0.0409	0.165
	1.23	0.0306	0.166
	2.49	0.0193	0.162
288.15	0	0.0365	-
	0.69	0.0289	0.148
	1.74	0.0203	0.146
293.15	0	0.0332	-
	0.81	0.0254	0.139
	1.77	0.0187	0.141
298.15	0	0.0307	-
	0.64	0.0250	0.139
	1.53	0.0187	0.141

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Gas absorption. The apparatus consists of a gas buret and an adsorption flask connected by a capillary tube. The whole apparatus is shaken. The capillary tube is a 2m-long glass helix. An amount of gas is measured at STP and placed in the gas buret. After shaking, the difference from the original amount of gas placed in the gas buret is determined.

SOURCE AND PURITY OF MATERIALS:

Components. Neither source nor purity given.

ESTIMATED ERROR:

$\delta L/L = 0.01$

REFERENCES:

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Sodium chloride; NaCl; [7647-14-5]

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

ORIGINAL MEASUREMENTS:

Mishnina, T. A.; Avdeeva, O. I. Bozhovskaya, T. K.

Materialy Vses. Nauchn. Issled. Geol. Inst. 1961, *46*, 93-110.

VARIABLES:

$T/K = 273.15 - 303.15$
$P/kPa = 101.325$
$c_3/mol\ dm^{-3} = 0 - 5.4$

PREPARED BY:

A. L. Cramer
H. L. Clever

EXPERIMENTAL VALUES:

NaCl/g eq dm^{-3}	Bunsen Coefficient, $\alpha \times 10^3$												Salt Effect Parameter k_s
T/K	0.0	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0	5.4	
273.15	48.9	39.8	32.1 31.2[1]	26.3	21.4 22.5[1]	17.4	14.1 15.1[1]	11.5	9.2	7.6	6.2	5.2 6.1[1]	0.180
278.15	42.9	35.4	29.1 27.9[1]	24.0	19.8 20.4[1]	16.3	13.4 13.6[1]	11.1	9.1	7.5	6.2	5.3 5.9[1]	0.168
283.15	38.5	32.0	26.6 25.3[1]	22.2	18.4 18.6[1]	15.3	12.8 12.5[1]	10.6	8.8	7.3	6.1	5.3 5.6[1]	0.160
288.15	34.2	28.6	23.9 23.1[1]	20.0	16.7 17.0[1]	13.9	11.6 11.7[1]	9.7	8.1	6.8	5.7	4.9 5.4[1]	0.156
293.15	30.8	25.9	21.9 21.4[1]	18.4	15.5 15.7[1]	13.1	11.0 11.0[1]	9.3	7.8	6.6	5.5	4.8 5.2[1]	0.149
298.15	28.2	23.9	20.2 20.0[1]	17.1	14.5 14.7[1]	12.2	10.4 10.4[1]	8.8	7.4	6.3	5.3	4.7 5.0[1]	0.145
303.15	26.3	22.5	19.1 18.7[1]	16.3	13.9 14.0[1]	11.8	10.0 10.0[1]	8.6	7.3	6.2	5.3	4.7 4.8[1]	0.139

[1] Appears to be experimental data of the authors.

The table of smoothed Bunsen coefficients of oxygen dissolved in aqueous sodium chloride solutions was prepared by the authors. The complete source of data for the table is not clear. The data of L. Winkler (*Z. angew. Chem.* 1911, *24*, 341)) are mentioned. A 1958 report of A. A. Cherepinnikov, mentioned in the paper, was not available to the compiler.

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Sodium chloride; NaCl; [7647-14-5] or geothermal brines

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

ORIGINAL MEASUREMENTS:

Cramer, S. D.

Ind. Eng. Chem., Process Design Develop., 1980, *19*. 300-5.

VARIABLES:

T/K = 274.65 - 583.15

O_2 P/MPa = 4.3 - 5.2

m_3/mol kg^{-1} = 0 - 5.69

PREPARED BY:

H. L. Clever

Brine Characteristics

Brine	Molality m/mol kg^{-1}	Molarity c/mol dm^{-3}	Ionic Strength I^1	Constituents
Water	0	0	0	Demineralized
NaCl-1	0.87	0.85	0.87	NaCl
NaCl-2	2.97	2.78	2.97	NaCl
NaCl-3	5.69	5.09	5.69	NaCl
EMGB	0.57	0.56	0.60	Mixed chlorides[2]
SSGB	4.87	4.19	7.34	Mixed chlorides[2]

[1] Based on molal concentrations.

[2] Composition in the table below. Also see footnotes on page before.

Composition (in ppm by weight) of the Geothermal Brines.

Constituent	EMGB	SSGB	Constituent	EMGB	SSGB
Na	11 000	53 000	Rb	1.7	70
Ca	1 370	28 800	Cs	4	20
K	1 430	16 500	Mg	22	10
Fe	0.2	2 000	Cu	0.05	3[1]
Mn	0.9	1 370	Ag	0.04	<1[1]
Zn	0.02	500	Cl	18 000	155 000
Sr	226	440	NH_4	3.9	Not det'n.
SiO_2	101	400	Br	35	" "
B	27	390	F	1.5	" "
Ba	58	250	SO_4	16	" "
Li	55	210	S	Not det'n.	30
Pb	0.3	80			

[1] Not included in the synthetic brine.

continued on following page

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The oxygen solubilities were determined from PVT measurements using the technique of gas extraction. The apparatus consists of (1) a high pressure, high temperature stainless steel stirred reactor fitted with a Pyrex liner for dissolving the gas in the brine, (2) a heat exchanger for cooling samples of gas saturated brine to room temperature, and (3) a low-pressure, constant-temperature unit for PVT measurements on collected gas and liquid samples.

Henry's constant is defined as $K^0 = \bar{f}_g/a_g$. The fugacity, $\bar{f}_g = \phi_g P_g$, where ϕ_g is the fugacity coefficient, and P_g is the oxygen partial pressure. The activity, $a_g = \gamma x_g$, where γ is the activity coefficient of the dissolved gas, and x_g is the mole fraction. The mole fraction is calculated with respect the gas, the ionic species and the water.

$$x' = m_g/(m_g + \Sigma m_j \Sigma \nu_{ij} + 1000/M_{H_2O})$$

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. Source not given, stated to be 99.5 per cent.

(2) Sodium chloride and SSGB. Prepare from reagent grade chemicals dissolved in demineralized water.

(3) Water. Demineralized water.

EMGB. Natural sample.

ESTIMATED ERROR:

Author's analysis of experimental error.

Variable	Uncertainty	Exp Error %
Reactor pressure	0.068 MPa	1.4
Reactor temperature	2°C	4.2
Sample volume:		
liquid fraction	0.4 cm^3	2.6
gas fraction	0.4 cm^3	2.6
Gas buret temp	2°C	0.6
Atmospheric press	1 mmHg	0.3
Brine conc	0.2 m	0.5

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Sodium chloride; NaCl; [7647-14-5] or geothermal brines

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

ORIGINAL MEASUREMENTS:

Cramer, S. D.

Ind. Eng. Chem., Process Design Develop. 1980, 19, 300-5.

EXPERIMENTAL VALUES:

Water

Temperature T/K	Temperature t/°C	Henry's Constant K x 10^{-3}/MPa
276.15	3.0	2.53
279.65	6.5	2.92
280.65	7.5	3.33
286.85	13.7	3.67
292.15	19.0	4.06
295.55	22.4	4.63
297.45	24.3	4.31
301.65	28.5	4.98
305.15	32.0	5.11
315.15	42.0	5.25
315.65	42.5	5.27
322.75	49.6	6.48
323.15	50.0	5.65
324.15	51.0	5.83
333.85	60.7	7.34
344.95	71.8	7.06
348.35	75.2	7.06
363.35	90.2	7.27
373.35	100.2	7.52
387.75	114.6	7.50
396.05	122.9	6.91
413.35	140.2	6.89
438.35	165.2	5.88
461.05	187.9	4.38
513.85	240.7	2.94
561.15	288.0	1.35

Sodium Chloride m_3/mol kg^{-1} = 0.87[1]

Temperature T/K	Temperature t/°C	Henry's Constant K x 10^{-3}/MPa
274.65	1.5	4.02
279.85	6.7	4.98
286.65	13.5	5.09
293.35	20.2	5.68
303.35	30.2	7.02
315.15	42.0	7.51
315.65	42.5	7.52
322.75	49.6	8.06
323.15	50.0	8.01
324.15	51.0	7.76
334.65	61.5	8.10
336.05	62.9	8.92
343.35	70.2	8.63
357.15	84.0	9.44
372.15	99.0	9.58
398.15	125.0	8.57
423.85	150.7	7.79
439.95	166.8	6.79
476.05	202.9	6.14
514.35	241.2	3.72
530.45	257.3	3.50
559.05	285.9	2.27

Sodium Chloride m_3/mol kg^{-1} = 2.97[2]

Temperature T/K	Temperature t/°C	Henry's Constant K x 10^{-3}/MPa
274.65	1.5	10.02
280.65	7.5	10.28
284.95	11.8	11.24
292.15	19.0	11.78
296.65	23.5	12.14
300.55	27.4	12.77
322.75	49.6	14.55
332.25	59.1	15.95
348.35	75.2	14.73
368.85	95.7	14.29
390.55	117.4	12.21
410.55	137.4	12.79
430.65	157.5	13.18
458.35	185.2	9.45
513.65	240.5	6.72
513.85	240.7	6.89
542.75	269.6	4.96
569.35	296.2	4.04

Sodium Chloride m_3/mol kg^{-1} = 5.69[3]

Temperature T/K	Temperature t/°C	Henry's Constant K x 10^{-3}/MPa
276.15	3.0	20.29
280.55	7.4	22.77
286.85	13.7	22.98
299.45	26.3	23.69
321.05	47.9	26.16
332.25	59.1	26.29
346.65	73.5	26.95
357.25	84.1	26.52
368.35	95.2	28.39
385.85	110.7	24.80
390.55	117.4	23.90
401.65	128.5	23.94
438.85	165.7	16.49
461.05	187.9	14.72
481.05	207.9	14.69
514.95	241.8	19.90
532.95	259.8	9.89
543.15	270.0	10.25
562.15	289.0	8.16

continued

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[1] Author designated NaCl-1

[2] Author designated NaCl-2

[3] Author designated NaCl-3

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Sodium chloride; NaCl; [7647-14-5] or geothermal brines

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

ORIGINAL MEASUREMENTS:

Cramer, S. D.

Ind. Eng. Chem., Process Design Develop. 1980, 19, 300-5.

EXPERIMENTAL VALUES:

Water			Water			EMGB[1] $m/\text{mol kg}^{-1} = 0.57$			SSGB[2] $m/\text{mol kg}^{-1} = 4.87$		
Temperature T/K	Temperature t/°C	Henry's Constant $K \times 10^{-3}$/MPa	Temperature T/K	Temperature t/°C	Henry's Constant $K \times 10^{-3}$/MPa	Temperature T/K	Temperature t/°C	Henry's Constant $K \times 10^{-3}$/MPa	Temperature T/K	Temperature t/°C	Henry's Constant $K \times 10^{-3}$/MPa
276.15	3.0	2.53	348.35	75.2	7.06	275.45	2.3	3.65	274.95	1.8	12.41
279.65	6.5	2.92	363.35	90.2	7.27	279.95	6.8	3.87	280.65	7.5	14.64
280.65	7.5	3.33	373.35	100.2	7.52	286.65	13.5	4.34	285.15	12.0	15.99
286.85	13.7	3.67	387.75	114.6	7.50	319.65	46.5	7.26	292.15	19.0	15.90
292.15	19.0	4.06	396.05	122.9	6.91	333.85	60.7	7.48	294.45	21.3	18.02
295.55	22.4	4.63	413.35	140.2	6.89	352.35	79.2	7.88	301.65	28.5	18.64
297.45	24.3	4.31	438.35	165.2	5.88	372.95	99.8	7.87	321.05	47.9	18.03
301.65	28.5	4.98	461.05	187.9	4.38	379.15	106.0	8.70	334.45	61.3	19.77
305.15	32.0	5.11	513.85	240.7	2.94	391.15	118.0	7.57	349.95	76.8	19.77
315.15	42.0	5.25	561.15	288.0	1.35	428.15	155.0	6.14	367.15	94.0	19.77
315.65	42.5	5.27				473.75	200.6	4.34	396.65	123.5	17.76
322.75	49.6	6.48				475.15	202.0	4.66	411.05	137.9	15.67
323.15	50.0	5.65				495.15	222.0	3.79	423.35	150.2	14.49
324.15	51.0	5.83							425.55	152.4	13.87
333.85	60.7	7.34							461.05	187.9	11.10
344.95	71.8	7.06							503.25	230.1	9.36
									545.55	272.4	6.10
									559.65	286.5	7.20
									583.15	310.0	5.63

continued

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[1] East Mesa geothermal brine, an unflashed sample from geothermal well Mesa G-1. (1) The composition of the low-salinity brine is given on the next page.

[2] Salton Sea geothermal brine, a synthetic brine based on an analysis of unflashed hypersaline brine from geothermal well IID-2 on the Salton sea geothermal field (2). The composition of the brine is given on the next page.

REFERENCES:

1. Berthold, C. E.; Hadzeriga, P.; Christopher, D. H.; Applegate; T. A.; Gillespie, D. M. "Process Technology for Recovering Geothermal Brine Minerals", PB-241867, Hazen Research, Inc., Golden, Co., 1975, Feb. 4.
2. Helgeson, H. C. *Am. J. Sci.* 1968, *266*, 129.

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Sodium bromide; NaBr; [7647-15-6]

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

ORIGINAL MEASUREMENTS:

MacArthur, C. G.

J. Phys. Chem. 1916, *20*, 495-502.

VARIABLES:

T/K = 298.15

O_2 P/kPa = ∿ 21.2 (O_2 in air at one atm)

c_3/mol dm^{-3} = 0 - 6

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

T/K	Sodium Bromide c_3/mol dm^{-3}	Solution density[1] ρ/g cm^{-3}	Solubility[2] cm^3 (STP) O_2 per dm^3	Setschenow Constant[3] k_s
298.15	0.0	1.000	5.78	-
	0.125	1.007	5.65	0.079
	0.25	1.017	5.52	0.080
	0.5	1.036	5.15	0.117
	1	1.075	4.47	0.112
	2	1.150	3.37	0.117
	3	1.219	2.57	0.117
	4	1.305	2.02	0.114
	6	1.455	1.28	0.109

[1] The author calculated the densities from data in the *International Critical Tables*. Use the density values with caution, some of them appear to be in error.

[2] The solubility in water is about 3 per cent smaller than the presently accepted value.

[3] The Setschenow constant (salt effect parameter) is calculated from $k_s = (1/c_3)$ log (Solubility in water/Solubility in solution).

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The solutions were thermostated in tall cylinder open to the air. They were shaken by hand several times a day for a period of four days.

A sample of 250 cm^3 was analyzed for oxygen by a modified Winkler method.

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. Air at one atm.

(2) Sodium bromide. No information.

(3) Water. No information.

ESTIMATED ERROR:

The solubility values may be in 5 to 10 per cent error. The salt concentrations above one mol dm^{-3} may be in error by 10 per cent.

REFERENCES:

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Sodium sulfate; Na_2SO_4; [7757-82-6]

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

ORIGINAL MEASUREMENTS:

MacArthur, C. G.

J. Phys. Chem. 1916, *20*, 495-502.

VARIABLES:

$T/K = 298.15$

O_2 P/kPa = ∿ 20.2 (O_2 in air at one atm)

c_3/mol dm^{-3} = 0 - 1

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

T/K	Sodium sulfate c_3/mol dm^{-3}	Solution density[1] ρ/g cm^{-3}	Solubility[2] cm^3 (STP) O_2 per dm^3	Setschenow Constant[3] k_s
298.15	0.0	1.000	5.78	-
	0.125	1.014	5.04	0.476
	0.25	1.032	4.60	0.397
	0.5	1.063	3.97	0.326
	1	1.13	3.00	0.285

[1] The author calculated the densities from data in the *International Critical Tables*. Use the density values with caution, some of them appear to be in error.

[2] The solubility in water is about 3 per cent smaller than the presently accepted value.

[3] The Setschenow constant (salt effect parameter) is calculated from $k_s = (1/c_3)$ log (Solubility in water/Solubility in solution).

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The solutions were thermostated in tall cylinder open to the air. They were shaken by hand several times a day for a period of four days.

A sample of 250 cm^3 was analyzed for oxygen by a modified Winkler method.

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. Air at one atm.

(2) Sodium sulfate. No information.

(3) Water. No information.

ESTIMATED ERROR:

The solubility values may be in 5 to 10 per cent error. The salt concentrations above one mol dm^{-3} may be in error by 10 per cent.

REFERENCES:

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Sodium sulfate; Na_2SO_4; [7757-82-6]

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

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

ORIGINAL MEASUREMENTS:

Kobe, K. A.; Kenton, F. H.

Ind. Eng. Chem., Anal. Ed. 1938, *10*, 76-7.

VARIABLES:

T/K = 298.15
O_2 P/kPa = 101.325

PREPARED BY:

P. L. Long
H. L. Clever

EXPERIMENTAL VALUES:

Temperature		Solvent Volume	Oxygen Volume Absorbed	Bunsen Coefficient	Ostwald Coefficient
t /°C	T/K	cm^3	cm^3	$\alpha \times 10^2$	$L \times 10^2$
25	298.15	49.54	0.44		
		49.54	0.44	0.81 av.	0.89 av.

The solvent was a mixture of 800 g H_2O
200 g Na_2SO_4 (anhydrous)
40 cm^3 H_2SO_4 (conc., 36 N)

Thus the solution molality was

$m_{Na_2SO_4}/mol\ kg^{-1}$ 1.76

$m_{H_2SO_4}/mol\ kg^{-1}$ 0.90

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The apparatus was described in detail in an earlier paper (1). The apparatus consists of a gas buret, a pressure compensator, a 200 cm^3 absorption bulb, and a mercury leveling bulb. The absorption bulb is attached to a shaking mechanism.

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

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. Source not given. Purity stated to be 99^+ per cent.

(2,3) Sodium sulfate and sulfuric acid. Sources not given. Analytical grades.

(4) Water. Distilled.

ESTIMATED ERROR:

$\delta\alpha/cm^3 = 0.001$ (authors)

REFERENCES:

1. Kobe, K. A.; Williams, J. S. *Ind. Eng. Chem., Anal. Ed.* 1935, *7*, 37.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Oxygen; O_2; [7782-44-7] (2) Sodium sulfate; Na_2SO_4; [7757-82-6] (3) Water; H_2O; [7732-18-5]	Linek, V.; Mayrhoferova, J. *Chem. Eng. Sci.* 1970, *25*, 787 - 800.
VARIABLES:	**PREPARED BY:**
T/K = 288 - 308 p/kPa = 101.325 (1 atm) c_2/kmol m^{-3} = 0 - 1.0	H. L. Clever

EXPERIMENTAL VALUES:

Temperature $t/^{\circ}C$	T/K	Sodium Sulfate[1] c_2/kmol m^{-3}[2]	Oxygen Solubility c_1/kmol m^{-3}[2]
15	288	0.50	9.88
20	293	0	13.60
		0.25	10.92
		0.50	8.93
		0.75	7.42
		1.00	6.06
25	298	0.50	8.15
30	303	0.50	7.49
35	308	0.50	7.03

[1] The table of data in the original paper is labeled sodium sulfite, however, the measurements were made in sodium sulfate solution and it was assumed they were the same in sodium sulfite.

[2] kmol m^{-3} is the same number as mol dm^{-3}.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:	SOURCE AND PURITY OF MATERIALS:
The details of the method were not given.	(1) Oxygen. No information. (2) Sodium sulfate. No information. (3) Water. Distilled in all glass apparatus.
	ESTIMATED ERROR:
	REFERENCES:

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Sodium sulfate; Na_2SO_4; [7757-82-6]

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

ORIGINAL MEASUREMENTS:

Yasunishi, A.

J. Chem. Eng. Jpn. 1977, *10*, 89-94.

VARIABLES:

$T/K = 288.15\text{-}308.15$

O_2 $P/kPa = 101.325$

$c_3/mol\ dm^{-3} = 0 - 1.656$

PREPARED BY:

H. L. Clever; C. L. Young

EXPERIMENTAL VALUES:

T/K	Sodium sulfate $c_3/mol\ dm^{-3}$	Ostwald Coefficient L
288.15	0.0	0.03643
	0.105	0.03370
	0.216	0.03058
	0.315	0.02734
	0.479	0.02386
	0.594	0.02183
	0.701	0.02030
	0.891	0.01823
298.15	0.0	0.03114
	0.155	0.02732
	0.239	0.02489
	0.510	0.02018
	0.513	0.02032
	0.618	0.01855
298.15	0.762	0.01704
	0.988	0.01455
	1.228	0.01244
	1.240	0.01225
	1.498	0.01067
	1.517	0.01040
308.15	0.0	0.02764
	0.317	0.02043
	0.609	0.01650
	0.967	0.01286
	1.301	0.01055
	1.656	0.00860

The author correlated the data by the empirical equation $\log(L_0/L) = Ac_3/(1 + Bc_3)$. The constants for the equation are:

T/K	$A/dm^3\ mol^{-1}$	$B/dm^3\ mol^{-1}$
288.15	0.420	0.251
298.15	0.398	0.183
308.15	0.421	0.231

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The apparatus is similar to that decribed by Horiuti (1).

The aqueous salt solution is degasses by boiling under reflux and under vacuum.

The gas phase volume and the solvent volume are measured by displacement of mercury.

Dry gas is intermittently added until equilibrium is attained. At that time total pressure in the dissolution vessel and the gas volume remaining in the buret are recorded.

The salt concentration and density are determined after the measurement. Salt solution vapor pressure is taken from the literature. A correction for the increase of the liquid volume by the dissloved gas is made.

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. Extra pure grade. Stated to be 99.995 per cent.

(2) Sodium sulfate. "Gauranteed reagent".

(3) Water. No information.

ESTIMATED ERROR:

Average deviation 0.3 to 0.5 per cent

REFERENCES:

1. Horiuti, J. *J. Sci. Pap. Inst. Phys. Chem. Res. Tokyo* 1931, *17*, 125.

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Sodium sulfite; Na_2SO_3; [7757-83-7]

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

ORIGINAL MEASUREMENTS:

Gestrich, W.; Pontow, B.

Chem.-Ing.-Tech. 1977, *49*, 564-5.

VARIABLES:

T/K = 273.15-303.15
P/kPa = 60.0 - 200
(0.6 - 2 bar)
$c_3/mol\ dm^{-3}$ = 0.05 - 1.2

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

T/K	Sodium sulfite $c_3/mol\ dm^{-3}$	Henry's constant[1] $K \times 10^3$	Measured pH at 293.15 K
273.15	0.05	2.08	8.30
	0.2	1.61	8.15
	0.6	1.33	8.03
	0.8	1.03	7.97
	1.2	0.747	7.78
288.15	0.05	1.50	8.30
	0.2	1.32	8.15
	0.6	0.995	8.03
	0.8	0.831	7.97
	1.2	0.518	7.78
298.15	0.05	1.25	8.30
	0.2	1.12	8.15
	0.6	0.872	8.03
	0.8	0.600	7.97
	1.2	0.463	7.78
303.15	0.05	1.08	8.30
	0.2	1.03	8.15
	0.6	0.775	8.03
	0.8	0.647	7.97
	1.2	0.476	7.78

---

[1] Henry's constant, $10^3\ K/mol\ dm^{-3}\ atm^{-1}$.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The apparatus consists of an absorption flask (*ca.* 40 cm^3) with a magnetic stirrer, a mercury manometer, and a motor controlled buret for the oxygen.

Five to six measurements were made at each temperature and salt concentration at pressures between o.6 and 2 bar. Only the measurements at 298.15 K were shown in a gr graph. The Henry's constants were tabulated, and are given above. No value for water was given.

The salt solution was prepared in a 38:1 ratio of Na_2SO_3 and $Na_2S_2O_5$.

The temperature coefficient of Henry's constant gives an enthalpy of solution of (-3.07 ± 0.05) kcal mol^{-1}.

SOURCE AND PURITY OF MATERIALS:

No details given.

ESTIMATED ERROR:

$\delta K/K$ = 0.05

REFERENCES:

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Sodium nitrate; $NaNO_3$; [7631-99-4]

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

ORIGINAL MEASUREMENTS:

Yasunishi, A.

Kagaku Kogaku Rombunshu 1978, *4*, 185-89.

VARIABLES:

$T/K = 298.15$

O_2 $P/kPa = 101.325$

$c_3/mol\ dm^{-3} = 0 - 5.121$

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

T/K	Sodium nitrate $c_3/mol\ dm^{-3}$	Ostwald Coefficient L
298.15	0.0	0.03114[1]
	0.480	0.02769
	1.047	0.02407
	2.038	0.01842
	2.057	0.01849
	3.081	0.01436
	3.102	0.01419
	4.055	0.01144
	5.121	0.00867

The author correlated the data with the Setschnow equation $\log(L_o/L) = 0.109\ c_3$.

[1] From reference 1.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The apparatus and procedure are described in reference (1). A Horiuti type apparatus is used.

The aqueous salt solution is degassed by boiling under reflux and under vacuum.

The gas phase volume and the solvent volume are measured by displacement of mercury.

Dry gas is intermittently added until equilibrium is attained. At that time the total pressure in the dissolution vessel and the gas volume remaining in the buret are recorded.

The salt solution concentration and density are determined after the solubility measurement. The salt solution vapor pressure is either taken from the literature or estimated. A correction for the increase of the liquid volume by the dissolved gas is made.

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. High purity grade stated to be 99.995 per cent.

(2) Sodium nitrate.

(3) Water. No information.

ESTIMATED ERROR:

REFERENCES:

1. Yasunishi, A.
J. Chem. Eng. Jpn. 1977, *10*, 89.

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Sodium hydroxide; NaOH; [1310-73-2]

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

ORIGINAL MEASUREMENTS:

Geffcken, G.

Z. Phys. Chem. 1904, *49*, 257-302.

VARIABLES:

T/K = 288-298
Composition

PREPARED BY:

C.L. Young; R. Battino

EXPERIMENTAL VALUES:

T/K	Conc of hydroxide/mol dm^{-3} (soln)	Ostwald coefficient, L
288.15	0.559	0.02777
	0.601	0.02784
	1.033	0.02291
	1.059	0.02262
	2.077	0.01479
	2.089	0.01456
298.15	0.559	0.02434
	0.601	0.02424
	1.033	0.02020
	1.059	0.01991
	2.077	0.01295
	2.089	0.01272

AUXILIARY INFORMATION

METHOD /APPARATUS/PROCEDURE:

Volumetric method using simple adsorption pipet and buret. Diagram and detailed description given in original paper.

SOURCE AND PURITY OF MATERIALS:

(1) Prepared by heating potassium chlorate and manganese dioxide. Washed with potassium hydroxide solution. Dried.

(3) Degassed.

ESTIMATED ERROR:

$\delta T/K = \pm 0.1; \delta L = \pm 1\%$.

(estimated by compiler).

REFERENCES:

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Sodium hydroxide; NaOH; [1310-73-2]

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

ORIGINAL MEASUREMENTS:

Levina, M.I.; Stisibarovskaya, N. P.

Russ. J. Phys. Chem. 1939, *12*, **653-9.**

VARIABLES:

T/K = 273-533
P/MPa = 9.81
Concentration

PREPARED BY:

V. Katovic

EXPERIMENTAL VALUES:

		Oxygen Solubility[b]			
			NaOH Solution/N		
t/°C	T[a]/K	H_2O	0.5	2	4
Total pressure of 100 kg/cm^2 (9.81 MPa)					
0	273	0.66	0.54	0.28	0.09
25	298	0.51	0.40	0.19	0.08
35	308	0.44	0.34	0.16	0.07
50	323	0.34	0.30	0.12	0.07
75	348	0.31	0.27	0.11	0.07
100	373	0.33	0.28	0.13	0.08
125	398	0.34	0.27	0.14	--
150	423	0.41	0.32	0.17	0.08
200	473	0.51	0.37	0.20	0.11
240	513	0.57	0.48	0.25	0.14

[a] Calculated by compiler.

[b] Solubility in cm^3 (STP) per 1 gram of solvent at total pressure of 100 kg/cm^2 (9.81 MPa).

continued on following page

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Solubility determined by an apparatus described in the paper by measuring the volume of liquid and air. Oxygen was determined with pyrogallol.

SOURCE AND PURITY OF MATERIALS:

(1) From air.

(2,3) No details given.

ESTIMATED ERROR:

REFERENCES:

COMPONENTS:	EVALUATOR:
(1) Oxygen; O_2; [7782-44-7] (2) Sodium hydroxide; NaOH; [1310-73-2] (3) Water; H_2O; [7732-18-5]	Levina, M.I.; Stisibarovskaya, N. P. *Russ. J. Phys. Chem.* 1939, *12*, 653-9.

CRITICAL EVALUATION:

continued

			Solubility Coefficient[b]		
			NaOH Solution/N		
t/°C	T^aK	H_2O	0.5	2	4
Partial pressure of O_2 of 100 kg/cm^2 (0.81 MPa)					
0	273	3.14	2.55	1.32	0.43
25	298	2.45	1.91	0.89	0.33
35	308	2.09	1.62	0.78	0.33
50	323	1.78	1.41	0.59	0.33
75	348	1.46	1.30	0.51	0.33
100	373	1.55	1.34	0.61	0.38
125	398	1.62	1.32	0.66	--
150	423	2.05	0.82	0.40	1.06
200	473	2.88	2.12	1.09	1.06[c]
240	513	4.09	3.50	1.76	0.95

[a] Calculated by compiler.

[b] Solubility coefficient of cm^3(STP) per 1 gram of solution at a partial oxygen pressure of 100 kg/cm^2 (9.81 MPa).

[c] Value reported in paper was 10.61 which must be a typographical error.

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Sodium hydroxide; NaOH; [1310-73-2]

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

ORIGINAL MEASUREMENTS:

Bruhn, G.; Gerlach, J.; Pawlek, F.

Z. Anorg. Allgem. Chem. 1965, 337, 68-79.

VARIABLES:

$T/K = 323-523$
Concentration

PREPARED BY:

C.L. Young

EXPERIMENTAL VALUES:

T/K	Conc of hydroxide/mol l^{-1}	Bunsen coefficient, $\alpha/cm^3 (STP) cm^{-3} atm^{-1}$
323.15	0.5	0.01692
	1.0	0.01356
	1.5	0.01104
373.15	0.5	0.01369
	1.0	0.01199
	1.5	0.00954
423.15	0.5	0.0160
	1.0	0.01225
	1.5	0.01052
473.15	0.5	0.02133
	1.0	0.01698
	1.5	0.01568
523.15	0.5	0.03160
	1.0	0.02563
	1.5	0.02078

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Static equilibrium cell. Similar to that described by Pray and Stephan (1). Composition of liquid determined by stripping solution of gas and estimating volumetrically.

SOURCE AND PURITY OF MATERIALS:

No details given.

ESTIMATED ERROR:

$\delta T/K = \pm 2$; $\delta\alpha = \pm 2\%$.

(estimated by compiler).

REFERENCES:

1. Pray, H.A.; Stephan, E.L. *Battelle Memorial Institute Report*, *BMI-840*, 1953.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Oxygen; O_2; [7782-44-7] (2) Sodium hydroxide; NaOH; [1310-73-2] (3) Water; H_2O; [7732-18-5]	Yasunishi, A. *Kagaku Kogaku Rombunshu* 1978, *4*, 185-9.
VARIABLES: T/K = 288.15 - 308.15 O_2 P/kPa = 101.325 c_3/mol dm^{-3} = 0 - 6.423	PREPARED BY: H. L. Clever

EXPERIMENTAL VALUES:

continued on following page

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The apparatus and procedure are described in reference (1). A Horiuti type apparatus is used.

The aqueous salt solution is degassed by boiling under reflux and under vacuum.

The gas phase volume and the solvent volume are measured by displacement of mercury.

Dry gas is intermittently added until equilibrium is attained. At that time the total pressure in the dissolution vessel and the gas volume remaining in the buret are recorded.

The salt solution concentration and density are determined after the solubility measurement. The salt solution vapor pressure is either taken from the literature or estimated. A correction for the increase of the liquid volume by the dissolved gas is made.

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. High purity grade stated to be 99.995 per cent.

(2) Sodium hydroxide.

(3) No information.

ESTIMATED ERROR:

REFERENCES:

1. Yasunishi, A., *J. Chem. Eng. Jpn.* 1977, *10*, 89.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Oxygen; O_2; [7782-44-7] (2) Sodium hydroxide; NaOH; [1310-73-2] (3) Water; H_2O; [7732-18-5]	Yasunishi, A. *Kagaku Kogaku Rombunshu* 1978, *4*, 185-9.

EXPERIMENTAL VALUES:

continued

T/K	Sodium hydroxide c_3/mol dm^{-3}	Ostwald Coefficient L
288.15	0.0	0.03643[1]
	0.589	0.02869
	1.064	0.02375
	1.997	0.01686
	2.676	0.01353
	3.547	0.01039
	4.095	0.00815
	4.447	0.00723
	5.188	0.00551
	5.419	0.00524
298.15	0.0	0.03114[1]
	0.624	0.02437
	1.025	0.02099
	1.959	0.01490
	3.613	0.00800
	4.115	0.00688
	4.779	0.00530
	6.423	0.00297
308.15	0.0	0.02764[1]
	0.674	0.02084
	0.773	0.02033
	0.986	0.01817
	1.630	0.01445
	2.153	0.01201
	2.476	0.01079
	3.424	0.00756

[1] Values from reference 1.

The author correlated the data by the Setschenow equation $\log(L_o/L)=KC_3$. Values of K are 0.158, 0.160, and 0.167 for temperatures of 288.15, 298.15, and 308.15 K, respectively. The data were also correlated by the empirical equation $\log(L_o/L) = AC_3/(1 + BC_3)$. Values of A and B are

T/K	A/dm^3 mol^{-1}	B/dm^3 mol^{-1}
288.15	0.171	0.0181
298.15	0.164	0.0049
308.15	0.181	0.0310

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]
(2) Sodium hydroxide; NaOH; [1310-73-2]
Sodium nitrate; $NaNO_3$; [7631-99-4]
Sodium bicarbonate; $NaHCO_3$; [144-55-8]
(3) Water; H_2O; [7732-18-5]

ORIGINAL MEASUREMENTS:

Broden, A.; Simonson, R.

Sven. Papperstidn. 1978, *81*, 541 - 544; 1979, *82*, 487 - 491.

VARIABLES:

T/K = 323 - 423
p/MPa = 1 - 5
c_2/mol dm^{-3} = up to 1.0

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES: The experimental data are presented by graphs and by the constants of an equation. The equation is

$$c_1/\text{mmol dm}^{-3} = \alpha_1 + \alpha_2(T/\text{K}) + \alpha_3(p/\text{MPa}) + \alpha_4(p/\text{MPa})(T/\text{K})^2 +$$

$$\alpha_5(p/\text{MPa})/(T/\text{K}) + \alpha_6(p/\text{MPa})^2 + \alpha_7(p/\text{MPa})^2/(T/\text{K}).$$

p/MPa is the oxygen partial pressure. The solubility of oxygen in water was fitted to both a five and a seven constant equation. Only the first five constants were used for the electrolyte solutions. The constants for the equation are given below.

α_1	$10^2\alpha_2$	$10^{-1}\alpha_3$	$10^4\alpha_4$	$10^{-4}\alpha_5$	α_6	$10^{-2}\alpha_7$
Water, standard deviation 0.45 mmol dm^{-3}.						
5.351	-1.252	-7.954	2.135	2.125		
Water, standard deviation 0.42 mmol dm^{-3}, improved representation of the pressure dependence of the data at low temperatures.						
-2.545	0.807	-8.414	2.096	2.322	1.027	-3.911
Sodium hydroxide, 0.01 mol dm^{-3}						
3.236	-0.7466	-5.602	1.558	1.542		
Sodium hydroxide, 0.10 mol dm^{-3}						
9.582	-2.436	-9.477	2.517	2.460		
Sodium bicarbonate, 0.10 mol dm^{-3}						
6.817	-1.750	-6.743	1.885	1.800		
Sodium bicarbonate, 0.50 mol dm^{-3}						
0	0	-6.479	1.757	1.740		

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The apparatus consisted of a stainless steel autoclave of 3 dm^3 volume, connected to a centrifugal pump which circulated the solvent at a rate of 2 $dm^3 min^{-1}$ and sprayed the solvent back into the top of the autoclave. The system was attached to controls to measure and control the temperature and pressure.

Equilibration was reached within 30 min. Samples of 0.426 cm^3 were taken under conditions of no change in temperature or pressure. The gas was stripped from the solvent and analysed by GC on a 200 x 0.46 cm column filled with 80 - 100 mesh 5 A Molecular sieve. The column temperature was 40 °C, the detector temperature was 75 °C, the carrier gas was helium.

All salt concentrations are referred to 298 K and atmospheric pressure.

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen.

(2) Electrolytes.

(3) Water.

No information on the source and purity of the materials.

ESTIMATED ERROR:

δT/K =± 0.3
δp/MPa = ± 0.005

Sodium nitrate. No equation was given for the solubility of oxygen in aqueous sodium nitrate. There is a graph of log c_1°/c_1 *vs.* c_2 showing measurements were made in 0.1, 0.5, and 1.0 mol dm^{-3} solutions at temperatures of 323, 373, and 423 K and pressures of 1, 3, and 5 MPa.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Oxygen; O_2; [7782-44-7] (2) Disodium sulfate; Na_2SO_4; [7757-82-6] (3) Sodium hydroxide; NaOH; [1310-73-2] (4) Sodium dithionite; $Na_2S_2O_4$; [7775-14-6] (5) Water; H_2O; [7732-18-5]	Jhaveri, A.S.; Sharma, M.M. *Chem. Eng. Sci.* <u>1968</u>, *23*, 1-8.

VARIABLES:	PREPARED BY:
T/K = 306 Composition	R. Battino

EXPERIMENTAL VALUES:

Na_2SO_4 /mol ℓ^{-1}	NaOH /mol ℓ^{-1}	Na_2SO_4 /mol ℓ^{-1}	10^5x_1	10^7C^* /mol cm^{-3}
0	0.0875	0.0254	1.83	10.4
0	0.0875	0.0342	1.87	10.35
0	0.0875	0.0720	1.81	10.0
0	0.0875	0.084	1.80	9.92
0	0.0875	0.131	1.70	9.38
0	0.0875	0.169	1.66	9.17
0	0.0375	0.276	1.52	8.40
1.0	0.20	0.0955	0.699	3.86
1.0	0.20	0.218	0.627	3.46
1.0	0.20	0.286	0.594	3.28
0	0.532	0.0167	0.147	0.81
0	0.532	0.0261	0.191	1.055
0	0.532	0.09	0.380	2.10
0	0.532	0.182	0.695	3.84

[a] All measurements at 33°C (306K)

[b] x_1, the mole fraction solubility at 101.325 kPa (1 atm) partial gas pressure calculated by compiler.

[c] C* is the reported unit of solubility.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Most measurements were carried out in a continuous-flow glass stirred cell. Some measurements were carried out in a packed column. The unreacted sodium dithionite was estimated iodimetrically using the procedures found in reference 1.

SOURCE AND PURITY OF MATERIALS:

"Chemicals were reagent grade."

ESTIMATED ERROR:

$\delta C^*/C^* = \pm 0.02$ (compiler's estimate)

REFERENCES:

1. Committee on Analytical Methods, *Am. Dyestuff Reptr.* <u>1957</u>, *46*, 443.

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Sodium acetate; $C_2H_3O_2Na$; [127-09-3]

(3) Potassium hydroxide and sulfuric acid to control pH

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

ORIGINAL MEASUREMENTS:

Guseva, M.S.; Konnik, E.I.; Saifi, R.N.; Kuz'min, A.A.; Mordukhovich, I.L.

Fiz. Khim. Rastvorov, 1972, 105-8. Ed. by Samoilov, O.Ya. "Nauka" Moscow, USSR.

Chem. Abstr. 1972, *77*, 157007v.

VARIABLES:

T/K = 293-313

pH = 0-14

PREPARED BY:

V. Katovic

EXPERIMENTAL VALUES:

	20°C (293K)		30°C (303K)		40°C (313K)	
pH	c^a/mg ℓ^{-1}	10^3c/ g-equiv ℓ^{-1}	c^a/mg ℓ^{-1}	10^3c/ g-equiv ℓ^{-1}	c^a/mg ℓ^{-1}	10^3c/ g-equiv ℓ^{-1}
Aqueous solutions[b]						
0	7.6	0.95	6.4	0.79	5.7	0.71
1	8.6	1.07	6.9	0.87	6.3	0.78
2-12	8.9	1.12	7.5	0.93	6.4	0.80
13	8.9	1.11	7.4	0.92	6.2	0.78
14	6.6	0.83	5.5	0.68	4.3	0.54
0.1 N Sodium acetate solution[b]						
0	7.2	0.90	5.9	0.74	5.5	0.69
1	8.4	1.04	6.8	0.85	6.3	0.78
2-12	8.8	1.10	7.4	0.93	6.3	0.79
13	8.4	1.04	7.1	0.89	6.2	0.78
14	6.4	0.80	5.5	0.68	4.3	0.54

[a] Solubilities at 101.325kPa partial pressure of air.

[b] The pH was adjusted by the addition of KOH or H_2SO_4.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The solubility of oxygen was measured after bubbling air through the solution for 30 minutes. The dissolved oxygen was determined by the Winkler method. The pH of the solutions was adjusted by the addition of KOH or H_2SO_4.

SOURCE AND PURITY OF MATERIALS:

(1) From air.

(2,3) No details given.

(4) Double distilled, specific conductance of 2×10^{-6} ohm^{-1} cm^{-1}.

ESTIMATED ERROR:

$\delta T/K = \pm 0.1$, authors' estimate.

$\delta c/c = \pm 0.05$, authors' estimate.

REFERENCES:

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Sodium carbonate; Na_2CO_3; [497-19-8]

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

ORIGINAL MEASUREMENTS:

Yasunishi, A.

Kagaku Kogaku Rombunshu 1978, *4*, 185-9.

VARIABLES:

T/K = 288.15 - 308.15

O_2 P/kPa = 101.325

c_3/mol dm^{-3} = 0 - 2.958

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

T/K	Sodium carbonate c_3/mol dm^{-3}	Ostwald Coefficient L
288.15	0.0	0.03643[1]
	0.205	0.02990
	0.421	0.02524
	0.647	0.02139
	0.868	0.01794
	1.043	0.01552
	1.313	0.01255
298.15	0.0	0.03114[1]
	0.202	0.02621
	0.379	0.02288
	0.798	0.01623
	1.235	0.01155
	1.258	0.01137
	1.593	0.00917
	1.636	0.00840
	1.906	0.00703
	2.128	0.00613
308.15	0.0	0.02764[1]
	0.407	0.01973
	0.858	0.01350
	1.245	0.00979
	1.631	0.00722
	2.086	0.00512
	2.337	0.00406
	2.532	0.00354
	2.958	0.00255

[1] Values from reference 1.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The apparatus and procedure are described in reference (1). A Horiuti type apparatus is used.

The aqueous salt solution is degassed by boiling under reflux and under vacuum.

The gas phase volume and the solvent volume are measured by displacement of mercury.

Dry gas is intermittently added until equilibrium is attained. At that time the total pressure in the dissolution vessel and the gas volume remaining in the buret are recorded.

The salt solution concentration and density are determined after the solubility measurement. The salt solution vapor pressure is either taken from the literature or estimated. A correction for the increase of the liquid volume by the dissolved gas is made.

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. High purity grade stated to be 99.995 per cent.

(2) Sodium carbonate.

(3) Water. No information.

ESTIMATED ERROR:

REFERENCES:

1. Yasunishi, A.
J. Chem. Eng. Jpn. 1977, *10*, 89.

The author correlated the data with the Setschnow equation $\log(L_0/L) = Kc_3$. Values of K are 0.356, 0.338, and 0.353 at 288.15, 298.15 and 308.15 K, respectively.

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Trialkali metal phosphates; Na_3PO_4 and K_3PO_4

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

ORIGINAL MEASUREMENTS:

Khomutov, N. E.; Konnik, E. I.

Zh. Fiz. Khim. 1974, *48*, 620-5.

Russ. J. Phys. Chem. 1974, *48*, 359-62.

VARIABLES:

$T/K = 298.15$

O_2 $P/kPa = \sim 21$ (air at 1 atm)

$c_3/mol\ dm^{-3} = 0 - 0.6$

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

T/K	Maximum Salt Concentration $c_3/mol\ dm^{-3}$	Number of Experimental Points	Salt Effect Parameter $k = (1/c_3)\log(S^0/S)$
	Trisodium phosphate; Na_3PO_4; [7601-54-9]		
298.15	0.6	7	0.652
	Tripotassium phosphate; K_3PO_4; [7778-53-2]		
298.15	0.6	6	0.507

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Air, saturated with water vapor from the salt solution, is bubbled for several hours through 500 cm^3 of solution.

Three samples are taken and analyzed by the Winkler chemical method.

The solubility unit is mg dm^{-3} at the normal oxygen partial pressure in air of 0.21 atm. The solubility in water is 8.15 mg dm^{-3}.

The results are presented graphically as log S *vs.* dm^{-3}. The slope is given as the salt effect parameter (Sechenow constant) k.

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. Air treated to free from dust and any foreign gases.

(2) Salts. No information.

(3) Water. No information.

ESTIMATED ERROR:

$\delta T/K = 0.1$

$\delta S/mg\ dm^{-3} = 0.05$

Max error in S is 1.8 per cent.

REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Oxygen; O_2; [7782-44-7] (2) Potassium hydroxide; KOH; [1310-58-3] (3) Water; H_2O; [7732-18-5]	Geffcken, G. *Z. Phys. Chem.* 1904, *49*, 257-302.
VARIABLES:	**PREPARED BY:**
T/K = 288-298 Concentration	C.L. Young; R. Battino

EXPERIMENTAL VALUES:

T/K	Conc of hydroxide/mol dm^{-3} (soln)	Ostwald coefficient, L
288.15	0.577	0.02791
	0.579	0.02791
	1.157	0.02191
	1.170	0.02181
298.15	0.577	0.02447
	0.579	0.02435
	1.157	0.01920
	1.170	0.01914

AUXILIARY INFORMATION

METHOD /APPARATUS/PROCEDURE:

Volumetric method using simple adsorption pipet and buret. Diagram and detailed description given in original paper.

SOURCE AND PURITY OF MATERIALS:

(1) Prepared by heating potassium chlorate and manganese dioxide. Washed with potassium hydroxide solution. Dried.

(3) Degassed.

ESTIMATED ERROR:

$\delta T/K = \pm 0.1$; $\delta L = \pm 1\%$.
(estimated by compiler).

REFERENCES:

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

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

(3) Potassium hydroxide; KOH; [1310-58-3]

ORIGINAL MEASUREMENTS:

Knaster, M. B.; Apel'baum, L. A.

Zh. Fiz. Khim. 1964, *38*, 223 - 225.

Russ. J. Phys. Chem. 1964, *38*, 120 - 122.

VARIABLES:

T/K: 294.15,318.15,348.15
P/kPa: 101.325 (1 atm)
c_3/mol dm^{-3}: 0 - 10

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

Temperature		Potassium Hydroxide	Bunsen Coefficient	Salt Effect Parameter[1]
t/°C	T/K	c_3/mol dm^{-3}	$10^3\alpha$	k_{sc}/dm^3 mol^{-1}
21	294.15	0	30.20	-
		1	20.10	0.177
		4	7.52	0.151
		7	2.29	0.160
		10	0.52	0.128
45	318.15	0	21.88	-
		1	15.94	0.138
		4	6.45	0.133
		7	1.98	0.149
		10	0.456	0.168
75	348.15	0	17.97	-
		1	13.38	0.128
		4	5.46	0.129
		7	1.82	0.142
		10	0.411	0.164

[1] Salt effect parameter, k_{sc}/dm^3 mol^{-1} = (1/(c/mol dm^{-3})) log ($\alpha°/\alpha$) where $\alpha°$ is the Bunsen coefficient for water.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The KOH solution was introduced into the saturating vessel. The solution was saturated with gas, which was bubbled through the solution at a rate of 15 dm^3 h^{-1} for 5 h. The gas stream was turned off and the solution was allowed to stand for one h to allow suspended gas bubbles to escape. A known amount of the gas-saturated solution was transferred to an evacuated flask. The gas evolved from the solution was withdrawn, together with water vapor, into an evacuated and calibrated portion of the apparatus. The water vapor was frozen out in a liquid oxygen trap. The pressure (*ca.* 1 mmHg) of the residual gas at a known temperature and volume was measured on a McLeod gage.

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. The gas was produced by electrolysis and subjected to a standard purification process.

(2) Water. No information.

(3) Potassium hydroxide. No information.

ESTIMATED ERROR:

$\delta T/K = 0.1$
$\delta\alpha/\alpha = 0.007$ (authors)

REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Oxygen; O_2; [7782-44-7] (2) Potassium hydroxide; KOH; [1310-58-3] (3) Water; H_2O; [7732-18-5]	Davis, R.E.; Horvath, G.L.; Tobias, C.W. *Electrochim. Acta* 1967, *12*, 287-97.

VARIABLES:	PREPARED BY:
T/K = 298 P/kPa = 101.325 C/N = 0-12	R. Battino

EXPERIMENTAL VALUES:

T/K[a]	Mole fraction[b] 10^5x_1	Ostwald Coefficient[c] 10^2L	Molarity[d] 10^3C
298.15	2.276	2.823	1.26

[a] Temperature reported to 0.2°C.

[b] Mole fraction solubility at 101.325 kPa (1atm) partial pressure of gas calculated by compiler.

[c] Calculated by compiler.

[d] At 1 atm partial pressure of gas.

[e] In the range 0-12N KOH and a partial pressure of oxygen of 1 atm the oxygen solubility is given by

$$\log_{10}S = \log_{10}(1.26 \times 10^{-3}) - 0.1746\ C$$

where S is the oxygen solubility in g-mol dm^{-3}, and C the concentration of KOH in g-mol dm^{-3}. This is for 25°C. Data are given graphically for 0°C and 60°C. Both the solubility and the coefficient of C in the above equation decrease as the temperature increases.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:	SOURCE AND PURITY OF MATERIALS:
Solubility measurements were made by the Van Slyke manometric method (1).	(1) 99.6% pure (2) Reagent grade (3) Distilled

ESTIMATED ERROR:

δC/C = ±0.01, estimate by authors

REFERENCES:

1. Van Slyke, D.D; Neill, J.M. *J. Biol. Chem.* 1924, *61*, 523.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Oxygen; O_2; [7782-44-7] (2) Potassium Hydroxide; KOH; [1310-58-3] (3) Water; H_2O; [7732-18-5]	Shoor, S. K.; Walker, R. D. Jr.; Gubbins, K. E. *J. Phys. Chem.* 1969, *73*, 312-7.
VARIABLES: T/K = 298.15 - 353.15 Total P/kPa = 101.325 KOH/wt % = 0 - 41.40	PREPARED BY: P. L. Long H. L. Clever

EXPERIMENTAL VALUES:

continued on following page

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

A gas chromatographic method was used (1). All analyses were made with a thermal conductivity detector and with helium as the carrier gas. The oxygen saturated solutions were prepared by bubbling the gas through presaturators and then through the KOH solution. Samples were drawn from the solution over a 48 hour period to determine whether or not equilibrium was established. Samples were transferred from the saturator to the gas chromotograph in gas tight Hamilton syringes.

The results are reported as activity coefficients, which are the mole fraction solubility ratio, X^o/X, where X^o is the argon mole fraction solubility in water and X is the argon mole fraction solubility in the aqueous KOH solution, both at a gas partial pressure of 1 atm. Solubility values were corrected to 1 atm assuming Henry's law is obeyed. The activity coefficients are the average of at least four measurements.

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. Source not given. Minimum purity 99.99 %.

(2) Potassium Hydroxide. Baker Analyzed Reagent Grade. Contained a maximum of 1% K_2CO_3. The KOH solutions were protected from atm CO_2.

(3) Water. Distilled and degassed in glass-teflon still.

ESTIMATED ERROR:

$\delta T/K = 0.05$
$\delta \gamma/\gamma = 0.01$

REFERENCES:

1. Gubbins, K. E.; Carden, S. N.; Walker, R. D. Jr. *J. Gas Chromatog.* 1965, *3*, 98.

COMPONENTS:	EVALUATOR:
(1) Oxygen; O_2; [7782-44-7] (2) Potassium Hydroxide; KOH; [1310-58-3] (3) Water; H_2O; [7732-18-5]	Shoor, S. K.; Walker, R. D. Jr.; Gubbins, K. E. *J. Phys. Chem.* 1969, *73*, 312-7.

EXPERIMENTAL VALUES: continued

T/K	Potassium Hydroxide		Mol Fraction	Solubility Ratio	Salt Effect Parameter
	Wt %	mol dm^{-3}	$O_2/X_1 \times 10^3$	$\gamma = X^o/X$	$k_s = (1/C)\log(X^o/X)$
298.15	0.0	0.0	0.0225	1.00	-
	5.00	0.92		1.53	0.201
	13.50	2.67		3.06	0.182
	23.00	5.00		8.15	0.182
	31.61	7.35		20.1	0.177
	40.70	10.12		70.1	0.182
	50.65	13.75		230.	0.172
					0.180 (authors)
313.15	0.0	0.0	0.0190	1.00	-
	5.0	0.92		1.54	0.204
	13.50	2.67		2.87	0.171
	23.00	5.00		7.24	0.172
	31.61	7.35		17.8	0.170
	40.70	10.12		53.3	0.171
					0.168 (authors)
333.15	0.0	0.0	0.0160	1.00	-
	5.00	0.92		1.45	0.175
	13.50	2.67		2.58	0.154
	23.00	5.00		6.30	0.160
	31.61	7.35		15.6	0.162
	40.70	10.12		45.3	0.164
	50.65	13.75		162.	0.161
					0.159 (authors)
353.15	0.0	0.0	0.0144	1.00	-
	5.00	0.92		1.35	0.142
	13.50	2.67		2.50	0.149
	23.00	5.00		5.73	0.152
	31.61	7.35		14.4	0.158
	40.70	10.12		40.1	0.158
	50.65	13.75		143.	0.157
					0.155 (authors)
373.15	0.0	0.0	0.0142	1.00	-
	40.70	10.12		38.4	0.157
	50.65	13.75		141.	0.156
	56.50	16.20		338.	0.156
					0.155 (authors)

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Potassium chloride; KCl; [7447-40-7]

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

ORIGINAL MEASUREMENTS:

MacArthur, C. G.

J. Phys. Chem. 1916, *20*, 495-502.

VARIABLES:

$T/K = 298.15$

O_2 $P/kPa = \sim 20.2$ (O_2 in air at one atm)

$c_3/mol\ dm^{-3} = 0 - 4$

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

T/K	Potassium Chloride $c_3/mol\ dm^{-3}$	Solution density[1] $\rho/g\ cm^{-3}$	Solubility[2] cm^3 (STP) O_2 per dm^3	Setschenow Constant[3] k_s
298.15	0.0	1.000	5.78	-
	0.125	1.003	5.52	0.160
	0.25	1.0086	5.30	0.151
	0.5	1.020	4.98	0.129
	1	1.042	4.26	0.133
	2	1.086	3.21	0.128
	3	1.134	2.36	0.130
	4	1.170	1.86	0.123

[1] The author calculated the densities from data in the *International Critical Tables*. Use the density values with caution, some of them appear to be in error.

[2] The solubility in water is about 3 per cent smaller than the presently accepted value.

[3] The Setschenow constant (salt effect parameter) is calculated from $k_s = (1/c_3)$ log (Solubility in water/Solubility in solution).

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The solutions were thermostated in tall cylinder open to the air. They were shaken by hand several times a day for a period of four days.

A sample of 250 cm^3 was analyzed for oxygen by a modified Winkler method.

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. Air at one atm.

(2) Potassium chloride. No information.

(3) Water. No information.

ESTIMATED ERROR:

The solubility values may be in 5 to 10 per cent error. The salt concentrations above one mol dm^{-3} may be in error by 10 per cent.

REFERENCES:

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Potassium Chloride; KCl; [7447-40-7]

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

ORIGINAL MEASUREMENTS:

Bikov, M. M.

Tr. Voronezhsk. Gos. Univ. 1937, 9, 29-57.

VARIABLES:

T/K = 273-510
P/MPa = 9.81
Concentration

PREPARED BY:

V. Katovic

EXPERIMENTAL VALUES:

		Oxygen Solubility [b]			
			KCl Solution/N		
t/°C	T^a/K	H_2O	0.5	1.0	2.0
Total pressure of 100 kg/cm^2 (9.81MPa)					
0	273	0.66	0.635	0.510	0.331
25	298	0.51	0.396	0.336	0.232
50	323	0.34	0.290	0.265	0.206
75	348	0.31	0.261	0.230	0.172
100	373	0.33	0.265	0.233	0.174
150	423	0.41	0.321	0.253	0.211
200	473	0.51	0.372	0.309	0.245
240	513	0.57	0.465	0.386	0.272

[a] Calculated by compiler.

[b] Solubility in cm^3(STP) per 1 gram of solvent.

continued on following page

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Details of the method and a drawing of the apparatus are given in the paper.

SOURCE AND PURITY OF MATERIALS:

(1) From air.

(2) No details given.

(3) Distilled.

ESTIMATED ERROR:

$\delta T/K = \pm 0.2$
$\delta S/S = \pm 0.01$ compiler's estimate for solubility.

REFERENCES:

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Potassium Chloride; KCl; [7447-40-7]

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

EVALUATOR:

Bikov, M. M.

Tr. Voronezhsk. Gos. Univ. 1937, 9, 29-57.

CRITICAL EVALUATION:

continued

			Solubility Coefficient[b]		
				KCl Solution/N	
t/°C	T[a]/K	H_2O	0.5	1.0	2.0
0	273	3.24	3.023	2.430	1.575
25	298	2.45	1.885	1.601	1.106
50	323	1.78	1.380	1.265	0.981
75	348	1.46	1.249	1.100	0.820
100	373	1.55	1.273	1.121	0.836
150	423	2.05	1.605	1.276	1.046
200	473	2.88	2.094	1.735	1.370
240	513	4.09	3.338	2.748	1.905

[a] Calculated by compiler.

[b] The solubility coefficient is cm^3 (STP) of oxygen dissolved per 1 gram of solution at an oxygen partial pressure of 100 kg/cm^2 (9.81MPa).

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Potassium Chloride: KCl; [7447-40-7]

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

ORIGINAL MEASUREMENTS:

Eucken, A.; Hertzberg, G.

Z. Physik. Chem. 1950, *195*, 1 - 23.

VARIABLES: T/K= 273.15, 293.15

P/kPa= 101.325

m_{KCl}/mol kg^{-1}= 0 - 2.76

PREPARED BY:

P. L. Long

H. L. Clever

EXPERIMENTAL VALUES:

T/K	Potassium Chloride mol kg^{-1} H_2O	Ostwald Coefficient L	Setschenow Constant $k = (1/m)\log(L^o/L)$
273.15	0	0.0490	-
	0.62	0.0387	0.167
	1.18	0.0309	0.170
	2.76	0.0172	0.165
293.15	0	0.0332	-
	0.47	0.0285	0.142
	0.97	0.0243	0.140
	1.59	0.0196	0.144

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Gas absorption. The apparatus consists of a gas buret and an adsorption flask connected by a capillary tube. The whole apparatus is shaken. The capillary tube is a 2m-long glass helix. An amount of gas is measured at STP and placed in the gas buret. After shaking, the difference from the original amount of gas placed in the gas buret is determined.

SOURCE AND PURITY OF MATERIALS:

Components. Neither source nor purity given.

ESTIMATED ERROR:

$\delta L/L = 0.01$

REFERENCES:

COMPONENTS: (1) Oxygen; O_2; [7782-44-7] (2) Potassium chloride; KCl; [7447-40-7] (3) Water; H_2O; [7732-18-5]	**ORIGINAL MEASUREMENTS:** Yasunishi, A. *Kagaku Kogaku Rombunshu* 1978, *4* (2), 185-9.
VARIABLES: T/K = 288.15 - 308.15 O_2 P/kPa = 101.325 $c_3/mol\ dm^{-3}$ = 0 - 4.124	**PREPARED BY:** H. L. Clever

EXPERIMENTAL VALUES:

See following page.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The apparatus and procedure are described in reference (1). A Horiuti type apparatus is used.

The aqueous salt solution is degassed by boiling under reflux and under vacuum.

The gas phase volume and the solvent volume are measured by displacement of mercury.

Dry gas is intermittently added until equilibrium is attained. At that time the total pressure in the dissolution vessel and the gas volume remaining in the buret are recorded.

The salt solution concentration and density are determined after the solubility measurement. The salt solution vapor pressure is either taken from the literature or estimated. A correction for the increase of the liquid volume by the dissolved gas is made.

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. High purity grade stated to be 99.995 per cent.

(2) Potassium chloride.

(3) Water. No information.

ESTIMATED ERROR:

REFERENCES:

1. Yasunishi, A. *J. Chem. Eng. Jpn.* 1977, *10*, 89.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Oxygen; O_2; [7782-44-7] (2) Potassium chloride; KCl; [7447-40-7] (3) Water; H_2O; [7732-18-5]	Yasunishi, A. *Kagaku Kogaku Rombunshu* <u>1978</u>, *4* (2), 185-9.

EXPERIMENTAL VALUES:

T/K	Potassium chloride c_3/mol dm^{-3}	Ostwald Coefficient L
288.15	0.0	0.03643[1]
	0.421	0.03270
	0.821	0.02996
	1.295	0.02670
	1.725	0.02368
	2.258	0.02127
	3.162	0.01685
	3.192	0.01675
	3.797	0.01417
298.15	0.0	0.03114[1]
	0.413	0.02844
	0.595	0.02720
	1.050	0.02452
	1.172	0.02425
	1.256	0.02360
	1.295	0.02348
	1.501	0.02249
	1.972	0.01973
	2.099	0.01951
	2.558	0.01745
	3.092	0.01641
	3.604	0.01427
	4.035	0.01405
308.15	0.0	0.02764[1]
	0.454	0.02497
	1.018	0.02253
	1.400	0.02120
	1.725	0.01962
	2.054	0.01827
	3.039	0.01507
	3.254	0.01419
	3.865	0.01307
	4.124	0.01330

[1] Values from reference 1.

The author correlated the data by the Setschenow equation, $\log(L_o/L) = KC_3$, up to concentrations of 3.2 mol dm^{-3} KCl. Values of K are 0.106, 0.095, and 0.087 at temperatures of 288.15, 298.15 and 308.15 K, respectively. For the entire concentration range the data are correlated better by the empirical equation $\log(L_o/L) = AC_3/(1 + BC_3)$. The values of A and B are

T/K	A/dm^3 mol^{-1}	B/dm^3 mol^{-1}
288.15	0.105	-0.0022
298.15	0.103	0.0378
308.15	0.0919	0.0291

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Potassium bromide; KBr; [7758-02-3]

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

ORIGINAL MEASUREMENTS:

MacArthur, C. G.

J. Phys. Chem. 1916, *20*, 495-502.

VARIABLES:

$T/K = 298.15$

O_2 $P/kPa = \sim 21.2$ (O_2 in air at one atm)

$c_3/mol\ dm^{-3} = 0 - 4$

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

T/K	Potassium bromide $c_3/mol\ dm^{-3}$	Solution density[1] $\rho/g\ cm^{-3}$	Solubility[2] cm^3 (STP) O_2 per dm^3	Setschenow Constant[3] k_s
298.15	0.0	1.000	5.78	-
	0.25	1.019	5.29	0.154
	2	1.079	3.27	0.124
	4	1.162	1.84	0.124

[1] The author calculated the densities from data in the *International Critical Tables*. Use the density values with caution, some of them appear to be in error.

[2] The solubility in water is about 3 per cent smaller than the presently accepted value.

[3] The Setschenow constant (salt effect parameter) is calculated from $k_s = (1/c_3) \log$ (Solubility in water/Solubility in solution).

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The solutions were thermostated in tall cylinder open to the air. They were shaken by hand several times a day for a period of four days.

A sample of 250 cm^3 was analyzed for oxygen by a modified Winkler method.

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. Air at one atm.

(2) Potassium bromide. No information.

(3) Water. No information.

ESTIMATED ERROR:

The solubility values may be in 5 to 10 per cent error. The salt concentrations above one mol dm^{-3} may be in error by 10 per cent.

REFERENCES:

COMPONENTS: (1) Oxygen; O_2; [7782-44-7] (2) Potassium iodide; KI; [7681-11-0] (3) Water; H_2O; [7732-18-5]	**ORIGINAL MEASUREMENTS:** MacArthur, C. G. *J. Phys. Chem.* 1916, *20*, 495-502.
VARIABLES: T/K = 298.15 O_2 P/kPa = ∿ 21.2 (O_2 in air at one atm) c_3/mol dm^{-3} = 0 - 5	**PREPARED BY:** H. L. Clever

EXPERIMENTAL VALUES:

T/K	Potassium iodide c_3/mol dm^{-3}	Solution density[1] ρ/g cm^{-3}	Solubility[2] cm^3 (STP) O_2 per dm^3	Setschenow Constant[3] k_s
298.15	0.0	1.000	5.78	-
	0.125	1.013	5.65	0.079
	0.25	1.027	5.49	0.089
	0.5	1.056	5.20	0.092
	1	1.116	4.75	0.085
	2	1.23	3.77	0.093
	5	1.46	1.81	0.101

[1] The author calculated the densities from data in the *International Critical Tables*. Use the density values with caution, some of them appear to be in error.

[2] The solubility in water is about 3 per cent smaller than the presently accepted value.

[3] The Setschenow constant (salt effect parameter) is calculated from $k_s = (1/c_3) \log$ (Solubility in water/Solubility in solution).

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The solutions were thermostated in tall cylinder open to the air. They were shaken by hand several times a day for a period of four days.

A sample of 250 cm^3 was analyzed for oxygen by a modified Winkler method.

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. Air at one atm.

(2) Potassium iodide. No information.

(3) Water. No information.

ESTIMATED ERROR:

The solubility values may be in 5 to 10 per cent error. The salt concentrations above one mol dm^{-3} may be in error by 10 per cent.

REFERENCES:

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Sulfuric acid, dipotassium salt; (Potassium sulfate); K_2SO_4; [7778-80-5]

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

ORIGINAL MEASUREMENTS:

Geffcken, G.

Z. Phys. Chem. 1904, *49*, 257-302.

VARIABLES:

T/K = 288-298
Concentration

PREPARED BY:

C.L. Young, R. Battino

EXPERIMENTAL VALUES:

T/K	Conc of salt/mol dm^{-3} (soln)	Ostwald coefficient, L
288.15	0.2495	0.02944
	0.2530	0.02922
	0.4840	0.02395
	0.4850	0.02377
298.15	0.2495	0.02528
	0.2530	0.02530
	0.4850	0.02096

AUXILIARY INFORMATION

METHOD /APPARATUS/PROCEDURE:

Volumetric method using simple adsorption pipet and buret. Diagram and detailed description given in original paper.

SOURCE AND PURITY OF MATERIALS:

(1) Prepared by heating potassium chlorate and manganese dioxide. Washed with potassium hydroxide solution. Dried.

(3) Degassed.

ESTIMATED ERROR:

$\delta T/K = \pm 0.1$; $\delta L = \pm 1\%$.

(estimated by compiler).

REFERENCES:

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Potassium sulfate; K_2SO_4; [7778-80-5]

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

ORIGINAL MEASUREMENTS:

MacArthur, C. G.

J. Phys. Chem. 1916, *20*, 495-502.

VARIABLES:

$T/K = 298.15$

O_2 $P/kPa = \sim 20.2$ (O_2 in air at one atm)

$c_3/mol\ dm^{-3} = 0 - 0.5$

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

T/K	Potassium sulfate $c_3/mol\ dm^{-3}$	Solution density[1] $\rho/g\ cm^{-3}$	Solubility[2] cm^3 (STP) O_2 per dm^3	Setschenow Constant[3] k_s
298.15	0.0	1.000	5.78	-
	0.125	1.016	5.11	0.428
	0.25	1.032	4.66	0.374
	0.5	1.060	3.89	0.344

[1] The author calculated the densities from data in the *International Critical Tables*. Use the density values with caution, some of them appear to be in error.

[2] The solubility in water is about 3 per cent smaller than the presently accepted value.

[3] The Setschenow constant (salt effect parameter) is calculated from $k_s = (1/c_3) \log$ (Solubility in water/Solubility in solution).

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The solutions were thermostated in tall cylinder open to the air. They were shaken by hand several times a day for a period of four days.

A sample of 250 cm^3 was analyzed for oxygen by a modified Winkler method.

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. Air at one atm.

(2) Potassium sulfate. No information.

(3) Water. No information.

ESTIMATED ERROR:

The solubility values may be in 5 to 10 per cent error. The salt concentrations above one mol dm^{-3} may be in error by 10 per cent.

REFERENCES:

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Potassium nitrate; KNO_3; [7757-79-1]

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

ORIGINAL MEASUREMENTS:

MacArthur, C. G.

J. Phys. Chem. 1916, *20*, 495-502.

VARIABLES:

$T/K = 298.15$

O_2 $P/kPa = \sim 21.2$ (O_2 in air at one atm)

$c_3/mol\ dm^{-3} = 0 - 2$

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

T/K	Potassium nitrate $c_3/mol\ dm^{-3}$	Solution density[1] $\rho/g\ cm^{-3}$	Solubility[2] cm^3 (STP) O_2 per dm^3	Setschenow Constant[3] k_s
298.15	0.0	1.000	5.78	-
	0.25	1.015	5.49	0.089
	0.5	1.029	5.11	0.107
	1	1.059	4.61	0.098
	2	1.110	3.65	0.100

[1] The author calculated the densities from data in the *International Critical Tables*. Use the density values with caution, some of them appear to be in error.

[2] The solubility in water is about 3 per cent smaller than the presently accepted value.

[3] The Setschenow constant (salf effect parameter) is calculated from $k_s = (1/c_3) \log$ (Solubility in water/Solubility in solution).

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The solutions were thermostated in tall cylinder open to the air. They were shaken by hand several times a day for a period of four days.

A sample of 250 cm^3 was analyzed for oxygen by a modified Winkler method.

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. Air at one atm.

(2) Potassium nitrate. No information.

(3) Water. No information.

ESTIMATED ERROR:

The solubility values may be in 5 to 10 per cent error. The salt concentrations above one mol dm^{-3} may be in error by 10 per cent.

REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Oxygen; O_2; [7782-44-7] (2) Rubidium chloride; RbCl; [7791-11-9] (3) Water; H_2O; [7732-18-5]	MacArthur, C. G. *J. Phys. Chem.* 1916, *20*, 495-502.
VARIABLES: T/K = 298.15 O_2 P/kPa = ∿ 21.2 (O_2 in air at one atm) c_3/mol dm^{-3} = 0.125	PREPARED BY: H. L. Clever

EXPERIMENTAL VALUES:

T/K	Rubidium chloride c_3/mol dm^{-3}	Solution density[1] ρ/g cm^{-3}	Solubility[2] cm^3 (STP) O_2 per dm^3	Setschenow Constant[3] k_s
298.15	0.0	1.000	5.78	-
	0.125	1.0094	5.65	0.079

[1] The author calculated the densities from data in the *International Critical Tables*. Use the density values with caution, some of them appear to be in error.

[2] The solubility in water is about 3 per cent smaller than the presently accepted value.

[3] The Setschenow constant (salt effect parameter) is calculated from $k_s = (1/c_3) \log$ (Solubility in water/Solubility in solution).

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The solutions were thermostated in tall cylinder open to the air. They were shaken by hand several times a day for a period of four days.

A sample of 250 cm^3 was analyzed for oxygen by a modified Winkler method.

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. Air at one atm.

(2) Rubidium chloride. No information.

(3) Water. No information.

ESTIMATED ERROR:

The solubility values may be in 5 to 10 per cent error. The salt concentrations above one mol dm^{-3} may be in error by 10 per cent.

REFERENCES:

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Cesium chloride; CsCl; [7647-17-8]

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

ORIGINAL MEASUREMENTS:

MacArthur, C. G.

J. Phys. Chem. 1916, *20*, 495-502.

VARIABLES:

T/K = 298.15

O_2 P/kPa = ∿ 21.2 (O_2 in air at one atm)

c_3/mol dm^{-3} = 0.125

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

T/K	Cesium chloride c_3/mol dm^{-3}	Solution density[1] ρ/g cm^{-3}	Solubility[2] cm^3 (STP) O_2 per dm^3	Setschenow Constant[3] k_s
298.15	0.0	1.000	5.78	-
	0.125	1.014	5.67	0.067

[1] The author calculated the densities from data in the *International Critical Tables*. Use the density values with caution, some of them appear to be in error.

[2] The solubility in water is about 3 per cent smaller than the presently accepted value.

[3] The Setschenow constant (salt effect parameter) is calculated from $k_s = (1/c_3) \log$ (Solubility in water/Solubility in solution).

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The solutions were thermostated in tall cylinder open to the air. They were shaken by hand several times a day for a period of four days.

A sample of 250 cm^3 was analyzed for oxygen by a modified Winkler method.

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. Air at one atm.

(2) Cesium chloride. No information.

(3) Water. No information.

ESTIMATED ERROR:

The solubility values may be in 5 to 10 per cent error. The salt concentrations above one mol dm^{-3} may be in error by 10 per cent.

REFERENCES:

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) 4-Methyl-1,3-dioxolan-2-one or propylene carbonate; $C_4H_6O_3$; [108-32-7]

(3) Lithium chloride; LiCl; [7447-41-8]

ORIGINAL MEASUREMENTS:

Chaenko, N. V.; Sukhova, G. I.; Naumenko, N. K.; Kedrinskii, I. A.

Zh. Fiz. Khim. 1979, *53*, 1189-92.

Russ. J. Phys. Chem. 1979, *53*, 1133-4.

VARIABLES:

T/K = 298.15 (?)
P/kPa = ∿ 21.3 - 101.325
m_3/mol kg^{-1}: =0, 0.2

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

T/K	Oxygen Pressure[2] p/atm	Lithium Chloride[3] m_3/mol kg^{-1}	Absorption Coefficient cm^3 cm^{-3}
298.15[1]	air-saturated	0	0.144 ± 0.016[4]
	0.3	0	0.128 ± 0.005
	0.5	0	0.169 ± 0.005
	0.7	0	0.239 ± 0.017
	1.0	0	0.319 ± 0.003
	air-saturated	0.2	0.115 ± 0.001
	0.3	0.2	0.107 ± 0.004
	0.5	0.2	0.147 ± 0.008
	0.7	0.2	0.181 ± 0.006
	1.0	0.2	0.214 ± 0.006

[1] The temperature is not given in the paper. However, the authors quote values from other of their papers which were measured at 298.15 K.

[2] Dry air has an oxygen partial pressure of ∿0.21 atm. The other runs were made with a mixture of helium and oxygen. In all cases the total pressure was apparently one atm.

[3] The authors did not define m. The compiler asumed m/mol kg^{-1}.

[4] The airsaturated absorption coefficient is a mole fraction 5.45×10^{-4}.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The oxygen concentration was determined by an electrochemical sensor. The sensor was calibrated against an oxygen saturated ethanol solution. The Bunsen coefficient was taken as 0.213 cm^3 cm^{-3} atm^{-1}.

Solutions were saturated in three hours without stirring.

The solvent water content was determined by the Fisher method. Water content of 0.0053 - 0.017 % had no effect on the oxygen solubility.

The sensitivity of the method with respect to oxygen is 3 μg dm^{-3}.

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. Either air or a He/O_2 mixture.

(2) Propylene carbonate. Freshly distilled after special purification.

(3) Lithium chloride. No information.

ESTIMATED ERROR:

The authors state the relative error in O_2 concentration to be 4 - 5 %.

REFERENCES:

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) 4-Methyl-1,3-dioxolan-2-one or propylene carbonate; $C_4H_6O_3$; [108-32-7]

(3) Lithium aluminum chloride; $LiAlCl_4$; [17611-22-2]

ORIGINAL MEASUREMENTS:

Chaenko, N. V.; Sukhova, G. I.; Naumenko, N. K.; Kedrinskii, I. A.

Zh. Fiz. Khim. 1979, *53*, 1189-92.

Russ. J. Phys. Chem. 1979, *53*, 1133-4.

VARIABLES:

T/K= 298.15 (?)
P/kPa= ∿21.3 - 101.325
m_3/mol kg^{-1}= 0, 0.2

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

T/K	Oxygen Pressure[2] p/atm	Lithium Chloride[3] m_3/mol kg^{-1}	Absorption Coefficient cm^3 cm^{-3}
298.15[1]	air-saturated	0	0.144 ± 0.016[4]
	0.3	0	0.128 ± 0.005
	0.5	0	0.169 ± 0.005
	0.7	0	0.239 ± 0.017
	1.0	0	0.319 ± 0.003
	air-saturated	1.0	0.089 ± 0.009
	0.7	1.0	0.185 ± 0.004
	1.0	1.0	0.255 ± 0.005

[1] The temperature is not given in the paper. However, the authors quote values from another of their papers in which the data were measured at 298.15 K.

[2] Dry air has an oxygen partial pressure of ∿0.21 atm. The other runs were made with a mixture of helium and oxygen. In all cases the total pressure was apparently one atm.

[3] The authors did not define m. The compiler assumed m/mol kg^{-1}.

[4] The air-saturated absorption coefficient corresponds to a mole fraction of 5.45 x 10^{-4}.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The oxygen concentration was determined by an electrochemical sensor. The sensor was calibrated against an oxygen saturated ethanol solution. The Bunsen coefficient was taken as 0.213 cm^3 cm^{-3} atm^{-1}.

Solutions were saturated in three hours without stirring.

The sensitivity of the method with respect to oxygen is 3 μg dm^{-3}.

The solvent water content was determined by the Fisher method. Water content of 0.0053 - 0.017 % had no effect on the oxygen solubility.

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. Either air or a He/O_2 mixture.

(2) Propylene carbonate. Freshly distilled after special purification.

(3) Lithium aluminum chloride. No information.

ESTIMATED ERROR:

The authors state that the relative error in O_2 concentration is 4-5 %.

REFERENCES:

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Dihydro-2(3H)-furanone or Butrolactone; $C_4H_6O_2$; [96-48-0]

(3) Lithium perchlorate; $LiClO_4$; [7791-03-9]

ORIGINAL MEASUREMENTS:

Baird, W. R.; Foley, R. T.

J. Chem. Eng. Data 1972, *17*, 355-7.

VARIABLES:

$T/K = 298.15$
$P/kPa = 101.325$

PREPARED BY:

P. L. Long
H. L. Clever

EXPERIMENTAL VALUES:

T/K	c_{LiClO_4}/mol dm^{-3}	Mol Fraction $x_1 \times 10^3$	Bunsen Coefficient $\alpha \times 10^2$	Ostwald Coefficient $L \times 10^2$
298.15	0.00	0.170	4.99 ± 0.25[1]	5.45
	0.20		5.13	
	0.45		5.31	
	0.60		4.95	
	0.80		5.13	

[1] Average of four measurements ± average deviation.

The mole fraction and Ostwald coefficient values were calculated by the compiler.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The apparatus and procedure used were based on those described by Morrison and Billett (1). Gas saturation is achieved by allowing a thin film of solvent to flow down a glass helix containing the gas and solvent vapor at a total pressure of one atm. About 100 cm^3 of solvent is saturated at a flow rate of 2 - 3 cm^3 m^{-1}.

The authors solubility values for oxygen dissolved in water and in dimethylsulfoxide were 3.5 and 21 per cent lower, respectively, than values reported by other workers.

The authors reported a Bunsen coefficient which they had calculated from their measured Ostwald coefficients.

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. No information.

(2) Butrolactone. Matheson, Coleman and Bell. Fractionally distilled under reduced pressure through spinning band column. Use 40 percent from the center of an initial one liter sample.

(3) Lithium perchlorate. No information.

ESTIMATED ERROR:

$\delta T/K = 0.5$
$\delta\alpha/\alpha = 0.023 - 0.050$ (authors)

REFERENCES:

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

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) 4-Methyl-1,3-dioxolan-2-one or propylene carbonate; $C_4H_6O_3$; [108-32-7]

(3) Lithium perchlorate; $LiClO_4$; [7791-03-9]

ORIGINAL MEASUREMENTS:

Baird, W. R.; Foley, R. T.

J. Chem. Eng. Data 1972, *17*, 355-7.

VARIABLES:

T/K = 298.15
P/kPa = 101.325

PREPARED BY:

P. L. Long
H. L. Clever

EXPERIMENTAL VALUES:

T/K	C_{LiClO_4}/mol dm^{-3}	Mol Fraction $x_1 \times 10^3$	Bunsen Coefficient $\alpha \times 10^2$	Ostwald Coefficient $L \times 10^2$
298.15	0.00	0.058	1.53 ± 0.04[1]	1.67
	0.50		1.40	
			1.50	
	1.00		1.50	
			1.60	

[1] Average of four measurements ± average deviation.

The mole fraction and Ostwald coefficient values were calculated by the compiler.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The apparatus and procedure used were based on those described by Morrison and Billett (1). Gas saturation is achieved by allowing a thin film of solvent to flow down a glass helix containing the gas and solvent vapor at a total pressure of one atm. About 100 cm^3 of solvent is saturated at a flow rate of 2 - 3 cm^3 m^{-1}.

The authors solubility values for oxygen dissolved in water and in dimethylsulfoxide were 3.5 and 21 per cent lower, respectively, than values reported by other workers.

The authors reported a Bunsen coefficient which they had calculated from their measured Ostwald coefficients.

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. No information.

(2) Propylene carbonate. Matheson, Coleman and Bell. Fractionally distilled under reduced pressure through spinning band column. Use 40 percent from the center of an initial one liter sample.

(3) Lithium perchlorate. No information.

ESTIMATED ERROR:

$\delta T/K = 0.5$
$\delta\alpha/\alpha = 0.023 - 0.050$
(authors)

REFERENCES:

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

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) 4-Methyl-1,3-dioxolan-2-one or propylene carbonate; $C_4H_6O_3$; [108-32-7]

(3) Lithium perchlorate; $LiClO_4$; [7791-03-9]

ORIGINAL MEASUREMENTS:

Chaenko, N. V.; Sukhova, G. I.; Naumenko, N. K.; Kedrinskii, I. A.

Zh. Fiz. Khim. 1979, *53*, 1189-92.

Russ. J. Phys. Chem. 1979, *53*, 1133-4.

VARIABLES:

T/K = 298.15 (?)
P/kPa = ∿21.3 - 101.325
m_3/mol kg^{-1} = 0, 0.2

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

T/K	Oxygen Pressure[2] p/atm	Lithium Chloride[3] m_3/mol kg^{-1}	Absorption Coefficient cm^3 cm^{-3}
298.15[1]	air-saturated	0	0.144 ± 0.016[4]
	0.3	0	0.128 ± 0.005
	0.5	0	0.169 ± 0.005
	0.7	0	0.239 ± 0.017
	1.0	0	0.319 ± 0.003
	air-saturated	1.0	0.077 ± 0.001
	0.3	1.0	0.080 ± 0.0025
	0.5	1.0	0.115 ± 0.005
	0.7	1.0	0.164 ± 0.002
	1.0	1.0	0.206 ± 0.005

[1] The temperature is not given in the paper. However, the authors quote values from another of their papers in which the data were measured at 298.15 K.

[2] Dry air has an oxygen partial pressure of ∿0.21 atm. The other runs were made with a mixture of helium and oxygen. In all cases the total pressure was apparently one atm.

[3] The authors did not define m. The compiler assumed m/mol kg^{-1}.

[4] The air-saturated absorption coefficient corresponds to a mole fraction of 5.45 x 10^{-4}.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The oxygen concentration was determined by an electrochemical sensor. The sensor was calibrated against an oxygen saturated ethanol solution. The Bunsen coefficient was taken as 0.213 cm^3 cm^{-3} atm^{-1}.

Solutions were saturated in three hours without stirring.

The sensitivity of the method with respect to oxygen is 3 μg dm^{-3}.

The solvent water content was determined by the Fisher method. Water content of 0.0053 - 0.017 % had no effect on the oxygen solubility.

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. Either air or a He/O_2 mixture.

(2) Propylene carbonate. Freshly distilled after special purification.

(3) Lithium perchlorate. No information.

ESTIMATED ERROR:

The authors state that the relative error in O_2 concentration is 4 -5%.

REFERENCES:

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Potassium hydroxide; KOH; [1310-58-3]

(3) Methanol; CH_4O; [67-56-1]

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

ORIGINAL MEASUREMENTS:

Pospisil, J.; Luzny, Z.
Czech. Chem. Comm. 1960, *25*, 589-92.

VARIABLES:

T/K = 293.15
P/kPa = 101.325
Concentration

PREPARED BY:

R. W. CARGILL

EXPERIMENTAL VALUES:

SOLVENT COMPOSITION				
CH_3OH wt %	H_2O wt %	KOH added mol dm^{-3}	Bunsen Coefficient $\alpha/cm^3(STP)cm^{-3}atm^{-1}$	Ostwald Coefficient L
0	100	0.0	0.0300	0.0322
		0.179	0.0272	0.0292
		0.893	0.0223	0.0239
		1.786	0.0173	0.0186
		3.571	0.0127	0.0136
		5.357	0.0112	0.0120
20	80	0.0	0.0814	0.0874
		0.179	0.0751	0.0806
		0.893	0.0583	0.0626
		1.786	0.0470	0.0504
		3.571	0.0357	0.0383
		5.357	0.0313	0.0336
44	56	0.0	0.1610	0.1728
		0.179	0.1540	0.1653
		0.893	0.1335	0.1433
		1.786	0.1201	0.1289
		3.571	0.1052	0.1129
		5.357	0.1003	0.1076

continued on following page

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The solvent was stirred magnetically in a wide, flat-bottomed flask, in contact with the gas. Equilibrium was established in 60-90 minutes. A gas burette was used to measure the absorption of gas in up to 100 cm^3 of solution. The absorption flask and burette were thermostatted.

The solution was degassed by boiling for 30 minutes under reflux. Each measurement was made 3 - 5 times, and the average value is given.

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. Electrochemical oxygen from a cylinder.

(2) KOH. Analytical purity.

(3) Methanol. Twice redistilled, density at 293.15K = 0.7932.

(4) Water. Distilled.

ESTIMATED ERROR:

$\delta L/L = \pm 0.01$ (authors)

REFERENCES:

COMPONENTS

(1) Oxygen; O_2; [7782-44-7]

(2) Potassium hydroxide; KOH; [1310-58-3]

(3) Methanol; CH_4O; [67-56-1]

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

ORIGINAL MEASUREMENTS

Pospisil, J.; Luzny, Z.
Czech. Chem. Comm. 1960, *25*, 589-92.

EXPERIMENTAL VALUES: continued

SOLVENT COMPOSITION

CH_3OH wt %	H_2O wt %	KOH added mol dm^{-3}	Bunsen Coefficient $\alpha/cm^3(STP)cm^{-3}atm^{-1}$	Ostwald Coefficient L
67.5	32.5	0.0	0.2158	0.2316
		0.179	0.2050	0.2200
		0.893	0.1820	0.1953
		1.786	0.1704	0.1829
		3.571	0.1599	0.1716
		5.357	0.1551	0.1664
100	0	0.0	0.2359	0.2532
		0.179	0.2258	0.2423

The Ostwald coefficients were calculated by the compiler as were the solvent compositions, using density data given in the paper, by reference to *International Critical Tables*, 1928 Vol. *III*, p 115-116 .

COMPONENTS:	EVALUATOR:
(1) Oxygen; O_2; [7782-44-7] (2) Water; H_2O; [7732-18-5] (3) Polar organic compounds	R.W. Cargill Department of Molecular & Life Sciences Dundee College of Technology Bell Street, Dundee December 1980

CRITICAL EVALUATION:

The solubility of oxygen in mixtures of water with polar organic compounds has been measured in several laboratories. As is usual different solubility units are employed by different workers, which sometimes makes it difficult to compare their results. However, a comparative study has been made where possible and some reliable conclusions have been drawn.

Most of the papers report only the solubility data and tabulate the variables carefully. Some authors (1, 8, 9), however, also attempt to explain the variation in solubility caused by different parameters and relate their studies to current models of the structure of water. In one case (1) thermodynamic functions of the solubility process were also calculated and are presented graphically in the original paper.

Each of the mixed solvent systems is described below, along with relevant comments and an evaluation. Much more work is necessary on most of these systems, however, before complete confidence may be placed in the results.

First of all it is worth mentioning the work which was done by Mejane *et al.*(5) and by Enders *et al.*(2) on the solubility of oxygen in various aqueous alcohol mixtures (including drinks), and also the work by Joslyn and Supplee (3) on its solubility in aqueous sugar solutions. These measurements, however, were not sufficiently accurate nor were the variables properly controlled to make the results useful for scientific purposes. Of more quantitative use are the data on the following systems.

1. Oxygen + water + methanol

Pospisil and Luzny (6) in 1960 determined the solubility of oxygen at 293.15 K in water + methanol mixtures of five different compositions. Tokunaga (9) also studied this system in 1975 and gave data for several different solvent compositions between 0.0 and 1.0 mole fraction of methanol, at 273.15 K, 293.15 K, and 313.15 K. The data from both laboratories agree well for the pure water and pure methanol solvents at the common temperature of 293.15 K, but the three values given by Pospisil and Luzny for intermediate compositions are very high compared with Tokunaga's which are more numerous and conform to the pattern expected for this system. A data sheet has been prepared for Tokunaga's work and the results may be accepted tentatively. Pospisil and Luzny's results are given in the system oxygen + water + methanol + potassium hydroxide referred to later, even though they are in some doubt.

2. Oxygen + water + ethanol

This system has been studied more than any other of this type. The experimental work which was reported in 1968 by Shchukarev and Tolmacheva (8) was done in 1939-1941. The whole range of solvent composition was covered at four temperatures between 273.15 K and 323.15 K. Kretschmer *et al.* (4) in 1946 reported the solubility of oxygen in a 95% ethanol-water mixture at four temperatures between 248.15 K and 323.15 K. Tokunaga's work (9) reported in 1975 again covers the whole range of solvent composition at temperatures of 273.15 K, 293.15 K, and 313.15K, as does Cargill's (1) in 1976 for several temperatures in the wider range of 276-335 K.

continued on following page

COMPONENTS:	EVALUATOR:
(1) Oxygen; O_2; [7782-44-7] (2) Water; H_2O; [7732-18-5] (3) Polar organic compounds	R.W. Cargill Department of Molecular & Life Sciences Dundee College of Technology Bell Street, Dundee December 1980

CRITICAL EVALUATION: continued

In order to compare the results of these investigations it was necessary to convert the units in Cargill's work from S_o ($cm^3\ kg^{-1}$) to L (the Ostwald coefficient) used by the other workers. The converstion formula is

$$L = S_o \times \rho_t \times \frac{T}{273.15} \times 10^{-3}$$

The table below gives selected values of L from Cargill's work.

Mol fraction of ethanol x_3	Ostwald coefficient x 10^3 at 293.15 K	313.15 K
0	33.1	26.4
0.008	33.3	26.7
0.032	34.4	28.0
0.063	33.9	29.1
0.097	33.3	30.6
0.120	33.3	32.3
0.162	35.9	37.8
0.229	45.6	49.0
0.493	104	112
0.780	174	183
0.992	232	242

There is good agreement between the sets of data except in the following cases:

(a) Shchukarev and Tolmacheva's results are 20-40% lower than those of the other workers, at the higher temperature of 323.15 K and where $x_3 > 0.4$, and should therefore be regarded as in error for that temperature only. This is confirmed by the unusual temperature effect which the authors themselves reported.

(b) Tokunaga's results are generally 2-3% higher than those of Cargill and of Shchukarev and Tolmacheva over their common temperature range, but where $x_3 < 0.15$, his results are up to 20% higher and some data points show a scatter. It is felt that the work of these other authors is more reliable in that concentration range.

Thus data sheets have been prepared for each set of results, and these may be accepted tentatively, bearing in mind the criticisms in paragraphs (a) and (b) above. The units which the authors themselves used are employed in these data sheets, and this may be a help to different readers who have different uses for the data.

3. Oxygen + water + 1-propanol, and

4. Oxygen + water + 2-propanol

Tokunaga (9) has reported the solubility of oxygen in mixtures of water + 1-propanol, and water + 2-propanol, for mol fraction x_3 0.00 to 1.00 and at temperatures of 273.15K, 293.15K, and 313.15K. A data sheet has been prepared for each system.

continued on following page

COMPONENTS:	EVALUATOR:
(1) Oxygen; O_2; [7782-44-7] (2) Water; H_2O; [7732-18-5] (3) Polar organic compounds.	R.W. Cargill Department of Molecular & Life Sciences Dundee College of Technology Bell Street, Dundee December 1980

CRITICAL EVALUATION: continued

5. Oxygen + water + 2-methyl-2-propanol

Cargill's work (1) on this system covers it in detail over the whole concentration range and between 276 K and 335 K. See the data sheets.

6. Oxygen + water + methanol + potassium hydroxide

Pospisil and Luzny (6) measured the solubility of oxygen in a wide range of mixtures of water, methanol, and potassium hydroxide at 293.15 K. Since some uncertainty exists about the accuracy of some of the data (see system 1 above) they are given as doubtful on a data sheet.

The only other reported measurements of the solubility of oxygen in aqueous alcohol mixtures are those by Schläpfer *et al.*(7). At the temperature of 303.15 K the solubility of oxygen was measured in mixtures of water with methanol, ethanol, 1-propanol, 2-propanol, 1-butanol, ethylene glycol, and glycerol over the whole range of solvent composition. These solubilities were given with an accuracy of 2.5% and were presented graphically. Therefore no data sheets were prepared for them.

REFERENCES

1. Cargill, R.W. *J. Chem. Soc. Faraday Trans. I* 1976, *72*, 2296.
2. Enders, C.; Kleber, W.; Paukner, E. *Brauwissenschaft* 1956, *2*, 50.
3. Joslyn, M.A.; Supplee, H. *Food Res.* 1949, *14*, 209.
4. Kretschner, C.B.; Nowakowska, J.; Wiebe, R. *Ind. Eng. Chem.* 1946, *38*, 506.
5. Mejane, J.V.; Debailleul, M.; Lecerf, J. *Ind. Aliment Agr.* 1974, *90*, 719.
6. Pospisil, J.; Luzny, Z. *Czech. Chem. Comm.* 1960, *25*, 589.
7. Schläpfer, P.; Audykowski, T.; Bukowiecki, A. *Schweiz Arch. Angew. Wiss. Tech.* 1949, *15*, 299.
8. Shchukarev, S.A.; Tolmacheva, T.A. *Zh. Strukt. Khim.* 1968, *9*, 21 (or *J. Struct. Chem.* 1968, *9*, 16)
9. Tokunaga, J. *J. Chem. Eng. Data.* 1975, *20*, 41.

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Methanol; CH_4O; [67-56-1]

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

ORIGINAL MEASUREMENTS:

Tokunaga, J.

J. Chem. Eng. Data, 1975, *20*, 41-6.

VARIABLES:

T/K = 273-313
Composition

PREPARED BY:

C.L.Young, R.W. Cargill

EXPERIMENTAL VALUES:

T/K	Mole fraction of alcohol, x_{CH_4O}	Ostwald coefficient*, L	Henry's Constant /atm	Mole fraction of oxygen in liquid**, x_{O_2}
273.15	0.0000	0.0490	25400	0.0000394
	0.0150	0.0511	24000	0.0000417
	0.0612	0.0535	21800	0.0000459
	0.1051	0.0526	21300	0.0000469
	0.1423	0.0503	21600	0.0000463
	0.1978	0.0488	21200	0.0000472
	0.3068	0.0533	17700	0.0000565
	0.3813	0.0606	14700	0.0000680
	0.5057	0.0777	10300	0.0000971
	0.6328	0.104	7030	0.000142
	0.8097	0.154	4200	0.000238
	1.0000	0.237	2390	0.000418
293.15	0.0000	0.0347	38400	0.0000260
	0.0188	0.0384	34000	0.0000294
	0.0492	0.0435	29100	0.0000344
	0.0907	0.0472	25700	0.0000389
	0.1103	0.0449	26600	0.0000376
	0.1564	0.0411	27800	0.0000360
	0.2066	0.0418	26100	0.0000383
	0.3054	0.0540	18500	0.0000541
	0.3976	0.0689	13400	0.0000746
	0.4895	0.0859	9990	0.000100
	0.5927	0.112	7050	0.000143
	0.7046	0.144	5050	0.000198

AUXILIARY INFORMATION

METHOD /APPARATUS/PROCEDURE:

Volumetric apparatus with multibulb buret and magnetic stirrer. Amount of solution and gas absorbed determined volumetrically. Partial pressure determined from total pressure and vapor pressure of solvent solution. Details in source.

SOURCE AND PURITY OF MATERIALS:

(1) High purity grade sample, purity 99.9 mole per cent.

(2,3) Guaranteed reagent, further purified by distillation. Solution degassed by boiling.

ESTIMATED ERROR:

$\delta T/K = \pm 0.5$; $\delta x_{O_2} = \pm 1\text{-}2\%$.

REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Oxygen; O_2; [7782-44-7] (2) Methanol; CH_4O; [67-56-1] (3) Water; H_2O; [7732-18-5]	Tokunaga, J. *J. Chem. Eng. Data.* 1975, *20*, 41-6.

EXPERIMENTAL VALUES:

T/K	Mole fraction of of alcohol, x_{CH_4O}	Ostwald coefficient*, L	Henry's Constant /atm	Mole fraction of oxygen in liquid**, x_{O_2}
293.15	0.8041	0.173	3930	0.000254
	0.8923	0.205	3120	0.000321
	0.9426	0.221	2790	0.000358
	1.0000	0.246	2400	0.000417
313.15	0.0000	0.0272	50700	0.0000197
	0.0569	0.0358	37200	0.0000269
	0.0972	0.0328	39000	0.0000256
	0.2106	0.0428	26800	0.0000373
	0.2974	0.0577	18400	0.0000543
	0.4357	0.0820	11500	0.0000870
	0.5052	0.0962	9240	0.000108
	0.5848	0.116	7170	0.000139
	0.7009	0.148	5180	0.000193
	0.8010	0.182	3900	0.000256
	0.8905	0.213	3140	0.000318
	1.0000	0.255	2440	0.000410

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* at 1.01325×10^5 Pa partial pressure

** at 1.01325×10^5 Pa partial pressure

(calculated from the reciprocal of Henry's Constant)

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Ethanol; C_2H_6O; [64-17-5]

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

ORIGINAL MEASUREMENTS:

Shchukarev, S.A.; Tolmacheva, T.A.

Zh. Strukt. Khim. 1968, 9, 21-8;
J. Struct. Chem. 1968, 9, 16-21.

VARIABLES:
T/K = 277 - 323
P/kPa = 101.325
Composition = 0 - 100%

PREPARED BY:

R. Battino; P. L. Long; R.W. Cargill

EXPERIMENTAL VALUES:

T/K[a] = 277.15		T/K = 285.15		T/K = 298.15		T/K = 323.15	
Mole Fraction Water[b]	Ostwald Coeff. L	Mole Fraction Water	Ostwald Coeff. L	Mole Fraction Water	Ostwald Coeff. L	Mole Fraction Water	Ostwald Coeff. L
1	0.0451	1	0.0381	1	0.0310	1	0.0238
0.978	0.0476	0.973	0.0392	0.980	0.0326	0.969	0.0240
0.956	0.0462	0.952	0.0417	0.973	0.0326	0.890	0.0245
0.936	0.0441	0.923	0.0394	0.947	0.0325	0.864	0.0270
0.928	0.0432	0.900	0.0358	0.909	0.0323	0.860	0.0272
0.891	0.0385	0.870	0.0356	0.904	0.0322	0.785	0.0391
0.854	0.0384	0.843	0.0362	0.894	0.0321	0.750	0.044
0.830	0.0379	0.700	0.0570	0.875	0.0338	0.616	0.069
0.818	0.0386	0.539	0.0949	0.811	0.0403	0.476	0.0935
0.492	0.105	0.275	0.156	0.683	0.0629	0.262	0.131
0.158	0.136	0.158	0.185	0.525	0.0980	0.140	0.154
0.008	0.233	0.149	0.184	0.289	0.152	0.141	0.154
		0.004	0.231	0.134	0.189	0.139	0.153
		0.002	0.232	0.120	0.193	0.002	0.180
				0.049	0.208	0.002	0.180
				0.049	0.208	0.001	0.182
				0.029	0.221		
				0.002	0.283		

[a] Temperature reported to 1°C, but as integer values, i.e., 4, 12, 25, 50°C.

[b] Mole fraction ethanol = 1 - mole fraction water.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Degassed water is transferred to an absorption vessel. The water is sealed over mercury. Gas is added and stirring accomplished with a magnetic bob. Uptake of gas is read on buret system which is thermostatted along with the absorption vessel. Details of operation and a drawing are in the original paper.

SOURCE AND PURITY OF MATERIALS:

(1) Prepared by electrolysis of NaOH solution, followed by removal of hydrogen traces, and thoroughly dried before use. No purity given.
(2) Dried to at least 99.7% for solubility in pure ethanol; for all others, alcohol was redistilled twice and diluted with distilled water.
(3) Distilled

ESTIMATED ERROR:

$\delta L/L = \pm 0.01$, estimate by compiler.

$\delta x/x = \pm 0.002$, estimate by compiler.

REFERENCES:

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Ethanol; C_2H_6O; [64-17-5]

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

ORIGINAL MEASUREMENTS:

Mejane, J. V.; Debailleul, M.; Lecerf, J.

Ind. Aliment. Agr. 1974, *90*, 719-27.
Chem. Abstr. 1974, *80*, 119192f.

VARIABLES:

T/K = 273-383
Composition

PREPARED BY:

R. Battino

EXPERIMENTAL VALUES:

Degre alcoolique °G.L.	$[O_2]^a$/ mg dm^{-3}	Degre alcoolique °G.L.	$[O_2]$/ mg dm^{-3}
0	9.17	60	13.3
5	8.5	65	15.5
10	8.8	70	18.3
15	7.9	75	22.6
20	7.8	80	27.6
25	7.9	85	33.8
30	7.8	90	41.0
35	7.9	95	48.7
40	8.4	96	52.0
45	8.8	98	56.3
50	10.0	100	61.9
55	11.9		

[a] Oxygen solubility at a partial gas pressure of 158 mm Hg (21.1 kPa).

continued on following page

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The various alcohol solutions were saturated with air and the oxygen solubility determined polarographically for P_{O_2} = 158 mm Hg.

SOURCE AND PURITY OF MATERIALS:

(1) No details given

(2) "surfin"

(3)

ESTIMATED ERROR:

δ°G.L. = ± 0.1
δT/K = ± 0.1
$\delta[O_2]$ = ±3%, Compiler's estimate

REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Oxygen; O_2; [7782-44-7] (2) Ethanol; C_2H_6O; [64-17-5] (3) Water; H_2O; [7732-18-5]	Mejane, J. V.; Debailleul, M.; Lecerf, J. *Ind. Aliment. Agr.* <u>1974</u>, *90*, 719-27. *Chem. Abstr.* <u>1974</u>, *80*, 119192f.

continued

t/°C \ °G.L.	10	20	30	40	50	60	70	80	90	100
0	12.6	11.7	11.1	11.9	14.2	17.6	21.4	30.1	44.8	65.0
5	11.3	10.6	10.1	10.8	12.6	16.0	20.8	29.7	44.2	64.6
10	10.1	9.6	9.2	9.7	11.2	14.6	20.1	29.3	43.5	64.1
15	9.2	8.9	8.6	9.0	10.5	13.9	19.3	28.8	42.8	63.0
20	8.3	8.1	8.0	8.4	10.0	13.3	18.5	27.9	40.9	61.2
25	7.7	7.5	7.4	7.8	9.4	12.4	17.4	25.9	38.1	56.1
30	7.2	7.1	7.0	7.3	8.9	11.5	16.4	23.9	35.0	51.8
35	6.9	6.8	6.7	7.0	8.3	10.3	14.6	21.2	30.5	44.2
40	6.6	6.6	6.4	6.8	7.7	9.3	12.8	18.6	26.5	39.0
45	6.1	6.1	6.1	6.5	7.5	9.3	12.8	18.1	25.5	37.6
50	5.5	5.6	5.8	6.2	7.3	9.3	13.0	17.9	25.0	36.6
55	5.1	5.2	5.2	5.5	6.8	9.0	12.4	16.7	23.1	34.4
60	4.7	4.7	4.7	4.9	6.4	8.7	11.6	15.1	20.6	29.8
65	4.3	4.3	4.2	4.3	5.8	7.9	10.6	13.7	18.4	26.1
70	3.8	3.7	3.5	3.6	5.1	7.1	9.2	11.8	15.4	22.2
75	3.0	2.8	2.4	2.5	3.3	4.2	5.0	6.1	7.6	9.9
80	2.2	1.7	1.2	1.2	1.2	0.9	0.6	0	0	0
85	1.3	0.7	0.1	0	0	0	0	0	0	0
90	0.4	0	0	0	0	0	0	0	0	0

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[a] Smoothed values of oxygen solubility in mg dm^{-3} at a partial pressure of 158mm Hg (21.1 kPa).

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Ethanol; C_2H_6O; [64-17-5]

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

ORIGINAL MEASUREMENTS:

Tokunaga, J.

J. Chem.Eng. Data 1975, *20*, 41-6.

VARIABLES:

T/K = 273-313
Composition

PREPARED BY:

C.L. Young; R.W. Cargill

EXPERIMENTAL VALUES:

T/K	Mole fraction of alcohol, $x_{C_2H_6O}$	Ostwald coefficient*, L	Henry's Constant /atm	Mole fraction of oxygen in liquid, ** x_{O_2}
273.15	0.0000	0.0490	25400	0.0000394
	0.0056	0.0485	25400	0.0000394
	0.0089	0.0512	23900	0.0000418
	0.0176	0.0487	24700	0.0000405
	0.0353	0.0489	23800	0.0000420
	0.0552	0.0467	24100	0.0000415
	0.0715	0.0444	24700	0.0000405
	0.1065	0.0403	25800	0.0000388
	0.1376	0.0372	26600	0.0000376
	0.1762	0.0364	25700	0.0000389
	0.2384	0.0437	19500	0.0000513
	0.3646	0.0689	10500	0.0000952
	0.4350	0.0912	7260	0.000138
	0.5464	0.111	5290	0.000189
	0.6676	0.142	3650	0.000274
	0.8981	0.206	2060	0.000485
	1.0000	0.238	1660	0.000602
293.15	0.0000	0.0347	38400	0.0000260
	0.0810	0.0420	27400	0.0000365
	0.1058	0.0409	27000	0.0000370
	0.2057	0.0456	20800	0.0000481
	0.3085	0.0663	12400	0.0000806
	0.4052	0.0890	8100	0.000123

AUXILIARY INFORMATION

METHOD /APPARATUS/PROCEDURE:

Volumetric apparatus with multibulb buret and magnetic stirrer. Amount of solution and gas absorbed determined volumetrically. Partial pressure determined from total pressure and vapor pressure of solvent solution. Details in source.

SOURCE AND PURITY OF MATERIALS:

(1) High purity grade sample, purity 99.9 mole per cent.

(2,3) Guaranteed reagent, further purified by distillation. Solution degassed by boiling.

ESTIMATED ERROR:

$\delta T/K = \pm 0.5$; $\delta x_{O_2} = \pm 1\text{-}2\%$.

REFERENCES:

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Ethanol; C_2H_6O; [64-17-5]

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

ORIGINAL MEASUREMENTS:

Tokunaga, J.

J. Chem. Eng. Data 1975, *20*, 46-6.

EXPERIMENTAL VALUES:

continued

T/K	Mole fraction of alcohol, $x_{C_2H_6O}$	Ostwald coefficient*, L	Henry's Constant /atm	Mole fraction of oxygen in liquid,** x_{O_2}
293.15	0.5280	0.118	5320	0.000188
	0.5978	0.137	4260	0.000235
	0.7171	0.165	3170	0.000315
	0.8065	0.189	2550	0.000392
	0.9382	0.225	1930	0.000518
	1.0000	0.244	1690	0.000592
313.15	0.0000	0.0272	50700	0.0000197
	0.0158	0.0430	31900	0.0000313
	0.0465	0.0383	33800	0.0000296
	0.1022	0.0366	32100	0.0000312
	0.2014	0.0483	20700	0.0000483
	0.3063	0.0675	12900	0.0000775
	0.3924	0.0885	8700	0.000115
	0.4940	0.114	5980	0.000167
	0.5817	0.137	4540	0.000220
	0.6915	0.163	3420	0.000292
	0.7984	0.193	2630	0.000380
	0.8723	0.213	2240	0.000446
	0.9317	0.230	1980	0.000505
	1.0000	0.247	1760	0.000568

* at 1.01325×10^5 Pa partial pressure

** at 1.01325×10^5 Pa partial pressure (calculated from the reciprocal of Henry's Constant).

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Ethanol; C_2H_6O; [64-17-5]

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

ORIGINAL MEASUREMENTS:

Cargill, R.W.

J. Chem. Soc., Faraday Trans. I 1976, 72, 2296-2300.

VARIABLES:

T/K = 277.3 - 334.4

P/kPa = 101.325

Concentration

PREPARED BY:

R.W.Cargill

EXPERIMENTAL VALUES:

Mol Fraction Ethanol	T/K	S_0/cm^3kg^{-1}	$\log(S_0/cm^3kg^{-1})$
0.78	277.7	194	2.287
0.78	294.3	198	2.296
0.78	314.2	200	2.301
0.78	331.9	202	2.306
0.99	278.9	269	2.430
0.99	294.8	274	2.437
0.99	313.3	274	2.438
0.99	330.8	275	2.439

continued on following page

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

METHOD: Absorption of gas by a thin film of liquid. The Morrison and Billett (1) method was modified by replacing valve A with a constant flow pump, and by measuring the mass of the solvent leaving the absorption tube (instead of the volume) on a top-pan balance.

APPARATUS/PROCEDURE: The solvent is degassed using the vapor pump principle (1). Each determination absorbs about 20 cm^3 of gas in up to 500 cm^3 of solvent, which was recycled. The density of the solvent was checked after each run, so that the exact composition of the solution could be determined (2).

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. British Oxygen Co. Gas 99.5 per cent pure, stored over saturated brine.

(2) Ethanol. Absolute Alcohol.

(3) Water. Distilled then deionized.

ESTIMATED ERROR:

$\delta T/K = 0.1$

$\delta P/mmHg = 0.5$

Solubility values reproducible within 0.5 per cent (author).

REFERENCES:

1. Morrison, T. J.; Billett, F. *J.Chem.Soc.* 1948, 2033; 1952, 3819
2. International Critical Tables, Volume III, pp 112-118.
3. Morrison, T. J.; Billett, F. *J.Chem.Soc.* 1952, 3819

(1) Oxygen; O_2; [7782-44-7] (2) Ethanol; C_2H_6O; [64-17-5] (3) Water; H_2O; [7732-18-5]	Cargill, R.W. *J. Chem. Soc., Faraday Trans. I* 1976, *72*, 2296-2300.

EXPERIMENTAL VALUES: continued

Mol Fraction Ethanol	T/K	S_o/cm^{3}kg^{-1}	log(S_o/cm^{3}kg^{-1})
0.00	277.0	43.7	1.640
0.00	279.4	41.0	1.613
0.00	283.1	37.4	1.573
0.00	285.7	36.4[a]	1.561
0.00	286.2	35.2	1.547
0.00	286.5	35.6[a]	1.551
0.00	290.4	32.6[a]	1.513
0.00	293.2	30.8	1.489
0.00	294.7	30.1[a]	1.479
0.00	303.1	26.5[a]	1.423
0.00	312.5	23.3[a]	1.368
0.00	322.4	21.1[a]	1.324
0.00	331.6	19.8[a]	1.296
0.00	338.4	19.1[a]	1.279
0.00	345.6	18.3[a]	1.263
0.00	348.0	18.2[a]	1.260
0.008	277.8	43.5	1.638
0.008	285.5	36.1	1.558
0.008	294.9	30.2	1.480
0.008	304.1	26.2	1.419
0.008	313.3	23.1	1.364
0.008	324.2	21.2	1.326
0.008	333.5	20.0	1.301
0.021	277.7	44.5	1.648
0.021	285.1	38.0	1.580
0.021	294.9	31.4	1.497
0.021	305.2	26.9	1.430
0.021	314.3	23.9	1.379
0.021	332.4	21.1	1.325
0.032	279.3	43.2	1.635
0.032	286.0	37.3	1.572
0.032	295.9	31.2	1.494
0.032	304.9	27.5	1.439
0.032	313.8	24.8	1.395
0.032	324.3	22.5	1.353
0.032	334.4	21.3	1.329
0.063	277.3	43.0	1.633
0.063	285.4	37.1	1.569
0.063	295.3	31.5	1.498
0.063	306.2	27.2	1.435
0.063	313.3	26.2	1.418
0.063	330.3	24.5	1.389

continued on following page

(1) Oxygen; O_2; [7782-44-7]
(2) Ethanol; C_2H_6O; [64-17-5]
(3) Water· H_2O; [7732-18-5]

Cargill, R.W

J. Chem. Soc., Faraday Trans. I 1976
72, 2296-2300.

EXPERIMENTAL VALUES: continued

Mol Fraction Ethanol	T/K	S_o/cm^3kg^{-1}	$\log(S_o/cm^3kg^{-1})$
0.097	278.7	38.6	1.586
0.097	280.8	37.0	1.568
0.097	286.2	34.8	1.542
0.097	293.3	31.8	1.502
0.097	304.2	29.4	1.468
0.097	313.4	27.8	1.444
0.097	324.7	26.7	1.427
0.097	333.9	26.4	1.422
0.12	277.7	37.0	1.568
0.12	285.5	34.3	1.535
0.12	297.3	31.3	1.496
0.12	319.5	29.4	1.469
0.12	332.9	29.5	1.470
0.16	277.6	36.6	1.564
0.16	288.6	35.5	1.550
0.16	308.8	34.7	1.540
0.16	331.9	37.0	1.568
0.23	277.7	45.7	1.660
0.23	294.3	45.8	1.661
0.23	314.3	46.2	1.665
0.23	322.5	48.0	1.681
0.23	333.4	49.2	1.692
0.31	277.8	67.5	1.829
0.31	283.5	67.3	1.828
0.31	298.1	69.0	1.839
0.31	318.3	71.3	1.853
0.49	277.7	110	2.041
0.49	295.3	111	2.044
0.49	314.8	116	2.063
0.49	333.1	121	2.081

[a] Values from reference 3. The solubility, S_o, calculated as cm^3 gas at 273.15 K and O_2 partial pressure of 101.325 kPa (1 atm) per kg of solvent. In the critical evaluation of this system some of these data have been converted to Ostwald coefficients.

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) 1-Propanol; C_3H_8O; [71-23-8]

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

ORIGINAL MEASUREMENTS:

Tokunaga, J.

J. Chem. Eng. Data. 1975, *20*, 41-6.

VARIABLES:

T/K = 273-313
Composition

PREPARED BY:

C.L. Young; R.W. Cargill

EXPERIMENTAL VALUES:

T/K	Mole fraction of alcohol, $x_{C_3H_8O}$	Ostwald coefficient,* L	Henry's Constant /atm	Mole fraction of oxygen in liquid,** x_{O_2}
273.15	0.0000	0.0490	25400	0.0000394
	0.0240	0.0507	23000	0.0000435
	0.0477	0.0446	24700	0.0000405
	0.0719	0.0411	25400	0.0000394
	0.1007	0.0417	23400	0.0000427
	0.1248	0.0454	20300	0.0000493
	0.1982	0.0647	12300	0.0000813
	0.2852	0.0840	8090	0.000124
	0.4223	0.106	5190	0.000193
	0.6208	0.154	2830	0.000353
	0.7842	0.173	2130	0.000469
	0.8784	0.187	1810	0.000552
	1.0000	0.209	1480	0.000676
293.15	0.0000	0.0347	38400	0.0000260
	0.0230	0.0370	33800	0.0000296
	0.0432	0.0353	33700	0.0000297
	0.0847	0.0401	26800	0.0000373
	0.1057	0.0446	22900	0.0000437
	0.2050	0.0703	11800	0.0000847
	0.3133	0.0970	7060	0.000142
	0.4175	0.119	4910	0.000204
	0.5103	0.138	3760	0.000266
	0.6020	0.152	3080	0.000325
	0.6953	0.169	2500	0.000400

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Volumetric apparatus with multibulb buret and magnetic stirrer. Amount of solution and gas absorbed determined volumetrically. Partial pressure determined from total pressure and vapor pressure of solvent solution. Details in source.

SOURCE AND PURITY OF MATERIALS:

(1) High purity grade sample, purity 99.9 mole per cent.

(2,3) Guaranteed reagent, further purified by distillation. Solution degassed by boiling.

ESTIMATED ERROR:

$\delta T/K = \pm 0.5$; $\delta x_{O_2} = \pm 1\text{-}2\%$.

REFERENCES:

COMPONENTS :	ORIGINAL MEASUREMENTS :
(1) Oxygen; O_2; [7782-44-7]	Tokunaga, J.
(2) 1-Propanol; C_3H_8O; [71-23-8]	*J. Chem. Eng. Data.* 1975, *20*, 41-6.
(3) Water; H_2O; [7732-18-5]	

EXPERIMENTAL VALUES :

T/K	Mole fraction of alcohol, $x_{C_3H_8O}$	Ostwald coefficient,* L	Henry's Constant /atm	Mole fraction of oxygen in liquid,** x_{O_2}
293.15	0.7987	0.184	2080	0.000481
	0.9085	0.202	1710	0.000585
	1.0000	0.221	1450	0.000690
313.15	0.0000	0.0272	50700	0.0000197
	0.0225	0.0305	42300	0.0000236
	0.0428	0.0265	46100	0.0000217
	0.0657	0.0294	39200	0.0000255
	0.0834	0.0347	32700	0.0000306
	0.1043	0.0393	27500	0.0000364
	0.2044	0.0707	12000	0.0000833
	0.3034	0.0983	7180	0.000139
	0.4033	0.122	4990	0.000200
	0.5056	0.142	3740	0.000267
	0.6063	0.159	2950	0.000339
	0.6972	0.173	2470	0.000405
	0.8010	0.188	2060	0.000485
	0.8955	0.205	1730	0.000578
	1.0000	0.226	1440	0.000694

* at 1.01325×10^5 Pa partial pressure

** at 1.01325×10^5 Pa partial pressure (calculated from the reciprocal of Henry's Constant).

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

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

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

ORIGINAL MEASUREMENTS:

Tokunaga, J.

J. Chem. Eng. Data, 1975, *20*, 41-6.

VARIABLES:

T/K = 273-313
Composition

PREPARED BY:

C.L. Young; R.W. Cargill

EXPERIMENTAL VALUES:

T/K	Mole fraction of alcohol, $x_{C_3H_8O}$	Ostwald coefficient* L	Henry's Constant /atm	Mole fraction of oxygen in liquid,** x_{O_2}
273.15	0.0000	0.0490	25400	0.0000394
	0.0096	0.0495	24500	0.0000408
	0.0168	0.0491	24200	0.0000413
	0.0467	0.0430	25600	0.0000391
	0.0851	0.0352	28700	0.0000348
	0.1116	0.0329	29000	0.0000345
	0.1602	0.0431	19900	0.0000503
	0.2779	0.0751	9130	0.000110
	0.3591	0.102	5900	0.000169
	0.4838	0.126	4000	0.000250
	0.5417	0.142	3310	0.000302
	0.6902	0.173	2300	0.000435
	0.7936	0.197	1820	0.000549
	1.0000	0.231	1300	0.000769
293.15	0.0000	0.0347	38400	0.0000260
	0.0220	0.0392	32000	0.0000313
	0.0408	0.0346	34600	0.0000289
	0.0733	0.0334	33100	0.0000302
	0.0943	0.0346	30400	0.0000329
	0.1994	0.0605	13800	0.0000725
	0.2985	0.0917	7600	0.000132
	0.3920	0.115	5220	0.000192
	0.5950	0.162	2860	0.000350

AUXILIARY INFORMATION

METHOD /APPARATUS/PROCEDURE:

Volumetric apparatus with multibulb buret and magnetic stirrer. Amount of solution and gas absorbed determined volumetrically. Partial pressure determined from total pressure and vapor pressure of solvent solution. Details in source.

SOURCE AND PURITY OF MATERIALS:

(1) High purity grade sample, purity 99.9 mole per cent.

(2,3) Guaranteed reagent, further purified by distillation. Solution degassed by boiling.

ESTIMATED ERROR:

$\delta T/K = \pm 0.5$; $\delta x_{O_2} = \pm 1\text{-}2\%$.

REFERENCES:

COMPONENTS :	ORIGINAL MEASUREMENTS :
(1) Oxygen; O_2; [7782-44-7] (2) 2-Propanol; C_3H_8O; [67-63-0] (3) Water; H_2O; [7732-18-5]	Tokunaga, J. *J. Chem. Eng. Data.* 1975, *20*, 41-6.

EXPERIMENTAL VALUES:

T/K	Mole fraction of alcohol, $x_{C_3H_8O}$	Ostwald coefficient,* L	Henry's Constant /atm	Mole fraction of oxygen in liquid,** x_{O_2}
293.15	0.7836	0.204	1860	0.000538
	1.0000	0.246	1270	0.000787
313.15	0.0000	0.0272	50700	0.0000197
	0.0791	0.0368	31200	0.0000321
	0.0993	0.0390	28000	0.0000357
	0.1496	0.0524	18500	0.0000541
	0.1984	0.0690	12700	0.0000787
	0.3003	0.105	6960	0.000144
	0.3952	0.131	4790	0.000209
	0.5000	0.156	3500	0.000286
	0.5978	0.179	2700	0.000370
	0.6995	0.199	2170	0.000461
	0.7930	0.220	1790	0.000559
	0.8950	0.238	1510	0.000662
	1.0000	0.255	1280	0.000781

* at 1.01325×10^5 Pa partial pressure

** at 1.01325×10^5 Pa partial pressure (calculated from the reciprocal of Henry's Constant).

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

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

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

ORIGINAL MEASUREMENTS:

Müller, C.

Z. Physik. Chem. 1912, *81*, 483-503.

VARIABLES:

$T/K = 285 - 288$

$P/kPa = 101.325$

PREPARED BY:

R. Battino

EXPERIMENTAL VALUES:

T/K[a]	Weight Percentage[b] Glycerol	Ostwald Coeff.[c] 10^2L	Bunsen Coeff.[d] $10^2\alpha$
285.35	20.5	3.034	2.904
285.65	25.	2.775	2.654
287.75	37.3	2.147	2.038
286.65	45.	1.889	1.800
285.55	52.	1.697	1.623
285.25	71.5	1.055	1.010
286.45	88.5	0.950	0.906

[a] Temperature reported to 0.1°C.

[b] 1,2,3-propanetriol.

[c] Ostwald coefficient calculated by compiler.

[d] Bunsen coefficient.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Water is degassed by pumping under vacuum. The absorption vessel is about 600 cm^3 and is separately thermostatted from the buret gas measuring system. Both are connected by a copper capillary tube. Gas uptake is measured on the gas burets. The absorption flask volume and all liquid volumes were calibrated with mercury. The original paper contains details and a drawing of the apparatus. Solubilities were also reported in aqueous solutions of sucrose, d-glucose, and chloral hydrate.

SOURCE AND PURITY OF MATERIALS:

(1) From the heating of $KMnO_4$ and washed in concentrated KOH solution.

(2) 1,2,3-Propanetriol from Merck.

(3) No comment by author.

ESTIMATED ERROR:

$\delta\alpha/\alpha = \pm 0.01$, estimated by compiler.

REFERENCES:

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) 2-Methyl-2-propanol (t-Butanol); $C_4H_{10}O$ [75-65-0]

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

ORIGINAL MEASUREMENTS:

Cargill, R.W.

J. Chem. Soc., Faraday Trans. I 1976, *72*, 2296-2300.

VARIABLES:

T/K = 277.5 - 333.9
p/kPa = 101.325
Concentration

PREPARED BY:

R.W. Cargill

EXPERIMENTAL VALUES:

Mol Fraction Alcohol	T/K	S_o/cm^{3}kg^{-1}	log($S_o$cm^{3}kg^{-1})
0.60	278.4	214	2.331
0.60	294.9	211	2.325
0.60	312.5	218	2.338
0.60	331.4	226	2.354
0.76	280.1	246	2.390
0.76	303.1	243	2.386
0.76	313.6	243	2.386
0.76	328.0	245	2.389
0.93	280.5	266	2.425
0.93	297.8	261	2.417
0.93	313.0	256	2.409

continued on following page

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

METHOD: Absorption of gas by a thin film of liquid. The Morrison and Billett (1) method was modified by replacing valve A with a constant flow pump, and by measuring the mass of the solvent leaving the absorption tube (instead of the volume) on a top-pan balance.

APPARATUS/PROCEDURE: The solvent is degassed using the vapor pump principle (1). Each determination absorbs about 20 cm^3 of gas in up to 500 cm^3 of solvent, which was recycled. The density of the solvent was checked after each run, so that the exact composition of the solution could be determined (2).

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. British Oxygen Co. Gas 99.5 per cent pure, stored over saturated brine.

(2) 2-Methyl-2-propanol. Reagent-grade (98 per cent boils 82-83°C).

(3) Water. Distilled then deionized.

ESTIMATED ERROR:

$\delta T/K = 0.1$
$\delta P/mmHg = 0.5$

Solubility values reproducible within 0.5 per cent (author).

REFERENCES:

1. Morrison, T. J.; Billett, F. *J. Chem. Soc.* 1948, 2033; 1952, 3819

2. International Critical Tables, Volume III, pp 112-118

3. Morrison, T. J; Billet, F. *J. Chem. Soc.* 1952, 3819

(1) Oxygen; O_2; [7782-44-7]
(2) 2-Methyl-2-propanol (t-Butanol); $C_4H_{10}O$; [75-65-0]
(3) Water; H_2O; [7732-18-5]

Cargill, R. W.
J. Chem. Soc., Faraday Trans. I 1976, *72*, 2296-2300.

EXPERIMENTAL VALUES: continued

Mol Fraction Alcohol	T/K	S_o/cm^{3}kg^{-1}	log($S_o$cm^{3}kg^{-1})
0.00	277.0	43.7	1.640
0.00	279.4	41.0	1.613
0.00	283.1	37.4	1.573
0.00	285.7	36.4[a]	1.561
0.00	286.2	35.2	1.547
0.00	286.5	35.6[a]	1.551
0.00	290.4	32.6[a]	1.513
0.00	293.2	30.8	1.489
0.00	294.7	30.1[a]	1.479
0.00	303.1	26.5[a]	1.423
0.00	312.5	23.3[a]	1.368
0.00	322.4	21.1[a]	1.324
0.00	331.6	19.8[a]	1.296
0.00	338.4	19.1[a]	1.279
0.00	345.6	18.3[a]	1.263
0.00	348.0	18.2[a]	1.260
0.006	277.7	42.8	1.631
0.006	285.5	35.8	1.554
0.006	292.8	31.3	1.495
0.006	296.5	28.8	1.459
0.006	304.2	26.2	1.419
0.006	318.5	22.1	1.344
0.006	332.9	19.8	1.296
0.014	278.0	43.5	1.638
0.014	278.7	42.6	1.629
0.014	285.5	36.6	1.563
0.014	297.0	29.4	1.469
0.014	304.2	26.1	1.417
0.014	308.3	24.7	1.392
0.014	314.4	23.2	1.366
0.014	325.2	21.7	1.336
0.014	333.0	20.5	1.312
0.014	333.4	20.5	1.312
0.022	277.6	42.7	1.630
0.022	285.5	35.3	1.548
0.022	295.9	29.2	1.466
0.022	304.7	26.2	1.418
0.022	314.4	23.4	1.370
0.022	324.7	21.8	1.338
0.022	334.4	20.6	1.313
0.032	278.4	38.9	1.590
0.032	285.5	32.9	1.517
0.032	294.3	29.4	1.469
0.032	305.1	26.1	1.416
0.032	314.3	24.3	1.386
0.032	324.2	23.6	1.373
0.032	333.9	22.4	1.351

continued on following page

(1) Oxygen; O_2; [7782-44-7]

(2) 2-Methyl-2-propanol (t-Butanol); $C_4H_{10}O$; [75-65-0]

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

Cargill, R.W.

J.Chem.Soc., Faraday Trans. I 1976, *72*, 2296-2300.

EXPERIMENTAL VALUES:

Mol Fraction Alochol	T/K	S_o/cm^3kg^{-1}	$Log(S_o cm^3kg^{-1})$
0.044	277.8	35.1	1.545
0.044	285.5	31.9	1.504
0.044	294.8	27.9	1.446
0.044	304.7	26.6	1.424
0.044	314.9	24.7	1.393
0.044	324.7	25.0	1.398
0.044	335.1	25.1	1.399
0.062	283.5	29.5	1.470
0.062	296.9	28.8	1.460
0.062	310.8	29.3	1.467
0.062	327.5	30.4	1.483
0.093	277.8	37.6	1.575
0.093	287.9	38.7	1.588
0.093	310.4	41.1	1.614
0.093	321.7	42.7	1.630
0.093	333.5	43.5	1.638
0.15	285.8	62.4	1.795
0.15	298.0	63.8	1.805
0.15	313.0	65.8	1.818
0.15	332.7	70.3	1.847
0.18	277.7	70.8	1.850
0.18	288.1	72.4	1.860
0.18	299.6	73.1	1.864
0.18	310.6	76.2	1.882
0.18	321.4	76.2	1.882
0.18	333.6	80.2	1.904
0.25	284.4	96.8	1.986
0.25	303.6	101	2.006
0.25	323.7	107	2.029
0.31	277.8	122	2.087
0.31	295.3	129	2.111
0.31	313.8	130	2.113
0.31	333.4	133	2.124
0.44	279.2	167	2.222
0.44	287.6	169	2.229
0.44	297.6	169	2.227
0.44	308.0	172	2.236
0.44	319.5	173	2.237
0.44	331.1	177	2.247

[a] Values from reference 3. The solubility, S_O, calculated as cm^3 gas at 273.15 K and O_2 partial pressure of 101.325 kPa (1 atm) per kg of solvent.

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) 2,2,2-Trichloro-1,1-ethanediol (Chloral hydrate); [302-17-0]

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

ORIGINAL MEASUREMENTS:

Müller, C.

Z. Physik. Chem. <u>1912</u>, *81*, 483-503.

VARIABLES:

T/K = 286 - 291

P/kPa = 101.325

PREPARED BY:

R. Battino

EXPERIMENTAL VALUES:

T/K[a]	Weight Percentage Chloral hydrate[b]	Ostwald Coeff.[c] 10^2L	Bunsen Coeff.[d] $10^2\alpha$
291.45	22.9	2.944	2.759
290.05	28.	2.856	2.690
288.55	36.6	2.736	2.590
289.75	38.6	2.548	2.402
285.95	51.3	2.553	2.439
289.35	58.44	2.489	2.350
289.05	70.	2.814	2.659
290.35	80.85	3.402	3.200
290.05	80.9	3.334	3.140

[a] Temperature reported to 0.1°C.

[b] 2,2,2-Trichloro-1,1-ethanediol.

[c] Ostwald coefficient calculated by compiler.

[d] Bunsen coefficient.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Water is degassed by pumping under vacuum. The absorption vessel is about 600 cm^3 and is separately thermostatted from the buret gas measuring system. Both are connected by a copper capillary tube. Gas uptake is measured on the gas burets. The absorption flask volume and all liquid volumes were calibrated with mercury. The original paper contains details and a drawing of the apparatus. Solubilities were also reported in aqueous solutions of sucrose, d-glucose, and glycerol.

SOURCE AND PURITY OF MATERIALS:

(1) From the heating of $KMnO_4$ and washed in concentrated KOH solution.

(2) 2,2,2-Trichloro-1,1-ethanediol- from Merck or from Münster.

(3) No comment by author.

ESTIMATED ERROR:

$\delta\alpha/\alpha = \pm 0.01$, estimated by compiler.

REFERENCES:

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Sulfuric acid monododecyl ester sodium salt (Sodium dodecyl sulfate or SDS); $C_{12}H_{26}O_4S.Na$; [151-21-3]

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

ORIGINAL MEASUREMENTS:

Matheson, I. B. C.; King, A. D.

J. Coll. Interface Sci. 1978, *66*, 464-9.

VARIABLES:

T/K = 298.15
P/kPa = 340 - 841
SDS/mol kg^{-1} H_2O = 0 - 0.300

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

T/K	Sulfuric acid monodecyl ester sodium salt mol kg^{-1} H_2O	Pressure pounds per square inch, gauge	Volume gas evolved ml	Ambient Pressure mmHg	Ambient Temperature °C	Henry's constant K x 10^3 mol Ar kg^{-1} H_2O atm^{-1}
298.15	0	49.3	12.5	746.3	25.1	
		71.5	18.0	743.5	25.2	
		74.7	18.6	745.5	24.8	
		108.5	26.2	747.0	24.8	
		122.0	29.7	745.5	25.9	1.41±0.02
	0.100	65.5	16.9	755.3	23.0	
		90.3	22.2	751.1	23.3	
		121.0	30.5	756.7	22.0	1.47±0.03
	0.200	52.2	14.9	741.7	22.6	
		69.0	19.4	741.0	23.1	
		91.0	25.0	743.2	22.9	1.61±0.02
	0.300	56.6	16.5	754.0	22.4	
		66.9	19.4	743.8	22.0	
		86.5	25.2	752.4	21.9	1.70±0.01

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The apparatus consists of a jacketed thermostated thick-walled cylindrical brass bomb which rests on a variable speed magnetic stirrer. An inlet line to the bomb is connected to a gas manifold, and an exit line is connected to a Warburg manometer. Bourden gauges are used to record the pressure.

The solution, consisting of 100 g of water and the colloidal electrolyte, is contained in a glass liner inside of the bomb. The solution is degassed by evacuation to just above water vapor pressure and then stirring for several hours. The gas is introduced over the solution at the desired pressure and the solution is stirred for a minimum of five hours.

The gas is vented to atmospheric pressure. The gas from the supersaturated solution is collected in the Warburg manometer and its volume measured at atmospheric pressure and ambient temperature. Corrections for gas lost during venting and thermal equilibration and for water vapor pressure are made.

The solubility is reported as Henry's constant, K/mol gas kg^{-1} water atm^{-1} = gas molality/pressure, m/p.

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. Source not given. Chemically pure or equivalent of 99.5 mol per cent purity or better.

(2) Sulfuric acid monodecyl ester sodium salt. Aldrich Chemical Co. Inc. Recrystallized from ethanol and dried in vacuo.

(3) Water. Laboratory distilled.

ESTIMATED ERROR:

δK/K = 0.02

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) 2,2,4-Trimethylpentane or iso-octane; C_8H_{18}; [540-84-1]

(3) Ethanol; C_2H_6O; [64-17-5]

ORIGINAL MEASUREMENTS:

Kretschmer, C. B.; Nowakowaska, J.; Wiebe, R.

Ind. Eng. Chem. 1946, *38*, 506-9.

VARIABLES:
T/K = 273.15 - 323.15
P/kPa = 101.325
Ethanol/vol % = 50

PREPARED BY:

P. L. Long; H.L. Clever; R.W. Cargill

EXPERIMENTAL VALUES:

T/K	Bunsen Coefficient α	Ostwald Coefficient L
273.15	0.3119	0.3119
298.15	0.2898	0.3163
323.15	0.2726	0.3225

The Ostwald coefficients were measured at a total pressure of 101.325 kPa (1 atm). The compiler calculated the Bunsen coefficient value for an oxygen partial pressure of 101.325 kPa (1 atm) assuming the Ostwald coefficient was independent of pressure.

The solvent is 2,2,4-trimethylpentane in ethanol, 50 per cent by volume.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The apparatus was similar to that of Horiuti (1), it consisted of a gas buret, manometer, and absorption pipet equipped with a magnetic stirrer. All volumes were calibrated by mercury displacement.

The solvent was partly degassed by boiling under reflux. About 40 cm^3 of solvent was admitted into the absorption pipet, and pumped on to complete the degassing. Dry gas, measured in the buret, was admitted, final equilibrium was established after 1 to 3 hours stirring. During the solution process the total pressure was kept at one atm by additions of dry gas.

The solubility value was corrected for the increase of solvent volume with gas absorption, and for the nitrogen impurity in the oxygen.

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. Source not given. Contained 0.4 per cent N_2. Passed through Drierite to dry.

(2) 2,2,4-Trimethylpentane. "Certified material," source not given. Dried over $CaSO_4$, distilled, b.p. (760 mmHg)/°C 99.24, density, ρ_4^{25}/g cm^{-3} 0.68774.

(3) Ethanol. Source not given. Dried with Mg. Density, ρ/g cm^{-3} 0.78508.

ESTIMATED ERROR:

Gas buret $\delta V/cm^3 = 0.005$
Average deviation from the mean 0.3%, maximum deviation 0.9% (authors).

REFERENCES:

1. Horiuti, J.
J. Sci Papers Inst. Phys. Chem. Res. (Tokyo) 1931, *17*, 125.

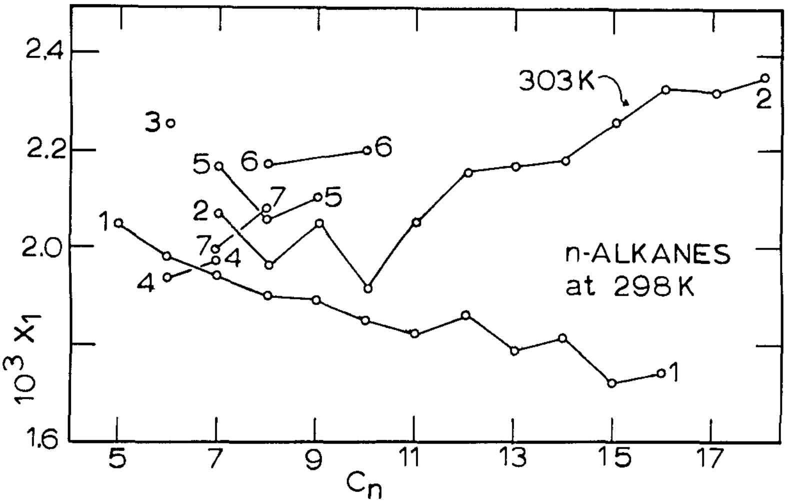
COMPONENTS:	EVALUATOR:
(1) Oxygen; O_2; [7782-44-7] (2) n-Alkanes	Rubin Battino Department of Chemistry Wright State University Dayton, OH 45435 U.S.A.

CRITICAL EVALUATION:

The solubility of oxygen in the n-alkanes has been studied by some seven workers (1-7) with surprisingly poor agreement. This is most striking when examining the figure below. The work of Makranczy, et al. (1) shows a decreasing solubility with increasing carbon number while that of Blance and Batiste (2) shows an increasing solubility. The work of these two groups appears to be of comparable precision. However, a judgment on accuracy must depend on a definitive study of these systems. There does appear to be a general trend for solubilities in even-numbered n-alkanes to be higher than for those in the odd-numbered members.

The solubility of oxygen in 2,2,4-trimethylpentane (isooctane) was measured by four groups (7-10) and the four values at 298.15, respectively, by reference number are: 2.43, 2.814, 2.59 (at 293.15), and 2.529 x 10^{-3} mole fraction solubility at 101.325 kPa partial pressure of gas. The average value is 2.58 x 10^{-3} ±0.17 (σ).

The n-alkanes need to be re-studied.



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COMPONENTS:	EVALUATOR:
(1) Oxygen; O_2; [7782-44-7] (2) n-Alkanes	Rubin Battino Department of Chemistry Wright State University Dayton, OH 45435 U.S.A.

CRITICAL EVALUATION:

continued

References

1. Makranczy, J.; Megyery-Balog, K.; Rusz, L.; Patyi, L. *Hung. J. Ind. Chem.* 1976, *4*, 269-80.
2. Blanc, C.; Batiste, M. *Bull. Cent. Rech. Pan* 1970, *4*, 235-41.
3. Naumenko, N.K. Candidates thesis, 1970, Leningrad.
4. Guerry, D. Ph.D. thesis, 1944, Vanderbilt University.
5. Thomsen, E.S.; Gjaldbaek, J. Chr. *Acta Chem. Scand.* 1963, *17*, 127-33.
6. Wilcock, R.J.; Battino, R.; Danforth, W.E. *J. Chem. Thermodyn.* 1978, *10*, 817-22.
7. Ijams, C.C. Ph.D. thesis, 1941, Vanderbilt University.
8. Kobatake, Y.; Hildebrand, J.H. *J. Phys. Chem.* 1961, *65*, 331-5.
9. Baldwin, R.R.; Daniel, S.G. *J. Appl. Chem. (London)* 1952, *2*, 161-5; *J. Inst. Petrol.* 1953, *39*, 105-24.
10. Kretschmer, C.G.; Nowakowska, J.; Wiebe, R. *Ind. Eng. Chem.* 1946, *38*, 506-9.

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Pentane; C_5H_{12}; [109-66-0]

ORIGINAL MEASUREMENTS:

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

Hung. J. Ind. Chem. 1976, *4*, 269-80.

VARIABLES:

T/K = 298.15 - 313.15

P/kPa = 101.325

PREPARED BY:

S. A. Johnson

H. L. Clever

EXPERIMENTAL VALUES:

T/K	Mol Fraction $X_1 \times 10^3$	Bunsen Coefficient α	Ostwald Coefficient L
298.15	2.05	0.396	0.432
313.15	1.67	0.317	0.362

The mole fraction solubilities and the Bunsen coefficients were calculated by the compiler.

Smoothed Data: $\Delta G^0/J\ mol^{-1} = -RT \ln X_1 = -10{,}610 + 87.050\ T$

The data and the equation are classed as tentative.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

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

SOURCE AND PURITY OF MATERIALS:

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

ESTIMATED ERROR:

$\delta X_1/X_1 = 0.03$

REFERENCES:

1. Bodor, E.; Bor, Gy.; Mohai, B.; Sipos, G. *Veszpremi Vegyip. Egy. Kozl.* 1957, *1*, 55. *Chem. Abstr.* 1961, *55*, 3175h.

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

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

ORIGINAL MEASUREMENTS:

Naumenko, N. K.

Candidates thesis, 1970, Leningrad.

VARIABLES:

$T/K = 298.15$
$P/kPa = 101.325$

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

T/K	Mol Fraction $x_1 \times 10^3$	Bunsen Coefficient α	Ostwald Coefficient L
298.15	2.258	0.385	0.421

The mole fraction solubility value is quoted in (1).

The Bunsen and Ostwald coefficients were calculated by the compiler.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Probably used volumetric method described by Naumenko *et al.* (2).

SOURCE AND PURITY OF MATERIALS:

No information.

ESTIMATED ERROR:

REFERENCES:

1. Chaenko, N. V.; Sukhova, G. I.; Naumenko, N. K.; Kedrinskii, I.A. *Zh. Fiz. Khim.* 1979, *53*, 1989.
2. Naumenko, N. K.; Mukhin, N. N. Aleskovskii, V. B. *Zh. Prikl. Khim.* 1969, *42*, 2090.

COMPONENTS:

(1) Oxygen; O_2 [7782-44-7]

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

ORIGINAL MEASUREMENTS:

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

Hung. J. Ind. Chem. 1976, *4*, 269-80.

VARIABLES:

T/K = 298.15 - 313.15
P/kPa = 101.325

PREPARED BY:

S. A. Johnson
H. L. Clever

EXPERIMENTAL VALUES:

T/K	Mol Fraction $X_1 \times 10^3$	Bunsen Coefficient α	Ostwald Coefficient L
298.15	1.98	0.337	0.368
313.15	1.52	0.254	0.291

The mole fraction solubilities and the Bunsen coefficients were calculated by the compiler.

Smoothed Data: $\Delta G°/J\ mol^{-1} = -RT \ln X_1 = -13{,}682 + 97.645\ T$

See the evaluation of the oxygen + hexane system for the recommended equation.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

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

SOURCE AND PURITY OF MATERIALS:

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

ESTIMATED ERROR:

$\delta X_1/X_1 = 0.03$

REFERENCES:

1. Bodor, E.; Bor, Gy.; Mohai, B.; Sipos, G.
Veszpremi Vegyip. Egy. Kozl. 1957, *1*, 55.
Chem. Abstr. 1961, *55*, 3157h.

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Alkanes; C_6H_{14} and C_7H_{16}

ORIGINAL MEASUREMENTS:

Guerry, D. Jr.

Ph.D. thesis, 1944, Vanderbilt University, Nashville, TN.

VARIABLES:

T/K = 293.15, 298.15
P/kPa = 101.325 (1 atm)

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

T/K	Mol Fraction $x_1 \times 10^4$	Bunsen Coefficient α	Ostwald Coefficient L
Hexane; C_6H_{14}; [110-54-3]			
293.15	19.6	0.337	0.362
298.15	19.3	0.329	0.359
Heptane; C_7H_{16}; [142-82-5]			
293.15	19.8	0.304	0.326
298.15	19.7	0.300	0.327

The Ostwald coefficients were calculated by the compiler.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

A Van Slyke-Neill Manometric Apparatus manufactured by the Eimer and Amend Co. was used.

The procedure of Van Slyke (1) for pure liquids was modified (2) so that small solvent samples (2 cm^3) could be used with almost complete recovery of the sample.

An improved temperature control system was used.

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. Air reduction Co. Purity 99.5 per cent.

(2) Alkanes. Distilled from sodium in air. In addition to the solubility data the thesis contains data of the refractive index, density, vapor pressure, and b.p.

SOURCE AND PURITY OF MATERIALS:

Hexane. Eastman Kodak Co. B.p. (760.3 mmHg) t/°C 68.85 - 68.90.

Heptane. B.p. (753.9 mmHg) t/°C 98.27 - 98.28 (corr.).

ESTIMATED ERROR:

$\delta T/K = 0.05$

REFERENCES:

1. Van Slyke, D. D. *J. Biol. Chem.* 1939, *130*, 545.
2. Ijams, C. C. Ph.D. thesis, 1941 Vanderbilt University

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Oxygen; O_2; [7782-44-7] (2) Heptane; C_7H_{16}; [142-82-5]	Thomsen, E. S.; Gjaldbaek, J. C. *Acta Chem. Scand.* 1963, *17*, 127-33.

VARIABLES:	PREPARED BY:
T/K = 298.15 - 307.95 Total P/kPa = 101.325	E. S. Thomsen

EXPERIMENTAL VALUES:

T/K	Mol Fraction $X_1 \times 10^3$	Bunsen Coefficient α	Ostwald Coefficient L
298.15	2.17	0.330	0.360
298.25	2.15	0.327	0.357
307.95	2.18	0.328	0.370

The mole fraction and Ostwald solubility values were calculated by the compiler.

Smoothed Data: $\Delta G^o/J\ mol^{-1} = -RT \ln X_1 = 705.6 + 48.663\ T$

$\Delta H^o/J\ mol^{-1} = 705.6$, $\Delta S^o/J\ K^{-1}\ mol^{-1} = -48.663$

T/K	Mol Fraction $X_1 \times 10^3$	$\Delta G^o/J\ mol^{-1}$
298.15	2.16	15,215
303.15	2.17	15,458
308.15	2.18	15,701

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

A calibrated all-glass combined manometer and bulb was enclosed in an air thermostat and shaken until equilibrium. Mercury was used for calibration and as the confining liquid. The solvents were degassed in the apparatus. Details are in references 1 and 2.

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

The saturation of the liquid with the gas was carried out close to atmospheric pressure. The solubility values were reported for one atmosphere gas pressure assuming Henry's law is obeyed.

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. Contained 0.2 percent N_2.

(2) Heptane. Merck Co. Distillation range of 0.09 degree.

ESTIMATED ERROR:

$\delta T/K = 0.05$
$\delta X_1/X_1 = 0.015$

REFERENCES:

1. Lannung, A.
J. Am. Chem. Soc. 1930, *52*, 68.

2. Gjaldbaek, J. C.
Acta Chem. Scand. 1952, *6*, 623.

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Heptane; C_7H_{16}; [142-82-5]

ORIGINAL MEASUREMENTS:

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

Hung. J. Ind. Chem. 1976, *4*, 269-80.

VARIABLES:

T/K = 298.15 - 313.15
P/kPa = 101.325

PREPARED BY:

S. A. Johnson
H. L. Clever

EXPERIMENTAL VALUES:

T/K	Mol Fraction $X_1 \times 10^3$	Bunsen Coefficient α	Ostwald Coefficient L
298.15	1.94	0.295	0.322
313.15	1.54	0.230	0.264

The mole fraction solubilities and the Bunsen coefficients were calculated by the compiler.

Smoothed Data: $\Delta G°/J\ mol^{-1} = - RT \ln X_1 = -11{,}950 + 92.003\ T$

See the evaluation of the oxygen + heptane system for the recommended equation.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

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

SOURCE AND PURITY OF MATERIALS:

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

ESTIMATED ERROR:

$\delta X_1/X_1 = 0.03$

REFERENCES:

1. Bodor, E.; Bor, Gy.; Mohai, B.; Sipos, G. *Veszpremi Vegyip. Egy. Kozl.* 1957, *1*, 55. *Chem. Abstr.* 1961, *55*, 3157h.

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

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

ORIGINAL MEASUREMENTS:

Thomsen, E. S.; Gjaldbaek, J. C.

Acta Chem. Scand. 1963, *17*, 127-33.

VARIABLES:

T/K = 298.15 - 308.15

Total P/kPa = 101.325

PREPARED BY:

E. S. Thomsen

EXPERIMENTAL VALUES:

T/K	Mol Fraction $X_1 \times 10^3$	Bunsen Coefficient α	Ostwald Coefficient L
298.15	2.06	0.283	0.309
298.25	2.11	0.290	0.317
308.15	2.08	0.282	0.318

The mole fraction and Ostwald solubility values were calculated by the compiler.

Smoothed Data: $\Delta G^o/J\ mol^{-1} = -RT \ln X_1 = -198.2 + 51.989\ T$

$\Delta H^o/J\ mol^{-1} = -198.2$, $\Delta S^o/J\ K^{-1}\ mol^{-1} = -51.989$

T/K	Mol Fraction $X_1 \times 10^3$	$\Delta G^o/J\ mol^{-1}$
298.15	2.08	15,302
303.15	2.08	15,562
308.15	2.08	15,822

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

A calibrated all-glass combined manometer and bulb was enclosed in an air thermostat and shaken until equilibrium. Mercury was used for calibration and as the confining liquid. The solvents were degassed in the apparatus. Details are in references 1 and 2.

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

The saturation of the liquid with the gas was carried out close to atmospheric pressure. The solubility values were reported for one atmosphere gas pressure assuming Henry's law is obeyed.

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. Contained 0.2 percent N_2.

(2) Octane. British Drug House. Fractionated, distillation range 0.02 K, (a) treated with $H_2SO_4 + HNO_3$, (b) no treatment with acids, (ca. 1 percent impurity).

ESTIMATED ERROR:

$\delta T/K = 0.05$

$\delta X_1/X_1 = 0.015$

REFERENCES:

1. Lannung, A.
J. Am. Chem. Soc. 1930, *52*, 68.

2. Gjaldbaek, J. C.
Acta Chem. Scand. 1952, *6*, 623.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Oxygen; O_2; [7782-44-7] (2) Octane; C_8H_{18}; [111-65-9]	Makranczy, J.; Megyery-Balog, K.; Rusz, L.; Patyi, L. *Hung. J. Ind. Chem.* 1976, *4*, 269-80.
VARIABLES:	PREPARED BY:
T/K = 298.15 - 313.15 P/kPa = 101.325	S. A. Johnson H. L. Clever

EXPERIMENTAL VALUES:

T/K	Mol Fraction $X_1 \times 10^3$	Bunsen Coefficient α	Ostwald Coefficient L
298.15	1.90	0.260	0.284
313.15	1.48	0.200	0.229

The mole fraction solubilities and the Bunsen coefficients were calculated by the compiler.

Smoothed Data: $\Delta G°/J\ mol^{-1} = -RT \ln X_1 = -12{,}928 + 95.458\ T$

See the evaluation of the oxygen + octane system for the recommended equation.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

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

SOURCE AND PURITY OF MATERIALS:

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

ESTIMATED ERROR:

$\delta X_1/X_1 = 0.03$

REFERENCES:

1. Bodor, E.; Bor, Gy.; Mohai, B.; Sipos, G. *Veszpremi Vegyip. Egy. Kozl.* 1957, *1*, 55. *Chem. Abstr.* 1961, *55*, 3157h.

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

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

ORIGINAL MEASUREMENTS:

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

J. Chem. Thermodyn. 1978, *10*, 817-22.

VARIABLES:

T/K = 283.31 - 313.15
P/kPa = 101.325

PREPARED BY:

A. L. Cramer

EXPERIMENTAL VALUES:

T/K	Mol Fraction $X_1 \times 10^3$	Bunsen Coefficient α	Ostwald Coefficient L
283.31	2.159	0.3015	0.3127
298.21	2.177	0.2990	0.3264
313.15	2.170	0.2927	0.3356

The Bunsen coefficients were calculated by the compiler.

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

Smoothed Data: $\Delta G^o/\text{J mol}^{-1} = -RT \ln X_1 = 120.84 + 50.591\,T$

Std. Dev. $\Delta G^o = 8.1$, Coef. Corr. = 0.9999

$\Delta H^o/\text{J mol}^{-1} = 120.84$, $\Delta S^o/\text{J K}^{-1}\text{ mol}^{-1} = -50.591$

T/K	Mol Fraction $X_1 \times 10^3$	$\Delta G^o/\text{J mol}^{-1}$
283.15	2.16	14,445
293.15	2.17	14,951
303.15	2.17	15,457
313.15	2.17	15,963

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

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

Degassing. Up to 500 cm^3 of solvent is placed in a flask of such size that the liquid is about 4 cm deep. The liquid is rapidly stirred, and vacuum is intermittently applied through a liquid N_2 trap until the permanent gas residual pressure drops to 5 microns.

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

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. Air Products and Chemicals Co. 99.6 per cent.

(2) Octane. Phillips Petroleum Co. 99 mol %, distilled, density $\rho_{298.15} = 0.6988$.

ESTIMATED ERROR:

$\delta T/K = 0.02$
$\delta P/mmHg = 0.5$
$\delta X_1/X_1 = 0.01$

REFERENCES:

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

2. Battino, R.; Evans, F. D.; Danforth, W. F. *J. Am. Oil Chem. Soc.* 1968, *45*, 830.

3. Battino, R.; Banzhof, M.; Bogan, M.; Wilhelm, E. *Anal. Chem.* 1971, *43*, 806.

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) 2,2,4-Trimethylpentane or isooctane; C_8H_{18}; [540-84-1]

ORIGINAL MEASUREMENTS:

Kretschmer, C. B.; Nowakowska, J.; Wiebe, R.

Ind. Eng. Chem. 1946, *38*, 506-9.

VARIABLES:

T/K = 248.15 - 323.15

P/kPa = 101.325

PREPARED BY:

P. L. Long

H. L. Clever

EXPERIMENTAL VALUES:

T/K	Mol Fraction $x_1 \times 10^3$	Bunsen Coefficient α	Ostwald Coefficient L
248.15	2.983	0.4264	0.3874
273.15	2.664	0.3701	0.3701
298.15	2.529	0.3413	0.3725
323.15	2.494	0.3266	0.3864

The Ostwald coefficients were measured at a total pressure of 101.325 kPa (1 atm). The compiler calculated the Bunsen coefficient and mole fraction values for an oxygen partial pressure of 101.325 kPa (1 atm) assuming the Ostwald coefficient was independent of pressure.

Smoothed Data: $\ln x_1 = -6.6138 + 1.9369/(T/100\text{ K})$

Standard error about the regression line = 7.44×10^{-5}

T/K	Mol Fraction $x_1 \times 10^3$
253.15	2.884
263.15	2.801
273.15	2.727
283.15	2.659
293.15	2.598
298.15	2.569
303.15	2.542
313.15	2.490
323.15	2.443

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The apparatus was similar to that of Horiuti (1), it consisted of a gas buret, manometer, and absorption pipet equiped with a magnetic stirrer. All volumes were calibrated by mercury displacement.

The solvent was partly degassed by boiling under reflux. About 40 cm^3 of solvent was admitted into the absorption pipet, and pumped on to complete the degassing. Dry gas, measured in the buret, was admitted, final equilibrium was established after 1 to 3 hours stirring. During the solution process the total pressure was kept at one atm by additions of dry gas.

The solubility value was corrected for the increase of solvent volume with gas absorption, and for the nitrogen impurity in the oxygen.

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. Source not given. Contained 0.4 per cent N_2. Gas dried by passing through Drierite.

(2) 2,2,4-Trimethylpentane. "Certified material", source not given. Dried over $CaSO_4$, distilled, b.p. (760 mmHg) 99.24, density ρ_4^{25}/g cm^{-3} 0.68774.

ESTIMATED ERROR:

Gas buret $\delta V/cm^3 = 0.005$

Average deviation from the mean 0.3 %, maximum deviation 0.9 % (authors).

REFERENCES:

1. Horiuti, J. *J. Sci Papers Inst. Phys. Chem. Res. (Tokyo)* 1931, *17*, 125.

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) 2,2,4-Trimethylpentane (Isooctane); C_8H_{18}; [540-84-1]

ORIGINAL MEASUREMENTS:

Baldwin, R. R.; Daniel, S. G.;

J. Appl. Chem., 1952, *2* (Apr.), 161-5.

J. Inst. Petrol., London, 1953, *39*, 105-24.

VARIABLES:

T/K = 293.15

O_2 P/kPa = 101.325

PREPARED BY:

P. L. Long
H. L. Clever

EXPERIMENTAL VALUES:

T/K	Mol Fraction $X_1 \times 10^3$	Bunsen Coefficient α	Ostwald Coefficient L
293.15	2.59	0.351	0.377

The mole fraction solubility was calculated by the compiler.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The method consists of two operations: Saturation of the liquid with the gas under consideration; and determination of the amount of dissolved gas in the liquid saturated with the gas. All gases were passed through a liquid air trap to remove water and CO2 vapors before passage through the liquid. All gases were passed through a long coil, thermostated, before the saturation process.

Oil or similar liquid is deaerated by passing it through a continuously evacuated vessel. Gas is then passed through the liquid to saturation. Liquid is then degassed, and transfered to a storage burette, disconnected from the degassing apparatus, thermostated, and saturated with the desired gas. Burette is now connected to another degassing apparatus, portions of the oil degassed and gas collected.

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. From commercial cylinders, and gas analysis on a Bone and Wheeler apparatus shows it to be at least 99.5% pure; no source given.

(2) 2,2,3-Trimethylpentane. No information.

ESTIMATED ERROR:

$\delta P/P = 0.01$
$\delta \alpha/\alpha = 0.01$

REFERENCES:

COMPONENTS:

(1) Oxygen, O_2; [7782-44-7]

(2) 2,2,4-Trimethylpentane or Isooctane; C_8H_{18}; [540-84-1]

ORIGINAL MEASUREMENTS:

Kobatake, Y.; Hildebrand, J. H.

J. Phys. Chem. 1961, *65*, 331-5.

VARIABLES:

$T/K = 282.87 - 303.36$

$P/kPa = 101.325$

PREPARED BY:

M. E. Derrick
H. L. Clever

EXPERIMENTAL VALUES:

T/K	Mol Fraction $X_1 \times 10^3$	Bunsen Coefficient α	Ostwald Coefficient L
282.87	2.912	0.401	0.415
292.00	2.853	0.389	0.416
298.15	2.814	0.381	0.416
303.36	2.783	0.374	0.415

The Bunsen and Ostwald coefficients were calculated by the compiler.

Smoothed Data: $\Delta G^\circ/J\ mol^{-1} = -RT \ln X_1 = -1579.9 + 54.130\ T$

Std. Dev. $\Delta G^\circ = 0.58$, Coef. Corr. = 1.000

$\Delta H^\circ/J\ mol^{-1} = -1579.9$, $\Delta S^\circ/J\ K^{-1}\ mol^{-1} = -54.130$

T/K	Mol Fraction $X_1 \times 10^3$	$\Delta G^\circ/J\ mol^{-1}$
283.15	2.911	13,747
288.15	2.877	14,018
293.15	2.845	14,288
298.15	2.814	14,559
303.15	2.785	14,830

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The apparatus consists of a gas-measuring buret, an absorption pipet, and reservoir for solvent. The buret is thermostated at 25°C, the pipet at any temperature from 5 to 30°C.

The solvent is degassed by freezing with liquid nitrogen, evacuating, then boiling with a heat lamp. The solvent never comes into contact with stopcock grease.

The amount of gas is determined by P-V measurements in the gas buret before and after admission of the gas into the pipet. No solvent vapor is allowed into the buret system. The solvent is magnetically stirred for up to 24 hours until equilibrium is reached.

Ideal gas behavior and Henry's law are assumed to calculate the mole fraction solubility at a gas partial pressure of one atm.

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. Linde Oxygen Co. Standard grade, 99.7% oxygen.

(2) C_8H_{18}: Phillips "pure" product. dried, fractionated b.p. 99.1°C.

ESTIMATED ERROR:

$\delta X_1/X_1 = 0.003$

REFERENCES:

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Nonane; C_9H_{20}; [111-84-2]

ORIGINAL MEASUREMENTS:

Thomsen, E. S.; Gjaldbaek, J. C.

Acta Chem. Scand. 1963, *17*, 127-33.

VARIABLES:

$T/K = 298.05 - 298.15$

Total $P/kPa = 101.325$

PREPARED BY:

E. S. Thomsen

EXPERIMENTAL VALUES:

T/K	Mol Fraction $X_1 \times 10^3$	Bunsen Coefficient α	Ostwald Coefficient L
298.05	2.13	0.266	0.290
298.15	2.09	0.261	0.285

The mole fraction and Ostwald solubility values were calculated by the compiler.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

A calibrated all-glass combined manometer and bulb was enclosed in an air thermostat and shaken until equilibrium. Mercury was used for calibration and as the confining liquid. The solvents were degassed in the apparatus. Details are in references 1 and 2.

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

The saturation of the liquid with the gas was carried out close to atmospheric pressure. The solubility values were reported for one atmosphere gas pressure assuming Henry's law is obeyed.

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. Contained 0.2 percent N_2.

(2) Nonane, Fluka "purum." Fractionated, distillation range 0.08 K.

ESTIMATED ERROR:

$\delta T/K = 0.05$

$\delta X_1/X_1 = 0.015$

REFERENCES:

1. Lannung, A.
J. Am. Chem. Soc. 1930, *52*, 68.

2. Gjaldbaek, J. C.
Acta Chem. Scand. 1952, *6*, 623.

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Nonane; C_9H_{20}; [111-84-2]

ORIGINAL MEASUREMENTS:

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

Hung. J. Ind. Chem. 1976, *4*, 269-80.

VARIABLES:

$T/K = 298.15 - 313.15$
$P/kPa = 101.325$

PREPARED BY:

S. A. Johnson
H. L. Clever

EXPERIMENTAL VALUES:

T/K	Mol Fraction $X_1 \times 10^3$	Bunsen Coefficient α	Ostwald Coefficient L
298.15	1.89	0.236	0.258
313.15	1.42	0.174	0.200

The mole fraction solubilities and the Bunsen coefficients were calculated by the compiler.

Smoothed Data: $\Delta G°/J\ mol^{-1} = -RT \ln X_1 = -14{,}797 + 101.769\ T$

See the evaluation of the oxygen + nonane system for the recommended equation.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

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

SOURCE AND PURITY OF MATERIALS:

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

ESTIMATED ERROR:

$\delta X_1/X_1 = 0.03$

REFERENCES:

1. Bodor, E.; Bor, Gy.; Mohai, B.; Sipos, G. *Veszpremi Vegyip. Egy. Kozl.* 1957, *1*, 55. *Chem. Abstr.* 1961, *55*, 3157h.

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

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

ORIGINAL MEASUREMENTS:

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

Inst. J. Ind. Chem. 1976, *4*, 269-80.

VARIABLES:

T/K = 298.15 - 313.15
P/kPa = 101.325

PREPARED BY:

S. A. Johnson
H. L. Clever

EXPERIMENTAL VALUES:

T/K	Mol Fraction $X_1 \times 10^3$	Bunsen Coefficient α	Ostwald Coefficient L
298.15	1.85	0.212	0.231
313.15	1.42	0.159	0.183

The mole fraction solubilities and the Bunsen coefficients were calculated by the compiler.

Smoothed Data: $\Delta G°/J\ mol^{-1} = -RT \ln X_1 = -13{,}690 + 98{,}234\ T$

See the evaluation of the oxygen + decane system for the recommended equation.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

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

SOURCE AND PURITY OF MATERIALS:

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

ESTIMATED ERROR:

$\delta X_1/X_1 = 0.03$

REFERENCES:

1. Bodor, E.; Bor, Gy.; Mohai, B.; Sipos, G.
Veszpremi Vegyip. Egy. Kozl. 1957, *1*, 55.
Chem. Abstr. 1961, *55*, 3157h.

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

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

ORIGINAL MEASUREMENTS:

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

J. Chem. Thermodyn. 1978, *10*, 817-22.

VARIABLES:

T/K = 283.15 - 313.48
P/kPa = 101.325

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

T/K	Mol Fraction $X_1 \times 10^3$	Bunsen Coefficient α	Ostwald Coefficient L
283.15	2.204	0.2564	0.2658
298.11	2.200	0.2522	0.2752
313.48	2.181	0.2460	0.2823

The Bunsen coefficients were calculated by the compiler.

The solubility values were adjusted to 101.325 kPa (1 atm) assuming Henry's law.

Smoothed Data: $\Delta G^o/J\ mol^{-1} = -RT \ln X_1 = -281.9 + 51.846\ T$

Std. Dev. $\Delta G^o = 5.9$, Coef. Corr. = 0.9999

$\Delta H^o/J\ mol^{-1} = -281.9$, $\Delta S^o/J\ K^{-1}\ mol^{-1} = -51.846$

T/K	Mol Fraction $X_1 \times 10^3$	$\Delta G^o/J\ mol^{-1}$
278.15	2.21	14,139
288.15	2.20	14,658
298.15	2.19	15,176
308.15	2.19	15,695
318.15	2.18	16,213

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

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

Degassing. Up to 500 cm^3 of solvent is placed in a flask of such size that the liquid is about 4 cm deep. The liquid is rapidly stirred, and vacuum is intermittently applied through a liquid N_2 trap until the permanent gas residual pressure drops to 5 microns.

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

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. Air Products and Chemicals Co. 99.6 per cent.

(2) Decane. Phillips Petroleum Co. 99 mol % distilled, density, $\rho_{298.15} = 0.7264$.

ESTIMATED ERROR:

$\delta T/K = 0.02$
$\delta P/mmHg = 0.5$
$\delta X_1/X_1 = 0.01$

REFERENCES:

1. Morrison, T. J.; Billett, F. *J. Chem. Soc.* 1948, 2033.
2. Battino, R.; Evans, F. D.; Danforth, W. F. *J. Am. Oil Chem. Soc.* 1968, *45*, 830.
3. Battino, R.; Banzhof, M.; Bogan, M.; Wilhelm, E. *Anal. Chem.* 1971, *43*, 806.

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Undecane; $C_{11}H_{24}$; [1120-21-4]

ORIGINAL MEASUREMENTS:

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

Hung. J. Ind. Chem. 1976, *4*, 269-80.

VARIABLES:

T/K = 298.15 - 313.15
P/kPa = 101.325

PREPARED BY:

H. L. Clever
S. A. Johnson

EXPERIMENTAL VALUES:

T/K	Mol Fraction $X_1 \times 10^3$	Bunsen Coefficient α	Ostwald Coefficient L
298.15	1.82	0.193	0.211
313.15	1.38	0.144	0.165

The mole fraction solubilities and the Bunsen coefficients were calculated by the compiler.

Smoothed Data: $\Delta G°/J\ mol^{-1} = -RT \ln X_1 = -14{,}322 + 100.49\ T$

The data and the equation are classed as tentative.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

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

SOURCE AND PURITY OF MATERIALS:

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

ESTIMATED ERROR:

$\delta X_1/X_1 = 0.03$

REFERENCES:

1. Bodor, E.; Bor, Gy.; Mohai, B.; Sipos, G.

Veszpremi Vegyip. Egy. Kozl. 1957, *1*, 55.
Chem. Abstr. 1961, *55*, 3157h.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Oxygen; O_2; [7782-44-7] (2) Dodecane; $C_{12}H_{26}$; [112-40-3]	Makranczy, J.; Megyery-Balog, K.; Rusz, L.; Patyi, L. *Hung. J. Ind. Chem.* 1976, *4*, 269-80.
VARIABLES: T/K = 298.15 - 313.15 P/kPa = 101.325	PREPARED BY: S. A. Johnson H. L. Clever

EXPERIMENTAL VALUES:

T/K	Mol Fraction $X_1 \times 10^3$	Bunsen Coefficient α	Ostwald Coefficient L
298.15	1.86	0.182	0.199
313.15	1.38	0.133	0.153

The mole fraction solubilities and the Bunsen coefficients were calculated by the compiler.

Smoothed Data: $\Delta G°/J\ mol^{-1} = -RT \ln X_1 = -15{,}447 + 104.08\ T$

The data and the equation are classes as tentative.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

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

SOURCE AND PURITY OF MATERIALS:

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

ESTIMATED ERROR:

$\delta X_1/X_1 = 0.03$

REFERENCES:

1. Bodor, E.; Bor, Gy.; Mohai, B.; Sipos, G. *Veszpremi Vegyip. Egy. Kozl.* 1957, *1*, 55. *Chem. Abstr.* 1961, *55*, 3157h.

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Tridecane; $C_{13}H_{28}$; [629-50-5]

ORIGINAL MEASUREMENTS:

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

Hung. J. Ind. Chem. 1976, *4*, 269-80.

VARIABLES:

T/K = 298.15 - 313.15
P/kPa = 101.325

PREPARED BY:

S. A. Johnson
H. L. Clever

EXPERIMENTAL VALUES:

T/K	Mol Fraction $X_1 \times 10^3$	Bunsen Coefficient α	Ostwald Coefficient L
298.15	1.79	0.164	0.179
313.15	1.39	0.126	0.144

The mole fraction solubilities and the Bunsen coefficients were calculated by the compiler.

Smoothed Data: $\Delta G°/J\ mol^{-1} = -RT \ln X_1 = -13{,}089 + 96.49\ T$

The data and the equation are classes as tentative.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

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

SOURCE AND PURITY OF MATERIALS:

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

ESTIMATED ERROR:

$\delta X_1/X_1 = 0.03$

REFERENCES:

1. Bodor, E.; Bor, Gy., Mohai, B.; Sipos, G. *Veszpremi Vegyip. Egy. Kozl.* 1957, *1*, 55. *Chem. Abstr.* 1961, *55*, 3157h.

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Tetradecane; $C_{14}H_{30}$; [629-59-4]

ORIGINAL MEASUREMENTS:

Makranczy, J.; Megyery-Balog, K.; Rusz, L.; Patyi, L.
Hung. J. Ind. Chem. 1976, *4*, 269-80.

VARIABLES:

T/K = 298.15 - 313.15
P/kPa = 101.325

PREPARED BY:

S. A. Johnson
H. L. Clever

EXPERIMENTAL VALUES:

T/K	Mol Fraction $X_1 \times 10^3$	Bunsen Coefficient α	Ostwald Coefficient L
298.15	1.81	0.156	0.170
313.15	1.35	0.114	0.131

The mole fraction solubilities and the Bunsen coefficients were calculated by the compiler.

Smoothed Data: $\Delta G°/J\ mol^{-1} = -RT \ln X_1 = -15.175 + 103.40\ T$

The data and the equation are classed as tentative.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

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

SOURCE AND PURITY OF MATERIALS:

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

ESTIMATED ERROR:

$\delta X_1/X_1 = 0.03$

REFERENCES:

1. Bodor, E.; Bor, Gy., Mohai, B., Sipos, G.
Veszpremi Vegyip. Egy. Kozl. 1957, *1*, 55.
Chem. Abstr. 1961, *55*, 3157h.

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Pentadecane; $C_{15}H_{32}$; [629-62-9]

ORIGINAL MEASUREMENTS:

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

Hung. J. Ind. Chem. 1976, *4*, 269-80.

VARIABLES:

T/K = 298.15 - 313.15
P/kPa = 101.325

PREPARED BY:

S. A. Johnson
H. L. Clever

EXPERIMENTAL VALUES:

T/K	Mol Fraction $X_1 \times 10^3$	Bunsen Coefficient α	Ostwald Coefficient L
298.15	1.72	0.139	0.152
313.15	1.38	0.110	0.126

The mole fraction solubilities and the Bunsen coefficients were calculated by the compiler.

Smoothed Data: $\Delta G°/J\ mol^{-1} = -RT \ln X_1 = -11,398 + 91.15\ T$.

The data and the equation are classed as tentative.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Volumetric method. The apparatus of Bodor, Bor, Moahi and Sipos (1) was used.

SOURCE AND PURITY OF MATERIALS:

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

ESTIMATED ERROR:

$\delta X_1/X_1 = 0.03$

REFERENCES:

1. Bodor, E.; Bor, Gy., Mohai, B.; Sipos, G.
Veszpremi Vegyip. Egy. Kozl. 1957, *1*, 55.
Chem. Abstr. 1961, *55*, 3157h.

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

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

ORIGINAL MEASUREMENTS:

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

Hung. J. Ind. Chem. 1976, *4*, 269-80.

VARIABLES:

T/K = 298.15 - 313.15
P/kPa = 101.325

PREPARED BY:

S. A. Johnson
H. L. Clever

EXPERIMENTAL VALUES:

T/K	Mol Fraction $X_1 \times 10^3$	Bunsen Coefficient α	Ostwald Coefficient L
298.15	1.74	0.133	0.145
313.15	1.38	0.104	0.119

The mole fraction solubilities and the Bunsen coefficients were calculated by the compiler.

Smoothed Data: $\Delta G°/J\ mol^{-1} = -RT \ln X_1 = -11{,}996 + 93.06\ T$

The data and the equation are classes as tentative.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

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

SOURCE AND PURITY OF MATERIALS:

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

ESTIMATED ERROR:

$\delta X_1/X_1 = 0.03$

REFERENCES:

1. Bodor, E.; Bor, Gy., Mohai, B.; Sipos, G.
Veszpremi Vegyip. Egy. Kozl. 1957, *1*, 55.
Chem. Abstr. 1961, *55*, 3157h.

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Alkanes; C_7H_{16}, C_8H_{18}, $C_{10}H_{22}$

ORIGINAL MEASUREMENTS:

Ijams, C. C.

Ph. D. thesis, 1941, Vanderbilt University, Nashville, TN

VARIABLES:

T/K= 298.15
P/kPa= 101.325

PREPARED BY:

H.L. Clever

EXPERIMENTAL VALUES:

T/K	Mol Fraction $x_1 \times 10^3$	Bunsen Coefficient α	Ostwald Coefficient L
Heptane; C_7H_{16}; [142-82-5]			
298.15	1.99	0.303	0.331
Octane; C_8H_{18}; [111-65-9]			
298.15	2.08	0.286	0.312
2,2,4-Trimethylpentane or isooctane; C_8H_{18}; [540-84-1]			
298.15	2.43	0.329	0.359
Decane; $C_{10}H_{22}$; [124-18-5]			
298.15	2.13	0.244	0.266

The mole fraction and Ostwald coefficient values were calculated by the compiler.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

A Van Slyke-Neill Manometric Apparatus manufactured by the Eimer and Amend Co. was used.

The procedure of Van Slyke (1) for pure liquids was modified so that small solvent sample (2 cm^3) could be used with almost 100 per cent recovery of the solvent.

An improved temperature control system was used.

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. Air Reduction Co. Purity 99.5 per cent.

(2) Alkanes. Purified. Vapor pressure and boiling point also reported in the thesis.

ESTIMATED ERROR:

$\delta T/K = 0.05$

REFERENCES:

1. Van Slyke, D. D. *J. Biol. Chem.* 1939, *130*, 545.

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) n-Alkanes (C_7-C_{18})

ORIGINAL MEASUREMENTS:

Blanc, C; Batiste, M.

Bull. Centr. Rech. Pau. 1970, *4*, 235-41.

Chem. Abstr. 1973, *79*, 108564g.

VARIABLES:

T/K = 303
P/kPa = 101

PREPARED BY:

R. Battino

EXPERIMENTAL VALUES:

Solvent	$10^5 C_p{}^a$/g cm^{-3}	$10^2 L^b$	$10^2 \beta^c$/cm^3(STP)cm^{-3}atm^{-1}
	t/°C = 30		
n-C_7H_{16}	44.64	34.67	31.24
n-C_8H_{18}	38.15	29.63	26.70
n-C_9H_{20}	36.45	28.31	25.51
n-$C_{10}H_{22}$	31.15	24.19	21.80
n-$C_{11}H_{24}$	30.87	23.97	21.60
n-$C_{12}H_{26}$	30.10	23.38	21.07
n-$C_{13}H_{28}$	28.27	21.95	19.78
n-$C_{14}H_{30}$	26.66	20.71	18.66

[a] Solubility in g O_2/cm^3 solvent at 101.325 kPa partial pressure of gas.

[b] Ostwald coefficient.

[c] Bunsen coefficient.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The apparatus is described in the paper and uses a manometric-volumetric technique.

SOURCE AND PURITY OF MATERIALS:

No details given.

ESTIMATED ERROR:

$\delta L/L = \pm 0.01$, authors' estimate.

REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Oxygen; O_2; [7782-44-7] (2) n-Alkanes (C_7-C_{18})	Blanc, C; Batiste, M. *Bull. Centr. Rech. Pan.* 1970, *4*, 235-41 *Chem. Abstr.* 1973, *79*, 108564g

EXPERIMENTAL VALUES:

continued

Solvent	$10^5 Cp^a$/g cm^{-3}	$10^2 L^b$	$10^2 \beta^c$/cm^3(STP)cm^{-3}atm^{-1}
	$t/^\circ C = 30$		
n-$C_{15}H_{32}$	26.00	20.20	18.20
n-$C_{16}H_{34}$	25.28	19.63	17.69
n-$C_{17}H_{36}$	23.88	18.54	16.71
n-$C_{18}H_{38}$	23.00	17.87	16.10

COMPONENTS: (1) Oxygen; O_2; [7782-44-7] (2) Cyclic hydrocarbons; C_6H_{10} and C_6H_{12}	**ORIGINAL MEASUREMENTS:** Guerry, D. Jr. Ph.D. thesis, 1944, Vanderbilt University, Nashville, TN.
VARIABLES: T/K = 293.15, 298.15 P/kPa = 101.325 (1 atm)	**PREPARED BY:** H. L. Clever

EXPERIMENTAL VALUES:

T/K	Mol Fraction $x_1 \times 10^4$	Bunsen Coefficient α	Ostwald Coefficient L
	Cyclohexene; C_6H_{10}; [110-83-8]		
293.15	10.4	0.231	0.248
298.15	10.4	0.229	0.250
	Cyclohexane; C_6H_{12}; [110-82-7]		
293.15	12.1	0.252	0.270
298.15	12.3	0.255	0.278

The Ostwald coefficients were calculated by the compiler.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

A Van Slyke-Neill Manometric Apparatus manufactured by the Eimer and Amend Co. was used.

The procedure of Van Slyke (1) for pure liquids was modified (2) so that small solvent samples (2 cm^3) could be used with almost complete recovery of the sample.

An improved temperature control system was used.

SOURCE AND PURITY OF MATERIALS:

Cyclohexene. B.p. (756.6 mmHg) t/°C 82.35 - 82.50 (corr.).

Cyclohexane. B.p. (760.7 mmHg) t/°C 80.90 (corr.).

Data on density, refractive index and vapor pressure are in the thesis.

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. Air reduction Co. Purity 99.5 per cent.

(2) Hydrocarbons. Both were Eastman Kodak Co. products. They were purified by standard methods, and distilled from Na in a nitrogen atm.

ESTIMATED ERROR:

$\delta T/K = 0.05$

REFERENCES:

1. Van Slyke, D. D. *J. Biol. Chem.* 1939, *130*, 545.

2. Ijams, C. C. Ph.D. thesis, 1941 Vanderbilt University

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

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

ORIGINAL MEASUREMENTS:

Wilhelm, E.; Battino, R.

J. Chem. Thermodyn. 1973, *5*, 117-20.

VARIABLES:

T/K = 283.47 - 313.06
P/kPa = 101.325

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

T/K	Mol Fraction $X_1 \times 10^3$	Bunsen Coefficient α	Ostwald Coefficient L
283.47	1.248	0.262	0.272
283.49	1.239	0.260	0.270
283.64	1.243	0.261	0.271
297.51	1.245	0.257	0.280
297.57	1.245	0.255	0.280
310.14	1.252	0.255	0.289
310.38	1.234	0.251	0.285
313.06	1.274	0.258	0.296

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

Smoothed Data: $\Delta G^\circ/\text{J mol}^{-1} = -RT \ln X_1 = 236.7 + 54.798\ T$

Std. Dev. $\Delta G^\circ = 22.3$, Coef. Corr. = 0.9992

$\Delta H^\circ/\text{J mol}^{-1} = 236.7$, $\Delta S^\circ/\text{J K}^{-1}\text{ mol}^{-1} = -54.798$

T/K	Mol Fraction $X_1 \times 10^3$	$\Delta G^\circ/\text{J mol}^{-1}$
283.15	1.242	15,753
293.15	1.246	16,301
303.15	1.250	16,849
313.15	1.254	17,397

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

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

Degassing. Up to 500 cm^3 of solvent is placed in a flask of such size that the liquid is about 4 cm deep. The liquid is rapidly stirred, and vacuum is intermittently applied through a liquid N_2 trap until the permanent gas residual pressure drops to 5 microns.

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

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. Air Products & Chemicals Co. Minimum purity 99.6 mole per cent.

(2) Cyclohexane. Phillips Petroleum Co. Pure Grade. Distilled.

ESTIMATED ERROR:

$\delta T/K = 0.03$
$\delta P/mmHg = 0.5$
$\delta X_1/X_1 = 0.005$

REFERENCES:

1. Morrison, T. J.; Billett, F. *J. Chem. Soc.* 1948, 2033.
2. Battino, R.; Evans, F. D.; Danforth, W. F. *J. Am. Oil Chem. Soc.* 1968, *45*, 830.
3. Battino, R.; Banzhof, M.; Bogan, M.; Wilhelm, E. *Anal. Chem.* 1971, *43*, 806.

COMPONENTS:

(1) Oxygen; O_2 [7782-44-7]

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

ORIGINAL MEASUREMENTS:

Wild, J. D.; Sridhar, T.; Potter, O.E.

Chem. Eng. J. 1978, *15*, 209-14.

VARIABLES:

T/K = 293-371
P/kPa = 0-1206

PREPARED BY:

R. Battino

EXPERIMENTAL VALUES:

T/°C	T^a/K	P^b/lb in^{-2}	$10^3x_1{}^c$	$H^{a,d}$
39	312.2	175	1.217	822
39	312.2	156	1.205	830
59	332.2	150	1.231	812
71	344.2	135	1.25	800
79	352.2	112	1.263	792
80	353.2	165	1.263	792
98	371.2	150	1.277	783
20	293.2	0^e	1.16	862
36	309.2	0^e	1.21	826
47	320.2	0^e	1.2	833
58	331.2	0^e	1.26	794

[a] Calculated by compiler.

[b] Gage pressure. Original table titled "pressure range".

[c] Mole fraction solubility at 101.325 kPa partial pressure of gas.

[d] Henry's law coefficient; $x_1 = H(P/\text{atm})$.

[e] Determined by a gas chromatographic method.

[f] $\log_{10} x_1 = 0.366 \log_{10} (T/K) - 3.8385$; authors' smoothing equation.

[g] In original paper table and equation mistakenly have H for x_1.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Details of the method are given in reference (1). Air was introduced into a reactor containing one gallon of cyclohexane and brought to the desired pressure. Equilibrium was approached from above and below the pressure. The oxygen in the solution was analyzed using the pyrogallol absorption method. A gas chromatographic method was also used.

SOURCE AND PURITY OF MATERIALS:

(1) "High purity medical grade."

(2) Distilled to a final boiling poing of 80.7°C and refractive index of 1.4261.

ESTIMATED ERROR:

$\delta x_1/x_1 = \pm\ 0.02$, compiler's estimate

$\delta T/K = \pm 0.5$

REFERENCES:

1. Wild, J.D. "*Gas Absorption With Chemical Reaction*," Ph.D. Thesis, Monash University, Clayton, Victoria, Australia 1968.

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

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

ORIGINAL MEASUREMENTS:

Field, L. R.; Wilhelm, E.; Battino, R.

J. Chem. Thermodyn. 1974, *6*, 237-43.

VARIABLES:

T/K = 284.15 - 313.26
P/kPa = 101.325

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

T/K	Mol Fraction $X_1 \times 10^3$	Bunsen Coefficient α	Ostwald Coefficient L
284.15	1.543	0.2743	0.2853
298.24	1.599	0.2795	0.3052
313.26	1.603	0.2755	0.3159

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

The Bunsen coefficients were calculated by the compiler.

Smoothed Data: $\Delta G^o/J\ mol^{-1} = -RT \ln X_1 = 943.0 + 50.459\ T$

Std. Dev. $\Delta G^o = 23.4$, Coef. Corr. = 0.9996

$\Delta H^o/J\ mol^{-1} = 943.0$, $\Delta S^o/J\ K^{-1}\ mol^{-1} = -50.459$

T/K	Mol Fraction $X_1 \times 10^3$	$\Delta G^o/J\ mol^{-1}$
283.15	1.55	15,230
293.15	1.57	15,735
303.15	1.59	16,240
313.15	1.61	16,744

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

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

Degassing. Up to 500 cm^3 of solvent is placed in a flask of such size that the liquid is about 4 cm deep. The liquid is rapidly stirred, and vacuum is intermittently applied through a liquid N_2 trap until the permanent gas residual pressure drops to 5 microns.

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

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. Air Products & Chemicals Co. Minimum purity 99.6 mole per cent.

(2) Methylcyclohexane. Phillips Petroleum Co. Pure Grade. Distilled.

ESTIMATED ERROR:

$\delta T/K = 0.03$
$\delta P/mmHg = 0.5$
$\delta X_1/X_1 = 0.005$

REFERENCES:

1. Morrison, T. J.; Billett, F. *J. Chem. Soc.* 1948, 2033.
2. Battino, R.; Evans, F. D.; Danforth, W. F. *J. Am. Oil Chem. Soc.* 1968, *45*, 830.
3. Battino, R.; Banzhof, M.; Bogan, M.; Wilhelm, E. *Anal. Chem.* 1971, *43*, 806.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Oxygen; O_2; [7782-44-7] (2) *cis*-1,2-Dimethylcyclohexane; C_8H_{16}; [2207-01-4]	Geller, E. B.; Battino, R.; Wilhelm, E. *J. Chem. Thermodyn.* 1976, *8*, 197-202.
VARIABLES: T/K = 297.96 - 312.99 P/kPa = 101.325	PREPARED BY: H. L. Clever A. L. Cramer

EXPERIMENTAL VALUES:

T/K	Mol Fraction $X_1 \times 10^3$	Bunsen Coefficient α	Ostwald Coefficient L
297.96	1.543	0.2446	0.2669
312.99	1.534	0.2394	0.2744

The Bunsen coefficients were calculated by the compiler.

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

Smoothed Data: The smoothed data are based on only two pair of experimental values and should be used with caution.

$$\Delta G^o/\text{J mol}^{-1} = -RT \ln X_1 = -300.5 + 54.836\ T$$

$$\Delta H^o/\text{J mol}^{-1} = -300.5,\ \Delta S^o/\text{J K}^{-1}\ \text{mol}^{-1} = -54.836$$

T/K	Mol Fraction $X_1 \times 10^3$	$\Delta G^o/\text{J mol}^{-1}$
298.15	1.543	16,049
313.15	1.534	16,871

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

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

Degassing. Up to 500 cm^3 of solvent is placed in a flask of such size that the liquid is about 4 cm deep. The liquid is rapidly stirred, and vacuum is applied intermittently through a liquid N_2 trap until the permanent gas residual pressure drops to 5 microns.

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

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. Either Air Products & Chemicals, Inc. or Matheson Co., Inc. 99 mol per cent or better.

(2) *cis*-1,2-Dimethylcyclohexane. Chemical Samples Co. Fractionally distilled and stored in dark. Refractive index (NaD, 298.15 K) 1.4337.

ESTIMATED ERROR:

$\delta T/K = 0.03$

$\delta P/\text{mmHg} = 0.5$

$\delta X_1/X_1 = 0.005$

REFERENCES:

1. Morrison, T. J.; Billett, F. *J. Chem. Soc.* 1948, 2033.
2. Battino, R.; Evans, F. D.; Danforth, W. F. *J. Am. Oil Chem. Soc.* 1968, *45*, 830.
3. Battino, R.; Banzhof, M.; Bogan, M.; Wilhelm, E. *Anal. Chem.* 1971, *43*, 806.

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) *cis*-1,3-Dimethylcyclohexane, 59 mol %; C_8H_{16}; [638-04-0]

(3) *trans*-1,3-Dimethylcyclohexane, 41 mol %; C_8H_{16}; [2207-03-6]

ORIGINAL MEASUREMENTS:

Geller, E. B.; Battino, R.; Wilhelm, E.

J. Chem. Thermodyn. 1976, *8*, 197-202.

VARIABLES:

T/K = 298.03 - 313.05
P/kPa = 101.325

PREPARED BY:

H. L. Clever
A. L. Cramer

EXPERIMENTAL VALUES:

T/K	Mol Fraction $X_1 \times 10^3$	Bunsen Coefficient α	Ostwald Coefficient L
298.03	1.722	0.2651	0.2893
313.05	1.698	0.2574	0.2950

The Bunsen coefficients were calculated by the compiler.

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

Smoothed Data: The Gibbs energy equation is based on only two pair of experimental values. It should be used with caution.

$$\Delta G^\circ/\text{J mol}^{-1} = -RT \ln X_1 = -738.2 + 55.393\ T$$

$$\Delta H^\circ/\text{J mol}^{-1} = -738.2,\ \Delta S^\circ/\text{J K}^{-1}\ \text{mol}^{-1} = -55.393$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

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

Degassing. Up to 500 cm^3 of solvent is placed in a flask of such size that the liquid is about 4 cm deep. The liquid is rapidly stirred, and vacuum is intermittently applied through a liquid N_2 trap until the permanent gas residual pressure drops to 5 microns.

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

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. Either Air Products & Chemicals, Inc., or Matheson Co., Inc. 99 mol per cent or better.

(2) *cis*-1,4-Dimethylcyclohexane.

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

ESTIMATED ERROR:

$\delta T/K = 0.03$
$\delta P/mmHg = 0.5$
$\delta X_1/X_1 = 0.005$

REFERENCES:

1. Morrison, T. J.; Billett, F. *J. Chem. Soc.* 1948, 2033.
2. Battino, R.; Evans, F. D.; Danforth, W. F. *J. Am. Oil Chem. Soc.* 1968, *45*, 830.
3. Battino, R.; Banzhof, M.; Bogan, M.; Wilhelm, E. *Anal. Chem.* 1971, *43*, 806.

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) *trans*-1,2-Dimethylcyclohexane; C_8H_{16}; [6876-23-9]

ORIGINAL MEASUREMENTS:

Geller, E. B.; Battino, R.; Wilhelm, E.

J. Chem. Thermodyn. 1976, *8*, 197-202.

VARIABLES:

T/K = 298.11 - 313.05
P/kPa = 101.325

PREPARED BY:

H. L. Clever
A. L. Cramer

EXPERIMENTAL VALUES:

T/K	Mol Fraction $X_1 \times 10^3$	Bunsen Coefficient α	Ostwald Coefficient L
298.11	1.734	0.2678	0.2923
313.05	1.705	0.2594	0.2973

The Bunsen coefficients were calculated by the compiler.

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

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

$$\Delta G^0/\text{J mol}^{-1} = -RT \ln X_1 = -878.35 + 55.803\ T$$

$$\Delta H^0/\text{J mol}^{-1} = -878.35,\ \Delta S^0/\text{J K}^{-1}\text{ mol}^{-1} = -55.803$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

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

Degassing. Up to 500 cm^3 of solvent is placed in a flask of such size that the liquid is about 4 cm deep. The liquid is rapidly stirred, and vacuum is intermittently applied through a liquid N_2 trap until the permanent gas residual pressure drops to 5 microns.

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

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. Either Air Products & Chemicals Inc., or Matheson Co., Inc. 99 mol per cent or better.

(2) *trans*-1,2-Dimethylcyclohexane. Chemical samples Co. Fractionally distilled and stored in dark. Refractive index (NaD, 298.15 K) 1.4248.

ESTIMATED ERROR:

$\delta T/K = 0.03$
$\delta P/mmHg = 0.5$
$\delta X_1/X_1 = 0.005$

REFERENCES:

1. Morrison, T. J.; Billett, F. *J. Chem. Soc.* 1948, 2033.
2. Battino, R.; Evans, F. D.; Danforth, W. F. *J. Am. Oil Chem. Soc.* 1968, *45*, 830.
3. Battino, R.; Banzhof, M.; Bogan, M.; Wilhelm, E. *Anal. Chem.* 1971, *43*, 806.

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) *cis*-1,4-Dimethylcyclohexane, 70 mol %; C_8H_{16}; [624-29-3]

(3) *trans*-1,4-Dimethylcyclohexane, 30 mol %; C_8H_{16}; [2207-04-7]

ORIGINAL MEASUREMENTS:

Geller, E. B.; Battino, R.; Wilhelm, E.

J. Chem. Thermodyn. 1976, *8*, 197-202.

VARIABLES:

T/K = 298.10 - 313.15
P/kPa = 101.325

PREPARED BY:

H. L. Clever
A. L. Cramer

EXPERIMENTAL VALUES:

T/K	Mol Fraction $X_1 \times 10^3$	Bunsen Coefficient α	Ostwald Coefficient L
298.10	1.737	0.2685	0.2930
313.15	1.724	0.2623	0.3007

The Bunsen coefficients were calculated by the compiler.

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

Smoothed Data: The Gibbs energy equation is based on only two pair of experimental values. It should be used with caution.

$$\Delta G^o/J\ mol^{-1} = -RT \ln X_1 = -370.1 + 54.086\ T$$

$$\Delta H^o/J\ mol^{-1} = -370.1,\ \Delta S^o/J\ K^{-1}\ mol^{-1} = -54.086$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

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

Degassing. Up to 500 cm^3 of solvent is placed in a flask of such size that the liquid is about 4 cm deep. The liquid is rapidly stirred, and vacuum is intermittently applied through a liquid N_2 trap until the permanent gas residual pressure drops to 5 microns.

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

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. Either Air Products & Chemicals, Inc., or Matheson Co., Inc. 99 mol per cent or better.

(2) *cis*-1,4-Dimethylcyclohexane.

(3) *trans*-1,4-Dimethylcyclohexane. Chemical Samples Co. The binary mixture used as received. Composition determined by refractive index by authors.

ESTIMATED ERROR:

$\delta T/K = 0.03$
$\delta P/mmHg = 0.5$
$\delta X_1/X_1 = 0.005$

REFERENCES:

1. Morrison, T. J.; Billett, F. *J. Chem. Soc.* 1948, 2033.
2. Battino, R.; Evans, F. D.; Danforth, W. F. *J. Am. Oil Chem. Soc.* 1968, *45*, 830.
3. Battino, R.; Banzhof, M.; Bogan, M.; Wilhelm, E. *Anal. Chem.* 1971, *43*, 806.

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Cyclooctane; C_8H_{16}; [292-64-8]

ORIGINAL MEASUREMENTS:

Wilcock, R. J.; Battino, R.;
Wilhelm, E.

J. Chem. Thermodyn. 1977, *9*, 111-5.

VARIABLES:

$T/K = 289.18 - 313.53$
$P/kPa = 101.325$

PREPARED BY:

H. L. Clever
A. L. Cramer

EXPERIMENTAL VALUES:

T/K	Mol Fraction $X_1 \times 10^3$	Bunsen Coefficient α	Ostwald Coefficient L
289.18	1.105	0.1852	0.1961
298.26	1.072	0.1782	0.1946
313.53	1.088	0.1782	0.2046

The Bunsen coefficients were calculated by the compiler.

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

Smoothed Data: $\Delta G^\circ/J\ mol^{-1} = -RT \ln X_1 = -15.78 + 56.783\ T$

Std. Dev. $\Delta G^\circ = 36.45$, Coef. Corr. = 0.9993

$\Delta H^\circ/J\ mol^{-1} = -15.78$, $\Delta S^\circ/J\ K^{-1}\ mol^{-1} = -56.783$

T/K	Mol Fraction $X_1 \times 10^3$	$\Delta G^\circ/J\ mol^{-1}$
288.15	1.089	16,346
293.15	1.088	16,630
298.15	1.088	16,914
303.15	1.088	17,198
308.15	1.088	17,482
313.15	1.088	17,766

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

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

Degassing. Up to 500 cm^3 of solvent is placed in a flask of such size that the liquid is about 4 cm deep. The liquid is rapidly stirred, and vacuum is intermittently applied through a liquid N_2 trap until the permanent gas residual pressure drops to 5 microns.

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

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. Air Products and Chemicals Co. Minimum purity 99.6 mol per cent.

(2) Cyclooctane. Chemical Samples Co. 99 mol percent, distilled, refractive index (NaD, 298.15 K) 1.4562.

ESTIMATED ERROR:

$\delta T/K = 0.03$
$\delta P/mmHg = 0.3$
$\delta X_1/X_1 = 0.005$

REFERENCES:

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

2. Battino, R.; Evans, F. D.; Danforth, W. F. *J. Am. Oil Chem. Soc.* 1968, *45*, 830.

3. Battino, R.; Banzhof, M.; Bogan, M.; Wilhelm, E. *Anal. Chem.* 1971, *43*, 806.

COMPONENTS:	EVALUATOR:
(1) Oxygen; O_2; [7782-44-7] (2) Benzene; C_6H_6; [71-43-2]	Rubin Battino Department of Chemistry Wright State University Dayton, OH 45435 U.S.A.

CRITICAL EVALUATION:

The solubility of oxygen in benzene was determined by five workers (1-5). Only three of these were of sufficient consistency to smooth. We used 16 data points for the smoothing and they were obtained as follows (reference-number of data points used from that reference): 1-3, 2-6, 5-7. The fitting equation used was:

$$\ln x_1 = A + B/(T/100K) + C \ln (T/100K) \qquad (1)$$

The least squares fit for the 16 points gave

$$\ln x_1 = -13.90754 + 8.741567/(T/100K) + 3.530241 \ln (T/100K) \qquad (2)$$

where x_1 is the mole fraction solubility at 101.325 kPa partial pressure of gas. The fit in the mole fraction was to $\pm 0.60 \times 10^{-5}$ or ±0.71 per cent at the middle of the temperature range. Table 1 gives smoothed values of the mole fraction at 101.325 kPa partial pressure of the gas and the Ostwald coefficients at 5K intervals.

Table 1 also gives the thermodynamic functions $\Delta\bar{G}_1^\circ$, $\Delta\bar{H}_1^\circ$, and $\Delta\bar{S}_1^\circ$ for the transfer of gas from the vapor phase at 101.325 kPa partial pressure to the (hypothetical) solution phase of unit mole fraction. These thermodynamic properties were calculated from the smoothing equation according to the following equations:

$$\Delta\bar{G}_1^\circ = -RAT - 100RB - RCT \ln(T/100) \qquad (3)$$

$$\Delta\bar{S}_1^\circ = RA + RC \ln(T/100) + RC \qquad (4)$$

$$\Delta\bar{H}_1^\circ = -100RB + RCT \qquad (5)$$

$$\Delta\bar{C}p_1^\circ = RC \qquad (6)$$

The $\Delta\bar{C}p_1^\circ$ value was constant at 29.4 J mol^{-1} K^{-1}.

Morgan and Pyne's (3) single value and Naumenko, et al.'s (4), single value were not used since they deviated by about three standard deviations from the smoothed line. There is no apparent reason for this.

TABLE 1. Smoothed values of the solubility of oxygen in benzene, and thermodynamic functions at 5K intervals using equation 2 at 101.325 kPa partial pressure of gas.

T/K	$10^4 x_1$ [a]	L [b]	$\Delta\bar{G}_1^\circ$/ kJ mol^{-1}	$\Delta\bar{H}_1^\circ$/ kJ mol^{-1}	$\Delta\bar{S}_1^\circ$/ J mol^{-1}
283.15	7.88	0.209	16.82	1.04	-55.7
288.15	7.95	0.213	17.10	1.19	-55.2
293.15	8.02	0.217	17.38	1.34	-54.7
298.15	8.10	0.222	17.65	1.48	-54.2
303.15	8.18	0.226	17.92	1.63	-53.7
308.15	8.27	0.231	18.18	1.78	-53.2
313.15	8.37	0.236	18.45	1.92	-52.8
318.15	8.47	0.241	18.71	2.07	-52.3
323.15	8.57	0.247	18.97	2.22	-51.9
328.15	8.69	9.252	19.23	2.36	-51.4
333.15	8.80	0.258	19.49	2.51	-51.0
338.15	8.93	0.264	19.74	2.66	-50.5
343.15	9.05	0.269	19.99	2.80	-50.1

[a] Mole fraction solubility at 101.325 kPa partial pressure of gas.

[b] Ostwald coefficient.

continued on following page

COMPONENTS:	EVALUATOR:
(1) Oxygen; O_2; [7782-44-7] (2) Benzene; C_6H_6; [71-43-2]	Rubin Battino Department of Chemistry Wright State University Dayton, OH 45435 U.S.A.

CRITICAL EVALUATION:

continued

References

1. Byrne, J.E.; Battino, R.; Danforth, W.F. *J. Chem. Thermodyn.* 1974, *6*, 245-50.
2. Horiuchi, J. *Sci. Papers Inst. Phys. Chem. Research (Tokyo)* 1931, *17*, 125-256.
3. Morgan, J.L.R.; Pyne, H.R. *J. Phys. Chem.* 1930, *34*, 2045-8.
4. Naumenko, N.K.; Mukhin, N.N.; Aleskovskii, V.B. *Zh. Prikl. Khim. (Leningrad)* 1969, *42*, 2522-8.
5. Schläpfer, P.; Audykowski, T.; Bukowiecki, A. *Schweiz. Arch. Angew. Wiss. Tech.* 1949, *15*, 299-307.

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Benzene; C_6H_6; [71-43-2]

ORIGINAL MEASUREMENTS:

Morgan, J.L.R.; Pyne, H.R.

J. Phys. Chem. 1930, 34, 2045-8.

VARIABLES:

T/K = 298

PREPARED BY:

R. Battino

EXPERIMENTAL VALUES:

t/°C	T/K^a	L^b	$10^4\ x_1^{a,c}$
25	298.15	0.2076	7.581
		0.2079	
		0.2146	
		0.2077	
		0.2051	
		0.2037	
		0.2030	
		0.2100	
		0.2062	

[a] Calculated by compiler.

[b] Ostwald coefficient.

[c] Mole fraction solubility at 101.325 kPa partial pressure of gas. Calculated from average value of L of 0.2079 with a standard deviation of ±0.0031.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Used the apparatus of Morgan and Pyne (1). A method is used whereby a rocking beam connected to mercury reservoirs and pumping bulbs pumps gas through previously degassed liquid. After equilibration the gas uptake is read on attached burets. The apparatus is all glass.

SOURCE AND PURITY OF MATERIALS:

(1) From an electrolytically prepared supply and passed over a heated spiral of copper oxide before use.

(2) Merck. Distilled to a boiling point of 80.4°C.

ESTIMATED ERROR:

δL/L = ±0.02, compiler's estimate

REFERENCES:

1. Morgan, J.L.R.; Pyne, H.R. *J. Phys. Chem.*, 1930, *34*, 1578-82.

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Benzene; C_6H_6; [71-43-2]

ORIGINAL MEASUREMENTS:

Horiuti, J.

Sci. Papers Inst. Phys. Chem. Res. (Tokyo)(Jpn) 1931/32, *17*, 125-256.

VARIABLES:

T/K = 283.15 - 333.15

Total P/kPa = 101.325

PREPARED BY:

M. E. Derrick
H. L. Clever

EXPERIMENTAL VALUES:

T/K	Mol Fraction $X_1 \times 10^3$	Bunsen Coefficient α	Ostwald Coefficient L
283.15	0.7897	0.2017	0.2091
293.15	0.8070	0.2037	0.2186
303.15	0.8241	0.2055	0.2281
313.15	0.8394	0.2068	0.2371
323.15	0.8626	0.2099	0.2483
333.15	0.8788	0.2112	0.2576

Smoothed Data: $\ln X_1 = -9.95246 + 3.0634/(T/100) + 1.6593 \ln (T/100)$

Standard error about the regression line = 1.96×10^{-6}

T/K	Mol Fraction $X_1 \times 10^3$
283.15	0.7899
293.15	0.8065
303.15	0.8237

T/K	Mol Fraction $X_1 \times 10^3$
313.15	0.8417
323.15	0.8603
333.15	0.8796

If the gas and solution are assumed to be ideal the fitted equation gives the following thermodynamic values.

T/K	ΔG^o/kJ mol^{-1}	ΔH^o/J mol^{-1}	ΔS^o/J K^{-1} mol^{-1}	ΔC_p^o/J K^{-1} mol^{-1}
273.15	16.817	1359	-54.59	13.80
298.15	17.631	1566	-53.88	13.80

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The apparatus consists of a gas buret, a solvent reservoir, and an absorption pipet. The volume of the pipet was determined at various miniscus heights by weighing a quantity of water. The miniscus height was read with a cathetometer.

The dry gas introduced into the degassed solvent. The gas and solvent are mixed with a magnetic stirrer until saturation. Care taken to prevent solvent vapor from mixing with the solute gas in the gas buret. The volume of gas was determined from a gas buret reading, the volume of the solvent was determined from the miniscus height in the absorption pipet.

The Ostwald coefficient was measured at a total pressure of one atm. The Bunsen coefficient and the mole fraction solubility values were calculated by the compiler for a gas pressure of one atm assuming the gas to behave ideally and the Ostwald coefficient to be independent of pressure.

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. Prepared in the laboratory by heating potassium permanganate (Kahlbaum). Gas fractionated in liquid air.

(2) Benzene. Merck. Extra pure, free from sulfur sample refluxed with sodium amalgam. Normal boiling point 80.18°C.

ESTIMATED ERROR:

$\delta T/K = 0.05$

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Benzene; C_6H_6; [71-43-2]

ORIGINAL MEASUREMENTS:

Schläpfer, P.; Audykowski, T.; Bukowiecki, A.

Schweiz. Arch. Angew. Wiss. Tech. 1949, *15*, 299-307.

VARIABLES:

T/K = 283 - 343

PREPARED BY:

R. Battino

EXPERIMENTAL VALUES:

t/°C	T^a/K	L^b
10	283	0.206
20	293	0.219
30	303	0.226
40	313	0.234
50	323	0.245
60	333	0.256
70	343	0.271

[a] Calculated by compiler.

[b] Ostwald coefficient.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The solvent was saturated with air and the dissolved oxygen determined iodimetrically.

SOURCE AND PURITY OF MATERIALS:

(1) From air.

(2) Specific gravity of 0.879 g cm^{-3} at 20°C.

ESTIMATED ERROR:

$\delta L/L = \pm 0.025$, authors' estimate.

REFERENCES:

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Benzene; C_6H_6; [71-43-2]

ORIGINAL MEASUREMENTS:

Byrne, J. E.; Battino, R.; Danforth, W. F.

J. Chem. Thermodyn. 1974, *6*, 245-50.

VARIABLES:

T/K = 310.59 - 310.66

P/kPa = 101.325

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

T/K	Mol Fraction $X_1 \times 10^3$	Bunsen Coefficient α	Ostwald Coefficient L
310.59	0.847	0.2092	0.2379
310.61	0.836	0.2066	0.2349
310.64	0.828	0.2045	0.2326
310.66	0.825	0.2038	0.2318

The Bunsen coefficients and mol fraction solubilities were calculated by the compiler.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

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

Degassing. Up to 500 cm^3 of solvent is placed in a flask of such size that the liquid is about 4 cm deep. The liquid is rapidly stirred, and vacuum is intermittently applied through a liquid N_2 trap until the permanent gas residual pressure drops to 5 microns.

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

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. Air Products & Chemicals Co. Minimum purity 99.6 mole per cent.

(2) Benzene. Baker Analyzed Reagent Grade. Thiophene free, 99.9 mol per cent.

ESTIMATED ERROR:

$\delta T/K = 0.03$

$\delta P/mmHg = 0.5$

$\delta X_1/X_1 = 0.005$

REFERENCES:

1. Morrison, T. J.; Billett, F. *J. Chem. Soc.* 1948, 2033.
2. Battino, R.; Evans, F. D.; Danforth, W. F. *J. Am. Oil Chem. Soc.* 1968, *45*, 830.
3. Battino, R.; Banzhof, M.; Bogan, M.; Wilhelm, E. *Anal. Chem.* 1971, *43*, 806.

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Benzene; C_6H_6; [71-43-2]

Methylbenzene or toluene; C_7H_8; [108-88-3]

ORIGINAL MEASUREMENTS:

Naumenko, N. K.; Mukhin, N. N. Aleskovskii, V. B.

Zh. Prikl. Khim. (Leningrad) 1969, *42*, 2522-8.

J. Appl. Chem. USSR 1969, *42*, 2376-81.

VARIABLES:

T/K = 298.15

O_2 P/kPa = 101.325

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

T/K	Mol Fraction $x_1 \times 10^4$	Bunsen Coefficient α	Ostwald Coefficient L
	Benzene; C_6H_6; [71-43-2]		
298.15	8.77	0.220±0.0041	0.240
	Methylbenzene or toluene; C_7H_8; [108-88-3]		
298.15	10.67	0.222±0.006	0.242

The Ostwald coefficent values were calculated by the compiler.

The absolute errors are calculated from the results of three or four determinations.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The oxygen solubility was determined by a volumetric gas method.

The liquids were deaerated for 20 to 30 minutes under reduced pressure with the aid of an oil pump. The deaeration was monitored from the readings of a thermocouple vacuum gage.

The liquids were saturated with oxygen under an oxygen partial pressure of about 760 mmHg at 25 °C for 2 hours. The amount of gas absorbed was then determined.

Details of the method are given in an earlier paper (1).

SOURCE AND PURITY OF MATERIALS:

The source and purity of the materials were not given.

ESTIMATED ERROR:

$\delta T/K = 0.1$

$\delta\alpha/\alpha = 0.023$ (relative)

REFERENCES:

1. Naumenko, N. K.; Mukhin, N. N. Aleskovskii, V. B. *Zh. Prikl. Khim.* 1969, *42*, 2090.

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Methylbenzene or Toluene; C_7H_8; [108-88-3]

ORIGINAL MEASUREMENTS:

Field, L. R.; Wilhelm, E.; Battino, R.

J. Chem. Thermodyn. 1974, *6*, 237-43.

VARIABLES:

$T/K = 293.71 - 313.20$
$P/kPa = 101.325$

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

T/K	Mol Fraction $X_1 \times 10^3$	Bunsen Coefficient α	Ostwald Coefficient L
293.71	0.922	0.1898	0.2041
309.69	0.909	0.1841	0.2087
313.20	0.960	0.1991	0.2283

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

The Bunsen coefficients were calculated by the compiler.

Smoothed Data: $\Delta G^o/J\ mol^{-1} = -RT \ln X_1 = 894.6 + 55.105\ T$

Std. Dev. $\Delta G^o = 66.5$, Coef. Corr. = 0.9938

$\Delta H^o/J\ mol^{-1} = 894.6$, $\Delta S^o/J\ K^{-1}\ mol^{-1} = -55.105$

T/K	Mol Fraction $X_1 \times 10^3$	$\Delta G^o/J\ mol^{-1}$
293.15	0.917	17,049
303.15	0.928	17,600
313.15	0.938	18,151

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

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

Degassing. Up to 500 cm^3 of solvent is placed in a flask of such size that the liquid is about 4 cm deep. The liquid is rapidly stirred, and vacuum is applied intermittently through a liquid N_2 trap until the permanent gas residual pressure drops to 5 microns.

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

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. Air Products & Chemicals Co. Minimum purity 99.6 mole per cent.

(2) Methylbenzene. Phillips Petroleum. Pure Grade. Distilled.

ESTIMATED ERROR:

$\delta T/K = 0.03$
$\delta P/mmHg = 0.5$
$\delta X_1/X_1 = 0.005$

REFERENCES:

1. Morrison, T. J.; Billett, F. *J. Chem. Soc.* 1948, 2033.
2. Battino, R.; Evans, F. D.; Danforth, W. F. *J. Am. Oil Chem. Soc.* 1968, *45*, 830.
3. Battino, R.; Banzhof, M.; Bogan, M.; Wilhelm, E. *Anal. Chem.* 1971, *43*, 806.

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Aromatic hydrocarbons; C_8H_{10}

ORIGINAL MEASUREMENTS:

Naumenko, N. K.; Mukhin, N. N.
Aleskovskii, V. B.

Zh. Prikl. Khim. (Leningrad) 1969, *42*. 2522-8.

J. Appl. Chem. 1969, *42*, 2376-81.

VARIABLES:

T/K = 298.15

O_2 P/kPa = 101.325 (1 atm)

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

T/K	Mol Fraction $x_1 \times 10^4$	Bunsen Coefficient α	Ostwald Coefficient L
1,2-Dimethylbenzene; C_8H_{10}; [95-47-6]			
298.15	11.18	0.206 ± 0.0043	0.225
1,3-Dimethylbenzene; C_8H_{10}; [108-38-3]			
298.15	11.96	0.216 ± 0.0043	0.236
1,4-Dimethylbenzene; C_8H_{10}; [106-42-3]			
298.15	12.44	0.225 ± 0.0070	0.246
Ethylbenzene; C_8H_{10}; [100-41-4]			
298.15	12.20	0.222 ± 0.0070	0.242

The Ostwald coefficient values were calculated by the compiler.

The absolute errors are calculated from the results of three or four determinations.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The oxygen solubility was determined by a volumetric gas method.

The liquids were deaerated for 20 to 30 minutes under reduced pressure with the aid of an oil pump. The deaeration was monitored from the readings of a thermocouple vacuum gage.

The liquids were saturated with oxygen under an oxygen partial pressure of about 760 mmHg at 25°C for 2 hours. The amount of gas absorbed was then determined.

Details of the method are given in an earlier paper (1).

SOURCE AND PURITY OF MATERIALS:

The source and purity of the materials were not given.

ESTIMATED ERROR:

$\delta T/K = 0.1$

$\delta\alpha/\alpha = 0.023$ (relative)

REFERENCES:

1. Naumenko, N. K.; Mukhin, N. N. Aleskovskii, V. B. *Zh. Prikl. Khim.* 1969, *42*, 2090.

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) p-Xylene; C_8H_{10}; [106-42-3]

ORIGINAL MEASUREMENTS:

Fisher, G.T.

J. Chem. Eng. Data 1963, *8*, 206; also see correction, *ibid.* 1963, *8*, 571.

VARIABLES:

T/K = 303.2 - 353.2

PREPARED BY:

R. Battino

EXPERIMENTAL VALUES:

t/°C	T/K[a]	10^{-2} Henry's Constant[b]	L[c]	10^3x_1[a]
30.0	303.2	8.89	0.220	1.13
40.0	313.2	9.00	0.214	1.11
50.0	323.2	8.81	0.215	1.14
60.0	333.2	8.46	0.220	1.13
70.0	343.2	8.40	0.215	1.19
80.0	353.2	8.70	0.193	1.15

[a] Calculated by compiler. x_1 is the mole fraction solubility at a partial gas pressure of 101.325 kPa (1 atm).

[b] Henry's Law Constant as $(P_{O_2}/\text{atm})x_1$.

[c] "Ostwald Constant" using 25°C volumes as $cm^3 O_2/cm^3$ p-xylene. Not a standard Ostwald coefficient.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The p-xylene is degassed by boiling and passed while hot into a 250 ml Erlenmeyer flask which contains p-xylene saturated oxygen. After equilibrium volume changes are recorded on a buret and the amount of p-xylene in a graduated cylinder. Measurements were carried out at 750 ±2 mm Hg. Henry's Law Constants were calculated from the measurements.

SOURCE AND PURITY OF MATERIALS:

(1) No details given.

(2) Enjay 99% pure with impurities being the o- and m-isomers.

ESTIMATED ERROR:

$\delta T/T = \pm 0.1$

δ(Henry's Constant) = ±3% (compiler)

REFERENCES:

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Aromatic hydrocarbons;
C_9H_{12} and $C_{10}H_{14}$

ORIGINAL MEASUREMENTS:

Naumenko, N. K.; Mukhin, N. N.
Aleskovskii, V. B.

Zh. Prikl. Khim. (Leningrad) 1969, *42*, 2522-8.

J. Appl. Chem. 1969, *42*, 2376-81.

VARIABLES:

T/K = 298.15
O_2 P/kPa = 101.325 (1 atm)

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

T/K	Mol Fraction $x_1 \times 10^4$	Bunsen Coefficient α	Ostwald Coefficient L
Propylbenzene; C_9H_{12}; [103-65-1]			
298.15	13.45	0.215 ± 0.0065	0.235
(1-methylethyl)benzene or isopropylbenzene or cumene; C_9H_{12}; [98-82-8]			
298.15	13.88	0.222 ± 0.0070	0.242
1-methyl-4-propylbenzene; $C_{10}H_{14}$; [1074-55-1]			
298.15	14.29	0.203 ± 0.0030	0.222
Butylbenzene; $C_{10}H_{14}$; [104-51-8]			
298.15	14.40	0.183 ± 0.0055	0.200
(1-methylpropyl)benzene or s-butylbenzene; $C_{10}H_{14}$; [135-98-8]			
298.15	15.69	0.208 ± 0.0026	0.227

The Ostwald coefficient values were calculated by the compiler.

The absolute errors are calculated from the results of three or four determinations.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The oxygen solubility was determined by a volumetric gas method.

The liquids were deaerated for 20 to 30 minutes under reduced pressure with the aid of an oil pump. The deaeration was monitored from the readings of a thermocouple vacuum gage.

The liquids were saturated with oxygen under an oxygen partial pressure of about 760 mmHg at 25°C for 2 hours. The amount of gas absorbed was then determined.

Details of the method are given in an earlier paper (1).

SOURCE AND PURITY OF MATERIALS:

The source and purity of the materials were not given.

ESTIMATED ERROR:

$\delta T/K = 0.1$
$\delta\alpha/\alpha = 0.023$ (relative)

REFERENCES:

1. Naumenko, N. K.; Mukhin, N. N. Aleskovskii, V. B. *Zh. Prikl. Khim.* 1969, *42*, 2090.

COMPONENTS:	EVALUATOR:
(1) Oxygen; O_2; [7782-44-7] (2) Alcohols	H. L. Clever Department of Chemistry Emory University Atlanta, GA 30322 USA 1981, March

CRITICAL EVALUATION:

An Evaluation of the Mole Fraction Solubility of Oxygen in Alcohols at an Oxygen Partial Pressure of 101.325 kPa (1 atm).

The solubility measurements evaluated in this section were carried out at an oxygen partial pressure of 200 kPa or less. Most of the measurements were made at a total pressure near 101.325 kPa (1 atm). The mole fraction solubility values are calculated for an oxygen partial pressure of 101.325 kPa assuming the gas is ideal, Henry's constant is obeyed, and the Ostwald coefficient is independent of pressure. The assumptions probably introduce a total error that is smaller than the experimental error of the solubility measurement.

Most of the oxygen solubility measurements were made with pure oxygen, but some were made with air at a pressure near 101.325 kPa, which has an oxygen partial pressure of about 21.3 kPa (0.21 atm). Both volumetric methods and chemical methods were used to determine the oxygen dissolved in the saturated solution.

Oxygen solubility values from twelve papers are evaluated. Only the results of Carius (1) are rejected. All other solubility values are classed as tentative. The results of Kretschmer, Nowakowska, and Wiebe (6) and Battino *et al.* (10, 11) are preferred wherever there is a choice.

The experimental methods used by the authors of the twelve papers are varied. Carius (1) used the original Bunsen technique. His results are high and should be rejected. Timofeev (2) used the original Ostwald technique. His results compare well with modern values. Metschl (3) saturated the solvent at oxygen pressures up to 456 kPa (4.5 atm). The solubility value he reports is essentially the volume of oxygen "shaken out" of the supersaturated solution as the pressure drops from 202 to 101 kPa (2 to 1 atm). His results appear to have a higher uncertainty than the others. Cauquil (4) used an Ostwald-like technique. Some of her results are doubtful. Ijams (5) used a modified van Slyke method. He carefully applied all corrections but he used a small sample volume which in some cases appears to result in a greater than average uncertainty.

Kretschmer, Nowakowska, and Wiebe (6) used the method of Horiuti. Their solvents were well characterized, and the experimental details of the measurement appear to have been carried out carefully. Schläpfer, Audykowski, and Bukowiecki (7) saturated the solvent with air and determined the dissolved oxygen iodimetrically. When their Ostwald coefficients are recalculated as mole fractions at 101.325 kPa oxygen pressure they compare well with other data at temperatures below 313 K. At higher temperatures their results appear to scatter. Shchukarev and Tolmacheva (8) use a volumetric method. Their results at a temperature of 288 K and below appear more reliable than their results at 298 K and above. Naumenko (9) uses a volumetric method. Battino *et al.* (10, 11) use a modified Morrison and Billett method. Their solvents are well characterized and the solubility measurement is carried out with care. Makranczy, Rusz, and Balog-Megyery (12) use a volumetric method to measure directly an Ostwald coefficient. In general their results at 298.15 K have appeared to be reliable while results at higher temperatures are not as reliable. (See evaluations in noble gas volumes of the *Solubility Series*). However, their results for many of the oxygen + alcohol systems they studied tend to be below average values when compared with other workers'results.

Oxygen + Methanol [67-56-1]

Kretschmer *et al.* (6) report solubility values at temperatures of 248.15, 273.15, 298.15, and 323.15 K. Makranczy *et al.* (12) report one value at 298.15 K which is 7.5 per cent lower than the Kretschmer *et al.* value. Although both sets of data are classed as tentative, the thermodynamic change and solubility values below are based on a linear regression of the Kretschmer *et al.* data.

The equation for use between 248.15 and 323.15 K is

$$\ln x_1 = -8.2471 + 1.3742/(T/100\ \mathrm{K})$$

with a standard error about the regression line of 3.67×10^{-6}.

The temperature independent thermodynamic changes for the transfer of one mole of oxygen from the gas at a partial pressure of 101.325 kPa to the infinitely dilute solution are

$$\Delta\bar{H}_1^\circ/\mathrm{kJ\ mol^{-1}}\ -1.142 \text{ and } \Delta\bar{S}_1^\circ/\mathrm{J\ K^{-1}\ mol^{-1}}\ -68.6$$

The smoothed solubility values and the Gibbs energy of solution are given in Table 1.

Table 1. Solubility of oxygen in methanol at an oxygen partial pressure of 101.325 kPa. Tentative values of mole fraction solubility and partial molar Gibbs energy of solution as a function of temperature.

T/K	Mol Fraction $10^4 x_1$	$\Delta\bar{G}_1^\circ$/kJ mol^{-1}
253.15	4.51	16.215
263.15	4.42	16.900
273.15	4.33	17.589
283.15	4.26	18.271
293.15	4.19	18.958
298.15	4.15	19.301
303.15	4.12	19.644
313.15	4.06	20.330
323.15	4.01	21.014

Oxygen + Ethanol [64-17-5]

The solubility of oxygen in ethanol is reported in at least eight papers. The results of Carius (1), a student of R. W. Bunsen, range from 18 per cent at 274 K to 28 per cent at 296 K greater than presently accepted values. The data are rejected.

The mole fraction solubility values at 298.15 K and an oxygen partial pressure of 101.325 kPa from the other papers are given below.

$10^4 x_1$	Reference
4.39	McKranczy *et al.* (12)
5.10	Metschl (3)
(5.53)[1]	Shchukarev and Tolmacheva (8)
(5.68)[2]	Timofeev (2)
5.74	Naumenko (9)
5.798	Kretschmer *et al.* (6)
(5.88)[3]	Schläpfer *et al.* (7)

[1] Extrapolated from the two measurements made at 277.15 and 285.15 K. The experimental value at 298.15 K is 6.78×10^{-4}.

[2] Extrapolated from the seven measurements made between 273.15 and 296.55 K.

[3] Interpolated from the eight measurements made between 273.15 and 343.15 K.

The mole fraction solubility values from the seven papers were compared. In general the higher values were favored if there were no other good reasons for a decision. A linear regression was carried out using the Kretschmer *et al.* data weighted two times; and at a weight of one, the Timofeev data, except the 296.55 K value; the Schläpfer *et al.* data; the Shchukarev and Tolmacheva value at 277.15 K and the Naumenko value. The linear regression of the 24 temperature/solubility pairs gives the equation for use between 248.15 and 343.15 K

$$\ln x_1 = -7.8738 + 1.2693/(T/100\ \mathrm{K})$$

with a standard deviation about the regression line of 1.13 x 10^{-5}.

The temperature independent thermodynamic changes in enthalpy and entropy for the transfer of one mole of oxygen from the gas at a partial pressure of 101.325 kPa to the infinitely dilute solution are

$$\Delta\bar{H}_1^\circ/\mathrm{kJ\ mol^{-1}}\ -1.055 \text{ and } \Delta\bar{S}_1^\circ/\mathrm{J\ K^{-1}\ mol^{-1}}\ -65.5$$

The smoothed solubility values and the Gibbs energy of solution are given in Table 2.

Table 2. Solubility of oxygen in ethanol at an oxygen partial pressure of 101.325 kPa. Tentative values of the mole fraction solubility and partial Gibbs energy of solution as a function of temperature.

T/K	Mol Fraction[1] $10^4 x_1$	$\Delta\bar{G}_1^\circ$/kJ $\mathrm{mol^{-1}}$
253.15	6.285	15.517
263.15	6.165	16.172
273.15	6.055	16.827
283.15	5.960	17.481
293.15	5.870	18.136
298.15	5.825	18.463
303.15	5.785	18.790
313.15	5.700	19.445
323.15	5.635	20.100
333.15	5.570	20.754
343.15	5.510	21.409

[1] Mole fraction values rounded to the nearest 0.005 x 10^{-4}.

A definitive study of the oxygen + ethanol system is yet to be carried out. Thus, the data of Table 2 are classed as tentative.

The equation and smoothed data based on the data of Kretschmer *et al.* (see their data sheet) may be an equally satisfactory representation of the system. From the equation based on their data $\Delta\bar{H}_1^\circ$/kJ $\mathrm{mol^{-1}}$ is -1.32 and $\Delta\bar{S}_1^\circ$/J $\mathrm{K^{-1}\ mol^{-1}}$ is -66.3.

Oxygen + 1-Propanol [71-23-8]

Makranczy *et al.* (12) report one solubility value at 298.15 K which is a mole fraction of 5.03 x 10^{-4}. It is classed as tentative.

Oxygen + 2-Propanol [67-63-0]

Only Kretschmer *et al.* (6) have reported solubility measurements on the oxygen + 2-propanol system. A linear regression of their three measurements over the temperature interval of 273.15 to 323.15 K gives the equation

$$\ln x_1 = -7.5774 + 1.2638/(T/100\ \mathrm{K})$$

with a standard error about the regression line of 9.35 x 10^{-6}.

The temperature independent thermodynamic changes in enthalpy and entropy for the transfer of one mole of oxygen from the gas at a partial pressure of 101.325 kPa to the infinitely dilute solution are

$$\Delta\bar{H}_1^\circ/\text{kJ mol}^{-1}\ -1.051 \text{ and } \Delta\bar{S}_1^\circ/\text{J K}^{-1}\text{ mol}^{-1}\ -63.0.$$

The smoothed values of the mole fraction solubility and the Gibbs energy are in Table 3.

Table 3. The solubility of oxygen in 2-propanol at an oxygen partial pressure of 101.325 kPa. Tentative values of the mole fraction solubility and partial molar Gibbs energy of solution as a function of temperature.

T/K	Mol Fraction $10^4 x_1$	$\Delta\bar{G}_1^\circ$/kJ mol^{-1}
273.15	8.13	16.158
283.15	8.00	16.788
293.15	7.88	17.418
298.15	7.82	17.733
303.15	7.77	18.048
313.15	7.66	18.678
323.15	7.57	19.308

Oxygen + 1-Butanol [71-36-3]

Kretschmer *et al.* (6) report three solubility values at the temperatures 273.15, 298.15 and 323.15 K. Makranczy *et al.* (12) report one value at 298.15 K which is 27 per cent smaller than the Kretschmer *et al.* (6) value. Although both sets of data are classed as tentative, the values of the thermodynamic changes and the solubility values below are based on a linear regression of the Kretschmer *et al.* data.

The equation for use between 273.15 and 323.15 K is

$$\ln x_1 = -7.6234 + 1.4553/(T/100\text{ K})$$

with a standard error about the regression line of 8.71×10^{-6}.

The temperature independent thermodynamic changes in enthalpy and entropy for the transfer of one mole of oxygen from the gas at a partial pressure of 101.325 kPa to the infinitely dilute solution are

$$\Delta\bar{H}_1^\circ/\text{kJ mol}^{-1}\ -1.210 \text{ and } \Delta\bar{S}_1^\circ/\text{J K}^{-1}\text{ mol}^{-1}\ -63.4$$

The smoothed values of mole fraction solubility and Gibbs energy of solution are in Table 4.

Table 4. The solubility of oxygen in 1-butanol at an oxygen partial pressure of 101.325 kPa. Tentative values of the mole fraction solubility and partial molar Gibbs energy of solution as a function of temperature.

T/K	Mol Fraction $10^4 x_1$	$\Delta\bar{G}_1^\circ$/kJ mol^{-1}
273.15	8.33	16.103
283.15	8.17	16.737
293.15	8.03	17.371
298.15	7.96	17.688
303.15	7.90	18.005
313.15	7.78	18.322
323.15	7.67	19.292

Oxygen + 2-methyl-1-propanol [78-83-1]

Only Battino *et al.* (10) have reported data on this system. A linear regression of their eight measurements between 274.09 and 327.96 K gives the equation

$$\ln x_1 = -7.9459 + 2.5735/(T/100\ \mathrm{K})$$

with a standard error about the regression line of 9.40×10^{-6}.

The temperature independent thermodynamic changes in enthalpy and entropy for the transfer of one mole of oxygen from the gas at a partial pressure of 101.325 kPa to the infinitely dilute solution are

$$\Delta\bar{H}_1^\circ/\mathrm{kJ\ mol^{-1}}\ -2.140 \text{ and } \Delta\bar{S}_1^\circ/\mathrm{J\ K^{-1}\ mol^{-1}}\ -66.1$$

The smoothed values of the mole fraction solubility and the Gibbs energy are in Table 5.

Table 5. The solubility of oxygen in 2-methyl-1-propanol at an oxygen partial pressure of 101.325 kPa. Tentative values of the mole fraction solubility and partial molar Gibbs energy of solution as a function of temperature.

T/K	Mol Fraction $10^4 x_1$	$\Delta\bar{G}_1^\circ$/kJ mol^{-1}
273.15	9.08	15.906
283.15	8.79	16.567
293.15	8.52	17.227
298.15	8.395	17.558
303.15	8.28	17.888
313.15	8.05	18.548
323.15	7.85	19.209

Oxygen + 1-Pentanol [71-41-0]
Oxygen + 1-Hexanol [111-27-3]

Makranczy *et al.* (12) report one solubility value on each of these systems at 298.15 K. The values are classed as tentative. However, when the values are compared with the solubility values for the other normal alcohols there is reason to suspect these values may be low.

T/K	Alcohol	Mol Fraction $10^4 x_1$
298.15	1-Pentanol	6.30
298.15	1-Hexanol	7.06

Oxygen + 1-Heptanol [111-70-6]

Both Makranczy *et al.* (12) and Ijams (5) report a single solubility value at 298.15 K. The mole fraction solubility values at 101.325 kPa oxygen partial pressure are

Ijams	10.8×10^{-4}
Makranczy *et al.*	7.59×10^{-4}

Although the two values differ by 30 per cent both are classed as tentative. However, in view of the trends in solubility with alcohol carbon number, the Ijams value is preferred.

Oxygen + 1-Octanol [111-87-5]

The following mole fraction solubility values are reported at 298.15 K and 101.325 kPa oxygen partial pressure

Ijams (5)	11.5×10^{-4}
Wilcock *et al.* (11)	11.3×10^{-4}
Makranczy *et al.* (12)	11.8×10^{-4}

The agreement is satisfactory.

Wilcock *et al.* report a second value at 283.35 K.

The tentative values for the system are based on the two determinations by Wilcock *et al.* The equation, based on only two experiments, should be used with caution.

$$\ln x_1 = -7.2357 + 1.3472/(T/100\ \mathrm{K})$$

The temperature independent changes in enthalpy and entropy for the transfer of one mole of oxygen from the gas phase at a partial pressure of 101.325 kPa to the infinitely dilute solution are

$$\Delta\bar{H}_1^\circ/\mathrm{kJ\ mol^{-1}}\ -1.120 \text{ and } \Delta\bar{S}_1^\circ/\mathrm{J\ K^{-1}\ mol^{-1}}\ -60.2$$

The smoothed values of the mole fraction solubility and the Gibbs energy are in Table 6.

Table 6. The solubility of oxygen in 1-octanol at an oxygen partial pressure of 101.325 kPa. Tentative values of the mole fraction solubility and partial molar Gibbs energy of solution as a function of temperature.

T/K	Mol Fraction $10^4 x_1$	$\Delta\bar{G}_1^\circ$/kJ mol^{-1}
283.15	11.6	15.914
288.15	11.5	16.215
293.15	11.4	16.516
298.15	11.3	16.817

Oxygen + 1-Nonanol [143-08-8]

Makranczy *et al.* (12) report one measurement at 298.15 K which is classed as tentative. It is equivalent to a mole fraction solubility at 101.325 kPa oxygen of 8.86×10^{-4}.

Oxygen + 1-Decanol [112-30-1]

Wilcock *et al.* (11) report solubility values at 282.74, 298.10 and 313.56. Makranczy *et al.* (12) report one value at 298.15. Both sets of solubility values are classed as tentative, but the values given below are based on a linear regression of the Wilcock *et al.* data only.

$$\ln x_1 = -6.9009 + 0.6185/(T/100\ \mathrm{K})$$

with a standard error about the regression line of 2.48×10^{-5}.

The temperature independent changes in enthalpy and entropy for the transfer of one mole of oxygen from the gas phase at a partial pressure of 101.325 kPa to the infinitely dilute solution are

$$\Delta\bar{H}_1^\circ/\mathrm{kJ\ mol^{-1}}\ -0.514 \text{ and } \Delta\bar{S}_1^\circ/\mathrm{J\ K^{-1}\ mol^{-1}}\ -57.4$$

The smoothed values of the mole fraction solubility and the Gibbs energy are in Table 7.

Table 7. The solubility of oxygen in 1-decanol at an oxygen partial pressure of 101.325 kPa. Tentative values of the mole fraction solubility and partial molar Gibbs energy of solution as a function of temperature.

T/K	Mol Fraction 10^4x_1	$\Delta\bar{G}_1^\circ$/kJ mol^{-1}
283.15	12.53	15.732
293.15	12.43	16.306
298.15	12.39	16.592
303.15	12.35	16.879
313.15	12.27	17.453

Oxygen + 1-Undecanol [112-42-5]
Oxygen + 1-Dodecanol [112-53-8]

Makranczy *et al.* (12) report one solubility value on each system at 298.15 K. The values are classed as tentative.

T/K	Alcohol	Mol Fraction 10^4x_1
298.15	1-Undecanol	10.3
298.15	1-Dodecanol	10.8

Oxygen + Cyclohexanol [108-93-0]

Cauquil (4) reports one value at 299.15 K. The mole fraction of 8.55×10^{-4} is classed as tentative.

References:

1. Carius, L. *J. Liebigs Ann. Chem.* 1855, *94*, 129.
2. Timofeev, W. *Z. Physik. Chem.* 1890, *6*, 141.
3. Metschl, J. *J. Phys. Chem.* 1924, *28*, 53.
4. Cauquil, G. *J. Chim. Phys.* 1927, *24*, 53.
5. Ijams, C. C. Ph.D. thesis, Vanderbilt University, 1941, Nashville, TN.
6. Kretschmer, C. B.; Nowakowska, J.; Wiebe, R. *Ind. Eng. Chem.* 1946, *38*, 506.
7. Schläpfer, P.; Audykowski, T.; Bukowiecki, A. *Schweiz. Arch. Angew. Wiss. Tech.* 1949, *15*, 299.
8. Shchukarev, S. A.; Tolmacheva, T. A. *Zh. Strukt. Khim.* 1968, *9*, 21.
9. Naumenko, N. K. Candidates thesis, 1970, Leningrad.
10. Battino, R.; Evans, F. D.; Danforth, W. F.; Wilhelm, E. *J. Chem. Thermodyn.* 1971, *3*, 743.
11. Wilcock, R. J.; Battino, R.; Danforth, W. F.; Wilhelm, E. *J. Chem. Thermodyn.* 1978, *10*, 317.
12. Makranczy, J.; Rusz, L.; Balog-Megyery, K. *Hung. J. Ind. Chem.* 1979, *7*, 41.

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Methanol; CH_4O; [67-56-1]

ORIGINAL MEASUREMENTS:

Kretschmer, C. B.; Nowakowska, J.; Wiebe, R.

Ind. Eng. Chem. 1946, *38*, 506-9.

VARIABLES:

T/K = 248.15 - 323.15
P/kPa = 101.325

PREPARED BY:

P. L. Long
H. L. Clever

EXPERIMENTAL VALUES:

T/K	Mol Fraction $x_1 \times 10^3$	Bunsen Coefficient α	Ostwald Coefficient L
248.15	0.4580	0.2672	0.2427
273.15	0.4315	0.2446	0.2446
298.15	0.4122	0.2268	0.2476
323.15	0.4038	0.2155	0.2550

The Ostwald coefficients were measured at a total pressure of 101.325 kPa (1 atm). The compiler calculated the Bunsen coefficient and mole fraction values for an oxygen partial pressure of 101.325 kPa (1 atm) assuming the Ostwald coefficient was independent of pressure.

Smoothed Data: $\ln x_1 = -8.2471 + 1.3742/(T/100K)$

Standard error about the regression line = 3.67×10^{-6}

T/K	Mol Fraction $x_1 \times 10^3$
253.15	0.4509
263.15	0.4417
273.15	0.4333
283.15	0.4257
293.15	0.4187
298.15	0.4154
303.15	0.4123
313.15	0.4064
323.15	0.4009

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The apparatus was similar to that of Horiuti (1), it consisted of a gas buret, manometer, and absorption pipet equipped with a magnetic stirrer. All volumes were calibrated by mercury displacement.

The solvent was partly degassed by boiling under reflux. About 40 cm^3 of solvent was admitted into the absorption pipet, and pumped on to complete the degassing. Dry gas, measured in the buret, was admitted, final equilibrium was established after 1 to 3 hours stirring. During the solution process the total pressure was kept at one atm by additions of dry gas.

The solubility value was corrected for the increase of solvent volume with gas absorption, and for the nitrogen impurity in the oxygen.

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. Source not given. Contained 0.4 per cent N_2.
Passed through Drierite to dry.

(2) Methanol. Source not given. Distilled, dried with metallic Al,
b.p. (760 mmHg)/°C 64.50,
density, $\rho_4^{25}/g\ cm^{-3}$ 0.78650.

ESTIMATED ERROR:

Gas buret $\delta V/cm^3 = 0.005$
Average deviation from the mean 0.3%, maximum deviation 0.9% (authors).

REFERENCES:

1. Horiuti, J. *J. Sci Papers Inst. Phys. Chem. Res. (Tokyo)* 1931, *17*, 125.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Oxygen; O_2; [7782-44-7] (2) Methanol; CH_4O; [67-56-1]	Makranczy, J.; Rusz, L.; Balog-Megyery, K. *Hung. J. Ind. Chem.* 1979 *7*, 41-6.
VARIABLES:	PREPARED BY:
T/K = 298	C.L. Young

EXPERIMENTAL VALUES:

T/K	P^{+}/kPa	Ostwald coefficient,	Mole fraction of oxygen*, x_{O_2}
298.15	101.3	0.229	0.000381

* calculated by compiler

\+ partial pressure of oxygen

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

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

SOURCE AND PURITY OF MATERIALS:

No details given

ESTIMATED ERROR:

$\delta x_{O_2} = \pm 3\%$

REFERENCES:

1. Bodor, E.; Bor, Gy.; Mohai, B.; Sipos, G. *Veszpremi Vegyip. Egy. Kozl.* 1957, *1*, 55. *Chem. Abstr.* 1961, *55*, 3175h.

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Ethanol; C_2H_6O; [64-17-5]

ORIGINAL MEASUREMENTS:

Timofeev, W.

Z. Physik. Chem. 1890, *6*, 141-52.

VARIABLES:

T/K = 273-297
P/kPa = 101.325

PREPARED BY:

R. Battino, H. L. Clever

EXPERIMENTAL VALUES:

t/°C	T^a/K	10^4x_1 ^{a,b}	$L^{a,c}$	$\alpha^d/\text{cm}^3(\text{STP})\text{cm}^{-3}\text{atm}^{-1}$
First series				
0	273.15	5.946	0.23344	0.23344(3)
6.35	279.65	5.885	0.23493	0.22947(4)
11.3	284.45	5.810	0.23467	0.22535(3)
17.1	290.25	5.750	0.23552	0.22164(4)
23.4	296.55	5.704	0.23707	0.21836(2)
Second series				
3.5	276.65	5.911	0.23419	0.23123(2)
15.1	288.25	5.774	0.23539	0.22306(1)

[a] Calculated by compiler.

[b] Mole fraction solubility at 101.325 kPa partial pressure of gas.

[c] Ostwald coefficient.

[d] Bunsen coefficient. Number in parentheses is the number of observations.

[e] All measurements in 99.7 wt % ethanol.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Used a Bunsen absorption apparatus as modified by Ostwald. Basically, a manometric/volumetric apparatus. Details and a drawing are given in the paper.

SOURCE AND PURITY OF MATERIALS:

No details given.

ESTIMATED ERROR:

$\delta\alpha/\alpha = \pm 0.01$, compiler's estimate.

REFERENCES:

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Ethanol; C_2H_6O; [64-17-5]

ORIGINAL MEASUREMENTS:

Metschl, J.

J. Phys. Chem. 1924, *28*, 417-37.

VARIABLES:

T/K = 298.15
P/kPa = 101.325

PREPARED BY:

M. E. Derrick
H. L. Clever

EXPERIMENTAL VALUES:

T/K	Mol Fraction $x_1 \times 10^4$	Bunsen Coefficient α	Ostwald Coefficient L
298.15	5.10	0.195	0.213

The compiler calculated the mole fraction and Ostwald coefficient values.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The degassed solvent is saturated with oxygen at 6 to 10 different pressures between 1.5 and 4.5 atm.

The pressure is reduced to one atm, and the "supersaturated gas" is shaken out of the solvent and measured.

The slope of a plot of the volume of gas reduced to standard conditions shaken out of 100 cm^3 of solvent *vs.* the pressure of saturation is nearly identical to the solubility-pressure graph (Henry's law). The slope of the curve is used to obtain the Bunsen coefficient. From the method of calculation the value represents the volume of gas shaken out of the solvent when the pressure is reduced from 2 to 1 atm.

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. Commercial cylinder. Prepared by Linde process, 97 per cent pure.

(2) Ethanol. Treated with metallic sodium and distilled. Specific gravity 0.7992 at 15 °C. About 98 per cent pure.

ESTIMATED ERROR:

REFERENCES:

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Ethanol; C_2H_6O; [64-17-5]

ORIGINAL MEASUREMENTS:

Kretschmer, C. B.; Nowakowska, J.; Wiebe, R.

Ind. Eng. Chem. 1946, *38*, 506-9.

VARIABLES:

$T/K = 248.15 - 323.15$
$P/kPa = 101.325$

PREPARED BY:

P. L. Long
H. L. Clever

EXPERIMENTAL VALUES:

T/K	Mol Fraction $x_1 \times 10^3$	Bunsen Coefficient α	Ostwald Coefficient L
248.15	0.6523	0.2627	0.2387
273.15	0.6140	0.2409	0.2409
298.15	0.5798	0.2214	0.2417
323.15	0.5646	0.2097	0.2481

The Ostwald coefficients were measured at a total pressure of 101.325 kPa (1 atm). The compiler calculated the Bunsen coefficient and mole fraction values for an oxygen partial pressure of 101.325 kPa (1 atm) assuming the Ostwald coefficient was independent of pressure.

Smoothed Data: $\ln x_1 = -7.9758 + 1.5846/(T/100K)$

Standard error about the regression line = 4.37×10^{-6}

T/K	Mol Fraction $x_1 \times 10^3$
253.15	0.6427
263.15	0.6276
273.15	0.6139
283.15	0.6014
293.15	0.5901
298.15	0.5848
303.15	0.5796
313.15	0.5701
323.15	0.5612

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The apparatus was similar to that of Horiuti (1), it consisted of a gas buret, manometer, and absorption pipet equipped with a magnetic stirrer. All volumes were calibrated by mercury displacement.

The solvent was partly degassed by boiling under reflux. About 40 cm^3 of solvent was admitted into the absorption pipet, and pumped on to complete the degassing. Dry gas, measured in the buret, was admitted, final equilibrium was established after 1 to 3 hours stirring. During the solution process the total pressure was kept at one atm by additions of dry gas.

The solubility value was corrected for the increase of solvent volume with gas absorption, and for the nitrogen impurity in the oxygen.

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. Source not given. Contained 0.4 per cent N_2.

Passed through Drierite to dry.

(2) Ethanol. Source not given. Dried with Mg. Density, $\rho/g\ cm^{-3}$ 0.78508.

ESTIMATED ERROR:

Gas buret $\delta V/cm^3 = 0.005$
Average deviation from the mean 0.3%, maximum deviation 0.9% (authors).

REFERENCES:

1. Horiuti, J. *J. Sci Papers Inst. Phys. Chem. Res. (Tokyo)* 1931, *17*, 125.

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Ethanol; C_2H_6O; [64-17-5]

ORIGINAL MEASUREMENTS:

Schläpfer, P.; Audykowski, T.; Bukowiecki, A.

Schweiz. Arch. Angew. Wiss. Tech. 1949, *15*, 299-307.

VARIABLES:

T/K = 273 - 343

PREPARED BY:

R. Battino

EXPERIMENTAL VALUES:

t/°C	T^a/K	L^b
0	273	0.242
10	283	0.243
20	293	0.244
30	303	0.243
40	313	0.244
50	323	0.250
60	333	0.253
70	343	0.262

[a] Calculated by compiler.

[b] Ostwald coefficient.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The solvent was saturated with air and the dissolved oxygen determined iodimetrically.

SOURCE AND PURITY OF MATERIALS:

(1) From air.

(2) Specific gravity of 0.789 g cm^{-3} at 20°C.

ESTIMATED ERROR:

$\delta L/L = \pm 0.025$, authors' estimate.

REFERENCES:

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Ethanol; C_2H_6O; [64-17-5]

ORIGINAL MEASUREMENTS:

Shchukarev, S.A.; Tolmacheva, T.A.

Zh. Strukt. Khim. 1968, 9, 21-8;
J.Struct. Chem. 1968, 9, 16-21.

VARIABLES:

T/K = 277-323
P/kPa = 101.325

PREPARED BY:

R. Battino

EXPERIMENTAL VALUES:

T/K[a]	Mole Fraction[b] 10^4x_1	Ostwald Coeff.[c] L	Mole Percent[d]
277.15	5.875	0.233	99.2
285.15	5.734	0.232	99.8
298.15	6.784	0.283	99.8
323.15	4.141	0.182	99.9

[a] Temperature reported to 1°C, but as integer values, i.e., 4,12,25, 50°C.

[b] Mole fraction solubility at 101.325 kPa (latm) partial pressure of gas calculated by compiler.

[c] Ostwald coefficient.

[d] Mole per cent purity of ethanol. Remainder is water.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Degassed solvent is transferred to an absorption vessel. The solvent is sealed over mercury. Gas is added and stirring accomplished with a magnetic bob. Uptake of gas is read on a gas buret system which is thermostatted along with the absorption vessel. Details of operation and a drawing are in the original paper. The paper also reports the solubility of oxygen in water/ethanol mixtures, 0-100%.

SOURCE AND PURITY OF MATERIALS:

(1) Prepared by electrolysis of NaOH solution, followed by removal of hydrogen traces, and thoroughly dried before use. No purity given.

(2) Dried to at least 99.7%.

ESTIMATED ERROR:

$\delta L/L = \pm 0.01$, estimate by compiler.

REFERENCES:

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Ethanol; C_2H_6O; [64-17-5]

ORIGINAL MEASUREMENTS:

Naumenko, N. K.

Candidates thesis, 1970, Leningrad.

VARIABLES:

T/K = 298.15
P/kPa = 101.325

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

T/K	Mol Fraction $x_1 \times 10^4$	Bunsen Coefficient α	Ostwald Coefficient L
298.15	5.74	0.219	0.239

The mole fraction solubility value is quoted in (1)

The Bunsen and Ostwald coefficients were calculated by the compiler.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Probably used volumetric method described by Naumenko *et al.* (2).

SOURCE AND PURITY OF MATERIALS:

No information.

ESTIMATED ERROR:

REFERENCES:

1. Chaenko, N. V.; Sukhova, G. I.; Naumenko, N. K.; Kedrinskii, I. A. *Zh. Fiz. Khim.* 1979, *53*, 1989.

2. Naumenko, N. K.; Mukhin, N. N. Aleskovskii, V. B. *Zh. Prikl. Khim.* 1969, *42*, 2090.

COMPONENTS: (1) Oxygen; O_2; [7782-44-7] (2) Ethanol; C_2H_6O; [64-17-5]	ORIGINAL MEASUREMENTS: Makranczy, J.; Rusz, L.; Balog-Megyery, K. *Hung. J. Ind. Chem.* 1979, *7*, 41-6.
VARIABLES: T/K = 298	PREPARED BY: C.L. Young

EXPERIMENTAL VALUES:

T/K	P^+kPa	Ostwald coefficient	Mole fraction of oxygen*, x_{O_2}
298.15	101.3	0.186	0.000439

* Calculated by compiler

\+ Partial pressure of oxygen

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE: Volumetric method. The apparatus of Bodor, Bor, Mohai, and Sipos (1) was used.	SOURCE AND PURITY OF MATERIALS: No details given.
	ESTIMATED ERROR: $\delta x_{O_2} = \pm 3\%$
	REFERENCES: 1. Bodor, E.; Bor, Gy.; Mohai, B.; Sipos, G. *Veszpremi Vegyip. Egy. Kozl.* 1957, *1*, 55. *Chem. Abstr.* 1961, *55*, 3175h

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Oxygen; O_2; [7782-44-7] (2) 1-Propanol; C_3H_8O; [71-23-8]	Makranczy, J.; Rusz, L.; Balog - Megyery, K. *Hung. J. Ind. Chem.* 1979, *7*, 41-6.
VARIABLES:	PREPARED BY:
T/K = 298	C.L. Young.

EXPERIMENTAL VALUES:

T/K	P^+/kPa	Ostwald coefficient	Mole fraction of oxygen*,x_{O_2}
298.15	101.3	0.164	0.000503

* calculated by compiler

\+ partial pressure of oxygen

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

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

SOURCE AND PURITY OF MATERIALS:

No details given.

ESTIMATED ERROR:

$\delta x_{O_2} = \pm 3\%$

REFERENCES:

1. Bodor, E.; Bor, Gy.; Mohai, B.; Sipos, G. *Veszpremi Vegyip. Egy. Kozl.* 1957, *1*, 55. *Chem. Abstr.* 1961, *55*, 3175h.

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) 2-Propanol or isopropyl alcohol; C_3H_8O; [67-63-0]

ORIGINAL MEASUREMENTS:

Kretschmer, C. B.; Nowakowska, J.; Wiebe, R.

Ind. Eng. Chem. 1946, *38*, 506-9.

VARIABLES:

T/K = 273.15 - 323.15
P/kPa = 101.325

PREPARED BY:

P. L. Long
H. L. Clever

EXPERIMENTAL VALUES:

T/K	Mol Fraction $x_1 \times 10^3$	Bunsen Coefficient α	Ostwald Coefficient L
273.15	0.8167	0.2443	0.2443
298.15	0.7745	0.2256	0.2463
323.15	0.7609	0.2157	0.2552

The Ostwald coefficients were measured at a total pressure of 101.325 kPa (1 atm). The compiler calculated the Bunsen coefficient and mole fraction values for an oxygen partial pressure of 101.325 kPa (1 atm) assuming the Ostwald coefficient was independent of pressure.

Smoothed Data: $\ln x_1 = -7.5774 + 1.2638/(T/100K)$

Standard error about the regression line = 9.35×10^{-6}

T/K	Mol Fraction $x_1 \times 10^3$
273.15	0.813
283.15	0.800
293.15	0.788
298.15	0.782
303.15	0.777
313.15	0.766
323.15	0.757

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The apparatus was similar to that of Horiuti (1), it consisted of a gas buret, manometer, and absorption pipet equipped with a magnetic stirrer. All volumes were calibrated by mercury displacement.

The solvent was partly degassed by boiling under reflux. About 40 cm^3 of solvent was admitted into the absorption pipet, and pumped on to complete the degassing. Dry gas, measured in the buret, was admitted, final equilibrium was established after 1 to 3 hours stirring. During the solution process the total pressure was kept at one atm by additions of dry gas.

The solubility value was corrected for the increase of solvent volume with gas absorption, and for the nitrogen impurity in the oxygen.

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. Source not given. Contained 0.4 per cent N_2.
Passed through Drierite to dry.

(2) 2-Propanol. Source not given. Distilled, dried with metallic Al,
b.p. (760 mmHg)/°C 82.24,
density, ρ_4^{25}/g cm^{-3} 0.78081.

ESTIMATED ERROR:

Gas buret $\delta V/cm^3 = 0.005$
Average deviation from the mean 0.3%, maximum deviation 0.9% (authors).

REFERENCES:

1. Horiuti, J.
J. Sci Papers Inst. Phys. Chem. Res. (Tokyo) 1931, *17*, 125.

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

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

ORIGINAL MEASUREMENTS:

Kretschmer, C. B.; Nowakowska, J.; Wiebe, R.

Ind. Eng. Chem. 1946, *38*, 506-9.

VARIABLES:

T/K = 273.15 - 323.15
P/kPa = 101.325

PREPARED BY:

P. L. Long
H. L. Clever

EXPERIMENTAL VALUES:

T/K	Mol Fraction $x_1 \times 10^3$	Bunsen Coefficient α	Ostwald Coefficient L
273.15	0.8363	0.2085	0.2085
298.15	0.7894	0.1924	0.2100
323.15	0.7707	0.1835	0.2171

The Ostwald coefficients were measured at a total pressure of 101.325 kPa (1 atm). The compiler calculated the Bunsen coefficient and mole fraction values for an oxygen partial pressure of 101.325 kPa (1 atm) assuming the Ostwald coefficient was independent of pressure.

Smoothed Data: $\ln x_1 = -7.6234 + 1.4553/(T/100K)$

Standard error about the regression line = 8.71×10^{-6}

T/K	Mol Fraction $x_1 \times 10^3$
273.15	0.833
283.15	0.817
293.15	0.803
298.15	0.796
303.15	0.790
313.15	0.778
323.15	0.767

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The apparatus was similar to that of Horiuti (1), it consisted of a gas buret, manometer, and absorption pipet equipped with a magnetic stirrer. All volumes were calibrated by mercury displacement.

The solvent was partly degassed by boiling under reflux. About 40 cm^3 of solvent was admitted into the absorption pipet, and pumped on to complete the degassing. Dry gas, measured in the buret, was admitted, final equilibrium was established after 1 to 3 hours stirring. During the solution process the total pressure was kept at one atm by additions of dry gas.

The solubility value was corrected for the increase of solvent volume with gas absorption, and for the nitrogen impurity in the oxygen.

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. Source not given. Contained 0.4 per cent N_2. Passed through Drierite to dry.

(2) 1-Butanol. Source not given. Distilled, dried with metallic Al, b.p. (760 mmHg)/°C 117.67, density, $\rho_4^{25}/g\ cm^{-3}$ 0.80573.

ESTIMATED ERROR:

Gas buret $\delta V/cm^3 = 0.005$
Average deviation from the mean 0.3%, maximum deviation 0.9% (authors).

REFERENCES:

1. Horiuti, J. *J. Sci Papers Inst. Phys. Chem. Res. (Tokyo)* 1931, *17*, 125.

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) 1-Butanol; $C_4H_{12}O$; [71-36-3]

ORIGINAL MEASUREMENTS:

Makranczy, J.; Rusz, L.;
Balog - Megyery, K.

Hung. J. Ind. Chem. 1979, *7*, 41-6.

VARIABLES:

T/K = 298

PREPARED BY:

C.L. Young

EXPERIMENTAL VALUES:

T/K	P^+/kPa	Ostwald coefficient,	Mole fraction of oxygen*, x_{O_2}
298.15	101.3	0.153	0.000575

* calculated by compiler

\+ partial pressure of oxygen

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

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

SOURCE AND PURITY OF MATERIALS:

No details given

ESTIMATED ERROR:

$\delta x_{O_2} = \pm 3\%$

REFERENCES:

1. Bodor, E.; Bor, Gy.; Mohai, B.; Sipos, G.
Veszpremi Vegyip. Egy. Kozl. 1957, *1*, 55.
Chem. Abstr. 1961, *55*, 3175h.

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) 2-Methyl-1-propanol or Isobutanol;
C_4H_9OH; [78-83-1]

ORIGINAL MEASUREMENTS:

Battino. R.; Evans, F. D.;
Danforth. W. F.; Wilhelm, E.

J. Chem. Thermodyn. 1971, *3*, 743-51.

VARIABLES:

T/K = 274.09 - 327.96
P/kPa = 101.325

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

T/K	Mol Fraction $X_1 \times 10^3$	Bunsen Coefficient α	Ostwald Coefficient L
274.09	0.897	0.221	0.222
282.85	0.874	0.214	0.222
297.63	0.847	0.205	0.223
298.25	0.854	0.206	0.225
308.37	0.822	0.196	0.222
312.78	0.807	0.192	0.220
314.14	0.801	0.190	0.219
327.96	0.765	0.179	0.215

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

Smoothed Data: $\Delta G^o/J\ mol^{-1} = -RT\ ln\ X_1 = -2196.4 + 66.256\ T$

Std. Dev. ΔG^o = 26.3, Coef. Corr. = 0.9998

$\Delta H^o/J\ mol^{-1} = -2196.4$, $\Delta S^o/J\ K^{-1}\ mol^{-1} = -66.256$

T/K	Mol Fraction $X_1 \times 10^3$	$\Delta G^o/J\ mol^{-1}$
278.15	0.895	16,233
288.15	0.866	16,895
298.15	0.839	17,558
308.15	0.816	18,220
318.15	0.794	18,883
328.15	0.774	19,546

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

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

Degassing. Up to 500 cm^3 of solvent is placed in a flask of such size that the liquid is about 4 cm deep. The liquid is rapidly stirred, and vacuum is intermittently applied through a liquid N_2 trap until the permanent gas residual pressure drops to 5 microns.

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

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. Air Products and Chemicals Co. 99.6 per cent.

(2) 2-methyl-1-propanol. Fisher Co. Certified grade (99 mole per cent).

ESTIMATED ERROR:

$\delta T/K = 0.03$
$\delta P/mmHg = 0.5$
$\delta X_1/X_1 = 0.01$

REFERENCES:

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

2. Battino, R.; Evans, F. D.; Danforth, W. F. *J. Am. Oil Chem. Soc.* 1968, *45*, 830.

3. Battino, R.; Banzhof, M.; Bogan, M.; Wilhelm, E. *Anal. Chem.* 1971, *43*, 806.

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) 1-Pentanol; $C_5H_{12}O$; [71-41-0]
or
1-Hexanol; $C_6H_{14}O$; [111-27-3]

ORIGINAL MEASUREMENTS:

Makranczy, J.; Rusz, L.;
Balog-Megyery, K.

Hung. J. Ind. Chem. 1979, *7*, 41-6.

VARIABLES:

T/K = 298

PREPARED BY:

C.L. Young

EXPERIMENTAL VALUES:

T/K	P^+/kPa	Ostwald coefficient	Mole fraction of oxygen*, x_{O_2}
		1-Pentanol	
298.15	101.3	0.142	0.000630
		1-Hexanol	
298.15	101.3	0.138	0.000706

* calculated by compiler

\+ partial pressure of oxygen

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

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

SOURCE AND PURITY OF MATERIALS:

No details given.

ESTIMATED ERROR:

$\delta x_{O_2} = \pm 3\%$

REFERENCES:

1. Bodor, E.; Bor, Gy.; Mohai, B.; Sipos, G.
Veszpremi Vegyip. Egy. Kozl. 1957, *1*, 55.
Chem. Abstr. 1961, *55*, 3175h.

COMPONENTS: (1) Oxygen; O_2; [7782-44-7] (2) Aliphatic alcohols; $C_7H_{16}O$ and $C_8H_{18}O$	**ORIGINAL MEASUREMENTS:** Ijams, C. C. Ph.D. thesis, 1941, Vanderbilt University, Nashville, TN.
VARIABLES: T/K = 298.15 P/kPa = 101.325	**PREPARED BY:**

EXPERIMENTAL VALUES:

T/K	Mol Fraction $x_1 \times 10^3$	Bunsen Coefficient α	Ostwald Coefficient L
1-Heptanol; $C_7H_{16}O$; [111-70-6]			
298.15	1.08	0.171	0.187
1-Octanol; $C_8H_{18}O$; [111-87-5]			
298.15	1.15	0.163	0.178

The mole fraction and Ostwald coefficient values were calculated by the compiler.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

A Van Slyke-Neill Manometric Apparatus manufactured by the Eimer and Amend Co. was used.

The procedure of Van Slyke (1) for pure liquids was modified so that small solvent sample (2 cm^3) could be used with almost 100 per cent recovery of the solvent.

An improved temperature control system was used.

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. Air Reduction Co. Purity 99.5 per cent.

(2) Aliphatic alcohols. Purified. Vapor pressure and boiling point also reported in the thesis.

ESTIMATED ERROR:

$\delta T/K = 0.05$

REFERENCES:

1. Van Slyke, D. D. *J. Biol. Chem.* 1939, *130*, 545.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Oxygen; O_2; [7782-44-7] (2) 1-Heptanol; $C_7H_{16}O$; [111-70-6] or 1-Octanol; $C_8H_{18}O$; [111-87-5]	Makranczy, J.; Rusz, L.; Balog - Megyery, K. *Hung. J. Ind. Chem.* 1979, *7*, 41-6.
VARIABLES:	PREPARED BY:
T/K = 298	C.L. Young

EXPERIMENTAL VALUES:

T/K	P^+/kPa	Ostwald coefficient	Mole fraction of oxygen*, x_{O_2}
		1-Heptanol	
298.15	101.3	0.131	0.000759
		1-Octanol	
298.15	101.3	0.183**	0.00118

* calculated by compiler

\+ partial pressure of oxygen

** appears to be an error in table 1 of the source reference.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

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

SOURCE AND PURITY OF MATERIALS:

No details given

ESTIMATED ERROR:

$\delta x_{O_2} = \pm 3\%$

REFERENCES:

1. Bodor, E.; Bor, Gy.; Mohai, B.; Sipos, G. *Veszpremi Vegyip. Egy. Kozl.* 1957, *1*, 55. *Chem. Abstr.* 1961, *55*, 3175h.

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) 1-Octanol; $C_8H_{17}OH$; [111-87-5]

ORIGINAL MEASUREMENTS:

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

J. Chem. Thermodyn. 1978, *10*, 817-22.

VARIABLES:

T/K = 283.35 - 298.13

P/kPa = 101.325

PREPARED BY:

A. L. Cramer
H. L. Clever

EXPERIMENTAL VALUES:

T/K	Mol Fraction $X_1 \times 10^3$	Bunsen Coefficient α	Ostwald Coefficient L
283.35	1.159	0.1662	0.1724
298.13	1.132	0.1602	0.1749

The Bunsen coefficients were calculated by the compiler.

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

Smoothed Data: $\Delta G^o/J\ mol^{-1} = -RT \ln X_1 = -1120.1 + 60.160\ T$

$\Delta H^o/J\ mol^{-1} = -1120.1$, $\Delta S^o/J\ K^{-1}\ mol^{-1} = -60.160$

T/K	Mol Fraction $X_1 \times 10^3$	$\Delta G^o/J\ mol^{-1}$
283.15	1.16	15,914
288.15	1.15	16,215
293.15	1.14	16,516
298.15	1.13	16,816

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

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

Degassing. Up to 500 cm^3 of solvent is placed in a flask of such size that the liquid is about 4 cm deep. The liquid is rapidly stirred, and vacuum is intermittently applied through a liquid N_2 trap until the permanent gas residual pressure drops to 5 microns.

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

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. Air Products and Chemicals Co. 99.6 per cent.

(2) 1-octanol. Eastman Organic Chemicals. Distilled, density $\rho_{298.15} = 0.8247\ g\ cm^{-3}$

ESTIMATED ERROR:

$\delta T/K = 0.03$
$\delta P/mmHg = 0.5$
$\delta X_1/X_1 = 0.01$

REFERENCES:

1. Morrison, T. J.; Billett, F. *J. Chem. Soc.* 1948, 2033.
2. Battino, R.; Evans, F. D.; Danforth, W. F. *J. Am. Oil Chem. Soc.* 1968, *45*, 830.
3. Battino, R.; Banzhof, M.; Bogan, M.; Wilhelm, E. *Anal. Chem.* 1971, *43*, 806.

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) 1-Decanol; $C_{10}H_{21}OH$; [112-30-1]

ORIGINAL MEASUREMENTS:

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

J. Chem. Thermodyn. 1978, *10*, 817-22.

VARIABLES:

T/K = 282.74 - 313.56
P/kPa = 101.325

PREPARED BY:

A. L. Cramer

EXPERIMENTAL VALUES:

T/K	Mol Fraction $X_1 \times 10^3$	Bunsen Coefficient α	Ostwald Coefficient L
282.74	1.263	0.1496	0.1549
298.10	1.219	0.1428	0.1558
313.56	1.237	0.1429	0.1641

The Bunsen coefficients were calculated by the compiler.

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

Smoothed Data: $\Delta G^o/J\ mol^{-1} = -RT \ln X_1 = -475.93 + 57.247\ T$

Std. Dev. $\Delta G^o = 35.1$, Coef. Corr. = 0.9992

$\Delta H^o/J\ mol^{-1} = -475.9$, $\Delta S^o/J\ K^{-1}\ mol^{-1} = -57.247$

T/K	Mol Fraction $X_1 \times 10^3$	$\Delta G^o/J\ mol^{-1}$
278.15	1.26	15,447
288.15	1.25	16,020
298.15	1.24	16,592
308 15	1.23	17,165
318.15	1.22	17,737

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

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

Degassing. Up to 500 cm^3 of solvent is placed in a flask of such size that the liquid is about 4 cm deep. The liquid is rapidly stirred, and vacuum is intermittently applied through a liquid N_2 trap until the permanent gas residual pressure drops to 5 microns.

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

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. Air Products and Chemicals Co. 99.6 per cent.

(2) 1-Decanol. Eastman Organic Chemicals. Distilled density $\rho_{298.15} = 0.8206\ g\ cm^{-3}$.

ESTIMATED ERROR:

$\delta T/K = 0.03$
$\delta P/mmHg = 0.3$
$\delta X_1/X_1 = 0.01$

REFERENCES:

1. Morrison, T. J.; Billett, F. *J. Chem. Soc.* 1948, 2033.
2. Battino, R.; Evans, F. D.; Danforth, W. F. *J. Am. Oil Chem. Soc.* 1968, *45*, 830.
3. Battino, R.; Banzhof, M.; Bogan, M.; Wilhelm, E. *Anal. Chem.* 1971, *43*, 806.

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) 1-Nonanol; $C_9H_{20}O$; [143-08-8]
or
1-Decanol; $C_{10}H_{28}O$; [112-30-1]

ORIGINAL MEASUREMENTS:

Makranczy, J.; Rusz, L.;
Balog-Megyery, K.

Hung. J. Ind. Chem. 1979, *7*, 41-6.

VARIABLES:

T/K = 298

PREPARED BY:

C.L. Young

EXPERIMENTAL VALUES:

T/K	P^+/kPa	Ostwald coefficient	Mole fraction of oxygen*, x_{O_2}
		1-Nonanol	
298.15	101.3	0.124	0.000886
		1-Decanol	
298.15	101.3	0.122	0.000954

* calculated by compiler

\+ partial pressure of oxygen.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

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

SOURCE AND PURITY OF MATERIALS:

No details given.

ESTIMATED ERROR:

$\delta x_{O_2} = \pm 3\%$

REFERENCES:

1. Bodor, E.; Bor, Gy.; Mohai, B.; Sipos, G.
Veszpremi Vegyip. Egy. Kozl. 1957, *1*, 55.
Chem. Abstr. 1961, *55*, 3175h.

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) 1-Undecanol; $C_{11}H_{24}O$; [112-42-5]
or
1-Dodecanol; $C_{12}H_{26}O$; [112-53-8]

ORIGINAL MEASUREMENTS:

Makranczy, J.; Rusz, L.; Balog-Megyery, K.

Hung. J. Ind. Chem. 1979, *7*, 41-6.

VARIABLES:

T/K = 298

PREPARED BY:

C.L. Young

EXPERIMENTAL VALUES:

T/K	P^+/kPa	Ostwald coefficient	Mole fraction of oxygen*, x_{O_2}
		1-Undecanol	
298.15	101.3	0.121	0.00103
		1-Dodecanol	
298.15	101.3	0.118	0.00108

* calculated by compiler

\+ partial pressure of oxygen

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

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

SOURCE AND PURITY OF MATERIALS:

No details given.

ESTIMATED ERROR:

$\delta x_{O_2} = \pm 3\%$

REFERENCES:

1. Bodor, E.; Bor, Gy.; Mohai, B.; Sipos. G.
Veszpremi Vegyip. Egy. Kozl. 1957, *1*, 55.
Chem. Abstr. 1961, *55*, 3175h

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Cyclohexanol; $C_6H_{14}O$; [108-93-0]

ORIGINAL MEASUREMENTS:

Cauquil, G.

J. Chim. Phys. 1927, *24*, 53-5.

VARIABLES:

T/K = 299.15
P/kPa = 102.125

PREPARED BY:

P. L. Long
H. L. Clever

EXPERIMENTAL VALUES:

T/K	Mol Fraction $x_1 \times 10^4$	Bunsen Coefficient α	Ostwald Coefficient L
299.15	8.55	0.181	0.198

The author reported the Ostwald coefficient. The compiler calculated the Bunsen coefficient and the mole fraction solubility values for 101.325 kPa (1 atm).

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The apparatus consists of a flask and a mercury leveling bulb to control the pressure.

The solvent volume was measured, the gas introduced over the solvent. The gas absorbed was found by difference between the initial and final gas volumes.

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. Purity not stated.

(2) Cyclohexanol. Source not given. Distilled. B.p. (766 mmHg) T/K 334.0. Degassed and tested to be air free.

ESTIMATED ERROR:

$\delta L/L = 0.05$ (compiler)

REFERENCES:

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

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

ORIGINAL MEASUREMENTS:

Metschl, J.

J. Phys. Chem. 1924, *28*, 417-37.

VARIABLES:

$T/K = 298.15$

$P/kPa = 101.325$

PREPARED BY:

M. E. Derrick
H. L. Clever

EXPERIMENTAL VALUES:

T/K	Mol Fraction $x_1 \times 10^4$	Bunsen Coefficient α	Ostwald Coefficient L
298.15	6.60	0.200	0.218

The compiler calculated the mole fraction and Ostwald coefficient values.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The degassed solvent is saturated with oxygen at 6 to 10 different pressures between 1.5 and 4.5 atm.

The pressure is reduced to one atm, and the "supersaturated gas" is shaken out of the solvent and measured.

The slope of a plot of the volume of gas reduced to standard conditions shaken out of 100 cm^3 of solvent *vs.* the pressure of saturation is nearly identical to the solubility-pressure graph (Henry's law). The slope of the curve is used to obtain the Bunsen coefficient. From the method of calculation the value represents the volume of gas shaken out of the solvent when the pressure is reduced from 2 to 1 atm.

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. Commercial cylinder. Prepared by Linde process, 97 per cent pure.

(2) Acetone. Chemically pure. Dried over anhydrous copper sulfate and distilled.

ESTIMATED ERROR:

REFERENCES:

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

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

ORIGINAL MEASUREMENTS:

Horiuti, J.

Sci. Papers Inst. Phys. Chem. Res. (*Tokyo*) (*Jpn*) 1931/32, *17*, 125-256.

VARIABLES:

T/K = 194.85 - 313.15

Total P/kPa = 101.325

PREPARED BY:

M. E. Derrick
H. L. Clever

EXPERIMENTAL VALUES:

T/K	Mol Fraction $X_1 \times 10^3$	Bunsen Coefficient α	Ostwald Coefficient L
194.85	0.8679	0.3010	0.2147
212.65	0.8233	0.2794	0.2175
231.85	0.8011	0.2654	0.2253
251.95	0.8006	0.2584	0.2385
273.15	0.8121	0.2550	0.2550
283.15	0.8247	0.2555	0.2649
293.15	0.8340	0.2549	0.2736
303.15	0.8505	0.2564	0.2846
313.15	0.8669	0.2577	0.2954

Smoothed Data: $\ln X_1 = -12.6970 + 7.18725/(T/100) + 2.9360 \ln (T/100)$

Standard error about the regression line = 1.18×10^{-6}

T/K	Mol Fraction $X_1 \times 10^3$	T/K	Mol Fraction $X_1 \times 10^3$
193.15	0.8734	263.15	0.8047
203.15	0.8433	273.15	0.8124
213.15	0.8226	283.15	0.8227
223.15	0.8091	293.15	0.8354
233.15	0.8015	303.15	0.8503
243.15	0.7988	313.15	0.8671
253.15	0.8000		

The Ostwald coefficient was measured at a total pressure of one atm. The Bunsen coefficient and the mole fraction solubility values were calculated by the compiler for a gas pressure of one atm assuming the gas to behave ideally and the Ostwald coefficient to be independent of pressure.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The apparatus consists of a gas buret, a solvent reservoir, and an absorption pipet. The volume of the pipet was determined at various miniscus heights by weighing a quantity of water. The miniscus height was read with a cathetometer.

The dry gas introduced into the degassed solvent. The gas and solvent are mixed with a magnetic stirrer until saturation. Care taken to prevent solvent vapor from mixing with the solute gas in the gas buret. The volume of gas was determined from a gas buret reading, the volume of the solvent was determined from the miniscus height in the absorption pipet.

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. Prepared in the laboratory by heating potassium permanganate (Kahlbaum). Gas fractionated in liquid air.

(2) 2-Propanone. Nippon Pure Chem. Co. or Merck. Extra pure grade, recrystallized with sodium sulfite. Stored over calcium chloride then fractionated. Normal boiling point 56.09°C.

ESTIMATED ERROR:

$\delta T/K = 0.05$

If the gas and solution are assumed to be ideal the fitted equation gives the following thermodynamic values.

T/K	ΔG^o/kJ mol^{-1}	ΔH^o/J mol^{-1}	ΔS^o/J K^{-1} mol^{-1}	ΔC_p^o/J K^{-1} mol^{-1}
273.15	16.160	692	-56.63	24.41
298.15	17.548	1302	-54.49	24.14

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

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

ORIGINAL MEASUREMENTS:

Kretschmer, C. B.; Nowakowaska, J.; Wiebe, R.

Ind. Eng. Chem. 1946, *38*, 506-9.

VARIABLES:

T/K = 248.15 - 298.15
P/kPa = 101.325

PREPARED BY:

P. L. Long
H. L. Clever

EXPERIMENTAL VALUES:

T/K	Mol Fraction $x_1 \times 10^3$	Bunsen Coefficient α	Ostwald Coefficient L
248.15	0.8115	0.2631	0.2390
273.15	0.8192	0.2570	0.2570
298.15	0.8440	0.2560	0.2794

The Ostwald coefficients were measured at a total pressure of 101.325 kPa (1 atm). The compiler calculated the Bunsen coefficient and mole fraction values for an oxygen partial pressure of 101.325 kPa (1 atm) assuming the Ostwald coefficient was independent of pressure.

Smoothed Data: $\ln x_1 = -6.8904 - 0.5703/(T/100K)$

Standard error about the regression line = 8.06×10^{-6}

T/K	Mol Fraction $x_1 \times 10^3$
253.15	0.812
263.15	0.819
273.15	0.826
283.15	0.832
293.15	0.838
298.15	0.840

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The apparatus was similar to that of Horiuti (1), it consisted of a gas buret, manometer, and absorption pipet equipped with a magnetic stirrer. All volumes were calibrated by mercury displacement.

The solvent was partly degassed by boiling under reflux. About 40 cm^3 of solvent was admitted into the absorption pipet, and pumped on to complete the degassing. Dry gas, measured in the buret, was admitted, final equilibrium was established after 1 to 3 hours stirring. During the solution process the total pressure was kept at one atm by additions of dry gas.

The solubility value was corrected for the increase of solvent volume with gas absorption, and for the nitrogen impurity in the oxygen.

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. Source not given. Contained 0.4 per cent N_2. Passed through Drierite to dry.

(2) 2-Propanone. Source not given. Treated with Ag_2O, dried over $CaSO_4$, distilled, b.p. (760 mmHg)/°C 56.10 - 56.14, density, ρ_4^{25}/g cm^{-3} 0.78490.

ESTIMATED ERROR:

Gas buret $\delta V/cm^3 = 0.005$
Average deviation from the mean 0.3%, maximum deviation 0.9% (authors).

REFERENCES:

1. Horiuti, J. *J. Sci Papers Inst. Phys. Chem. Res. (Tokyo)* 1931, *17*, 125.

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) 2-Propanone (Acetone); C_2H_6O; [67-64-1]

ORIGINAL MEASUREMENTS:

Bub, G.K.; Hillebrand, W. A.

J. Chem. Eng. Data 1979, *24*, 315-9.

VARIABLES:

T/K = 297-318

PREPARED BY:

R. Battino

EXPERIMENTAL VALUES:

T/K	H^a	$10^4x_1{}^b$
298.2	1190	8.403
297.4	1204	8.306
297.8	1207	8.285
297.8	1194	8.375
297.8	1203	8.313
303.2	1188	8.418
303.2	1186	8.432
303.2	1183	8.453
303.6	1173	8.525
303.6	1161	8.613
307.8	1171	8.540
308	1180	8.475
308	1143	8.749
308	1153	8.673
312.6	1185	8.439
312.8	1164	8.591
312.8	1184	8.446
313.5	1164	8.591
317.2	1146	8.726
318	1171	8.540
318	1144	8.742

[a] Henry's Law constant in bar/mole fraction.

[b] Mole fraction solubility calculated by compiler at 1 bar (10^5Pa) partial pressure of gas.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

A 100 cm^3 round-bottom flask with a built-in Clark oxygen electrode with temperature compensation was used to detect oxygen concentrations and changes in concentration. The electrode was calibrated with water saturated with air. One cm^3 samples were taken of the ketone saturated with oxygen and these were injected into the flask. The solubility could be determined from the oxygen concentrations and the known volumes.

SOURCE AND PURITY OF MATERIALS:

(1) 99.996% pure

(2) Fluka p.a. grade

ESTIMATED ERROR:

$\delta T/K = \pm 0.1$, compiler's estimate
$\delta H/H = \pm 0.024$, authors' estimate

REFERENCES:

COMPONENTS:

(1) Oxygen; O_2;[7782-44-7]

(2) 2-Butanone; C_4H_8O;[78-93-3]

ORIGINAL MEASUREMENTS:

Bub, G. K.; Hillebrand, W. A.

J. Chem. Eng. Data 1979, *24*, 315-9.

VARIABLES:

T/K = 298-332

PREPARED BY:

R. Battino

EXPERIMENTAL VALUES:

T/K	H^a	$10^3x_1{}^b$
298.2	986	1.014
298.2	999	1.001
298.6	1000	1.000
298.6	990	1.010
302.7	964	1.037
303.7	963	1.038
307.9	974	1.027
308.2	988	1.012
308.6	969	1.032
308.9	965	1.036
313.2	979	1.021
313.7	960	1.042
314.2	969	1.032
318.4	947	1.056
319.2	954	1.048
323.2	963	1.038
323.4	924	1.082
323.6	950	1.053
327.8	963	1.038
332.2	936	1.068

[a] Henry's Law constant in bar/mole fraction.

[b] Mole fraction solubility calculated by compiler at 1 bar partial pressure of gas.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

A 100 cm^3 round-bottom flask with a built-in Clark oxygen electrode with temperature compensation was used to detect oxygen concentrations and changes in concentration. The electrode was calibrated with water saturated with air. One cm^3 samples were taken of the ketone saturated with oxygen and these were injected into the flask. The solubility could be determined from the oxygen concentrations and the known volumes.

SOURCE AND PURITY OF MATERIALS:

(1) 99.996% pure

(2) Fluka p.a. grade

ESTIMATED ERROR:

$\delta T/K = \pm 0.1$, compiler's estimate
$\delta H/H = \pm 0.024$, authors' estimate

REFERENCES:

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) 2-Pentanone; $C_5H_{10}O$; [107-87-9]

ORIGINAL MEASUREMENTS:

Bub, G. K.; Hillebrand, W. A.

J. Chem. Eng. Data 1979, *24*, 315-9.

VARIABLES:

T/K = 298-342

PREPARED BY:

R. Battino

EXPERIMENTAL VALUES:

T/K	H^a	$10^3x_1{}^b$
298.2	904	1.106
298.2	900	1.111
298.2	883	1.133
298.2	909	1.100
303.7	876	1.142
305.6	909	1.100
306.4	890	1.124
310.4	888	1.126
311.9	914	1.094
315.2	897	1.115
319.2	876	1.142
319.2	893	1.120
323.2	882	1.134
323.2	887	1.127
323.2	887	1.127
325.2	876	1.142
329.4	886	1.129
329.6	886	1.129
331.4	868	1.152
334.7	867	1.153
336.7	889	1.125
341.7	877	1.140

[a] Henry's Law constant in bar/mole fraction.

[b] Mole fraction solubility calculated by compiler at 1 bar partial pressure of gas.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

A 100 cm round-bottom flask with a built-in Clark oxygen electrode with temperature compensation was used to detect oxygen concentrations and changes in concentration. The electrode was calibrated with water saturated with air. One cm^3 samples were taken of the ketone saturated with oxygen and these were injected into the flask. The solubility could be determined from the oxygen concentrations and the known volumes.

SOURCE AND PURITY OF MATERIALS:

(1) 99.996% pure

(2) Fluka p.a. grade

ESTIMATED ERROR:

$\delta T/K = \pm 0.1$, compiler's estimate

$\delta H/H = \pm 0.024$, author's estimate

REFERENCES:

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) 2-Hexanone; $C_6H_{12}O$; [591-78-6]

ORIGINAL MEASUREMENTS:

Bub, G. K.; Hillebrand, W. A.

J. Chem. Eng. Data 1979, *24*, 315-9.

VARIABLES:

T/K = 298-344

PREPARED BY:

R. Battino

EXPERIMENTAL VALUES:

T/K	H^a	$10^3x_1^{\ b}$
298.2	855	1.170
298.5	860	1.163
298.7	850	1.176
307.7	847	1.181
307.7	865	1.156
308.4	849	1.178
309.0	850	1.176
316.5	881	1.135
318.2	863	1.159
318.2	893	1.120
318.2	883	1.133
326.1	889	1.125
327.0	864	1.157
328.0	895	1.117
335.7	897	1.115
336.2	906	1.104
336.6	881	1.135
337.0	912	1.096
337.2	871	1.148
341.2	893	1.120
343.7	896	1.116
343.7	874	1.144

[a] Henry's Law constant in bar/mole fraction.

[b] Mole fraction solubility calculated by compiler at 1 bar partial pressure of gas.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

A 100 cm^3 round-bottom flask with a built-in Clark oxygen electrode with temperature compensation was used to detect oxygen concentrations and changes in concentration. The electrode was calibrated with water saturated with air. One cm^3 samples were taken of the ketone saturated with oxygen and these were injected into the flask. The solubility could be determined from the oxygen concentrations and the known volumes.

SOURCE AND PURITY OF MATERIALS:

(1) 99.996% pure

(2) Fluka p.a. grade

ESTIMATED ERROR:

$\delta T/K = \pm 0.1$, compiler's estimate

$\delta H/H = \pm 0.024$, author's estimate

REFERENCES:

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Cyclohexanone; $C_6H_{10}O$; [108-94-1]

ORIGINAL MEASUREMENTS:

Guerry, D. Jr.

Ph. D. thesis, 1944, Vanderbilt University Nashville, TN

VARIABLES:

T/K= 293-298
P/kPa= 101.325

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

T/K	Mol Fraction $x_1 \times 10^4$	Bunsen Coefficient α	Ostwald Coefficient L
293.15	6.38	0.138	0.148
298.15	6.36	0.137	0.150

The Ostwald coefficients were calculated by the compiler.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

A modified Van Slyke-Neill manometric apparatus (1, 2) was used.

The modifications were improved temperature control, and procedures that allowed small samples (2 cm^3) with almost 100 per cent recovery of the solvent.

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. Air Reduction Co. Purity 99.5 per cent.

(2) Cyclohexanone. Eastman Kodak Co. Purified and distilled, b. p. (754.5 mmHg) t/°C 155.19 (corr.). Refractive index, density, and vapor pressure data are in the thesis.

ESTIMATED ERROR:

$\delta T/K = 0.05$

REFERENCES:

1. Ijams, C. C.
   Ph. D. thesis, 1941
   Vanderbilt University

2. Van Slyke, D. D.
   J. Biol. Chem. 1939, *130*, 545.

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) 1,1'-Oxybisethane or diethyl ether; $C_4H_{10}O$; [60-29-7]

ORIGINAL MEASUREMENTS:

Christoff, A.

Z. Phys. Chem. 1912, *79*, 456-60.

VARIABLES:

T/K = 273.15

P/kPa = Atmospheric

PREPARED BY:

M. E. Derrick

H. L. Clever

EXPERIMENTAL VALUES:

T/K	Mol Fraction $x_1 \times 10^3$	Bunsen Coefficient α	Ostwald Coefficient L
273.15	1.90	0.4235	0.4235

The Bunsen coefficient and mole fraction values were calculated by the compiler.

The value is 2.0 per cent lower than the value reported by Horiuti at 273.15. The Horiuti value is preferred.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The apparatus is a modified Ostwald apparatus described by Just (1), and modified by Skirrow (2). The apparatus consists of a thermostated gas buret and an absorption flask.

The modification involes the use of vapor free gas in the gas buret. A correction is made for the vapor pressure of the liquid. A steel capillary tube with a stopcock, which prevents the gas and the liquid vapor from mixing in the buret, is used to connect the absorption flask and the buret.

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. Prepared from $KClO_3$.

(2) Diethylether. Merck and Co. Stated to be pure and anhydrous.

ESTIMATED ERROR:

$\delta L/L = 0.03$

REFERENCES:

1. Just, G. *Z. Phys. Chem.* 1901, *37*, 342.
2. Skirrow, F. W. *Z. Phys. Chem.* 1902, *41*, 139.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Oxygen; O_2; [7782-44-7] (2) 1,1-Oxybisethane or Diethylether; $C_4H_{10}O$; [60-29-7]	Horiuti, J. *Sci. Papers Inst. Phys. Chem. Res. (Tokyo) (Jpn)* 1931/32, *17*, 125-256.
VARIABLES: T/K = 195.05 - 293.15 Total P/kPa = 101.325	PREPARED BY: M. E. Derrick H. L. Clever

EXPERIMENTAL VALUES:

T/K	Mol Fraction $X_1 \times 10^3$	Bunsen Coefficient α	Ostwald Coefficient L
195.05	2.537	0.6309	0.4505
213.05	2.287	0.5550	0.4329
232.65	2.067	0.4983	0.4244
253.25	1.996	0.4581	0.4247
273.15	1.939	0.4325	0.4325
293.15	1.432	0.4203	0.4511

Smoothed Data: $\ln X_1 = 2.34441 - 9.53953/(T/100) - 5.17850 \ln (T/100)$

Standard error about the regression line = 1.56×10^{-4}

T/K	Mol Fraction $X_1 \times 10^3$
193.15	2.47
203.15	2.43
213.15	2.36
223.15	2.27
233.15	2.17
243.15	2.07

T/K	Mol Fraction $X_1 \times 10^3$
253.15	1.96
263.15	1.85
273.15	1.74
283.15	1.64
293.15	1.53

The Ostwald coefficient was measured at a total pressure of one atm. The Bunsen coefficient and the mole fraction solubility values were calculated by the compiler for a gas pressure of one atm assuming the gas to behave ideally and the Ostwald coefficient to be independent of pressure.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The apparatus consists of a gas buret, a solvent reservoir, and an absorption pipet. The volume of the pipet was determined at various miniscus heights by weighing a quantity of water. The miniscus height was read with a cathetometer.

The dry gas introduced into the degassed solvent. The gas and solvent are mixed with a magnetic stirrer until saturation. Care taken to prevent solvent vapor from mixing with the solute gas in the gas buret. The volume of gas was determined from a gas buret reading, the volume of the solvent was determined from the miniscus height in the absorption pipet.

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. Prepared in the laboratory by heating potassium permanganate (Kahlbaum). Gas fractionated in liquid air.

(2) 1,1-Oxybisethane. Merck's "for analysis". Stored over sodium amalgam and distilled. Constant boiling within 0.01°C.

ESTIMATED ERROR:

$\delta T/K = 0.05$

If the gas and solution are assumed to be ideal the fitted equation gives the following thermodynamic values.

T/K	ΔG^o/kJ mol^{-1}	ΔH^o/J mol^{-1}	ΔS^o/J K^{-1} mol^{-1}	ΔC_p^o/J K^{-1} mol^{-1}
273.15	14.425	-3829	-66.82	-43.05
293.15	15.792	-4690	-69.87	-43.05

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) 1,1'-Oxybispropane or dipropyl ether; $C_6H_{14}O$; [111-43-3]

ORIGINAL MEASUREMENTS:

Guerry, D. Jr.

Ph.D. thesis, 1944, Vanderbilt University, Nashville, TN.

VARIABLES:

T/K = 293-298

P/kPa = 101.325

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

T/K	Mol Fraction $x_1 \times 10^4$	Bunsen Coefficient α	Ostwald Coefficient L
293.15	18.8	0.310	0.333
298.15	19.1	0.312	0.341

The Ostwald coefficients were calculated by the compiler.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

A Van Slyke-Neill Manometric Apparatus manufactured by the Eimer and Amend Co. was used.

The procedure of Van Slyke (1) for pure liquids was modified (2) so that small solvent samples (2 cm^3) could be used with almost complete recovery of the sample.

An improved temperature control system was used.

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. Air Reduction Co. Purity 99.5 per cent.

(2) Dipropyl ether. Eastman Kodak Co. Refluxed four hours over Na, then distilled from Na in a N_2 atm. B.p. (746.2 mmHg) t/°C 89.03 - 89.28 (corr.). Refractive index, density, and vapor pressure data are in the thesis.

ESTIMATED ERROR:

$\delta T/K = 0.05$

REFERENCES:

1. Van Slyke, D. D. *J. Biol. Chem.* 1939, *130*, 545.
2. Ijams, C. C. Ph.D. thesis, 1941 Vanderbilt University

COMPONENTS:

(1) Oxygen; O_2; 7782-44-7

(2) Cyclic ethers; C_4H_8O, $C_4H_8O_2$, and $C_5H_{10}O$

ORIGINAL MEASUREMENTS:

Guerry, D. Jr.

Ph. D. thesis, 1944, Vanderbilt University, Nashville, TN

VARIABLES:

T/K = 293-298
P/kPa = 101.325

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

T/K	Mol Fraction $x_1 \times 10^4$	Bunsen Coefficient α	Ostwald Coefficient L
Tetrahydrofuran; C_4H_8O; [109-99-9]			
293.15	8.03	0.222	0.238
298.15	8.16	0.224	0.245
1,4-Dioxane; $C_4H_8O_2$; [123-91-1]			
293.15	5.20	0.137	0.147
298.15	5.38	0.141	0.154
Tetrahydro-2H-pyran; $C_5H_{10}O$; [142-68-7]			
293.15	9.41	0.217	0.233
298.15	9.64	0.221	0.241

The Ostwald coefficients were calculated by the compiler.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

A Van Slyke-Neill Manometric Apparatus manufactured by the Eimer and Amend Co. was used.

The procedure of Van Slyke (1) for pure liquids was modified (2) so that small solvent samples (2 cm^3) could be used with almost complete recovery of the sample.

An improved temperature control system was used.

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. Air reduction Co. Purity 99.5 per cent.

(2) Cyclic ethers.

Tetrahydrofuran. Eastman Kodak Co. Refluxed several times over Na. Fractionally distilled from over Na in a nitrogen atm. b. p. (752.7 mmHg) t/°C 65.50-65.54 (corr.)

1,4-Dioxane. Eastman Kodak Co. Purified and distilled from Na under a nitrogen atm. b.p. (743.7 mmHg) t/°C 100.81 - 100.82.(corr).

Tetrahydro-2H-pyran. Prepared by the catalytic reduction of 2,3-dihydropyran, which had been prepared from tetrahydrofurfuryl alcohol. b.p.(750.6mmHg)t/C 87.52 (corr.).

ESTIMATED ERROR:

$\delta T/K = 0.05$

REFERENCES:

1. Van Slyke, D. D.
J. Biol. Chem. 1939, *130*, 545.

2. Ijams, C. C.
Ph. D. thesis, 1941
Vanderbilt University

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Acetic acid, methyl ester or Methyl acetate; $C_3H_6O_2$; [79-20-9]

ORIGINAL MEASUREMENTS:

Horiuti, J.

Sci. Papers Inst. Phys. Chem. Res. (Tokyo) (Jpn) 1931/32, *17*, 125-256.

VARIABLES:

T/K = 194.75 - 313.15

Total P/kPa = 101.325

PREPARED BY:

M. E. Derrick
H. L. Clever

EXPERIMENTAL VALUES:

T/K	Mol Fraction $X_1 \times 10^3$	Bunsen Coefficient α	Ostwald Coefficient L
194.75	0.8327	0.2666	0.1901
212.35	0.8153	0.2556	0.1987
232.25	0.8172	0.2500	0.2126
252.35	0.8304	0.2477	0.2288
273.15	0.8567	0.2488	0.2488
283.15	0.8695	0.2492	0.2583
295.00	0.8872	0.2503	0.2703
303.15	0.9007	0.2513	0.2789
313.15	0.9120	0.2510	0.2877

Smoothed Data: $\ln X_1 = -10.8973 + 4.6638/(T/100) + 2.1142 \ln (T/100)$

Standard error about the regression line = 2.96×10^{-6}

T/K	Mol Fraction $X_1 \times 10^3$
193.15	0.8326
203.15	0.8226
213.15	0.8176
223.15	0.8166
233.15	0.8191
243.15	0.8245
253.15	0.8323

T/K	Mol Fraction $X_1 \times 10^3$
263.15	0.8423
273.15	0.8541
283.15	0.8677
293.15	0.8827
303.15	0.8991
313.15	0.9168

The Ostwald coefficient was measured at a total pressure of one atm. The Bunsen coefficient and the mole fraction solubility values were calculated by the compiler for a gas pressure of one atm assuming the gas to behave ideally and the Ostwald coefficient to be independent of pressure.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The apparatus consists of a gas buret, a solvent reservoir, and an absorption pipet. The volume of the pipet was determined at various miniscus heights by weighing a quantity of water. The miniscus height was read with a cathetometer.

The dry gas introduced into the degassed solvent. The gas and solvent are mixed with a magnetic stirrer until saturation. Care taken to prevent solvent vapor from mixing with the solute gas in the gas buret. The volume of gas was determined from a gas buret reading, the volume of the solvent was determined from the miniscus height in the absorption pipet.

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. Prepared in the laboratory by heating potassium permanganate (Kahlbaum). Gas fractionated in liquid air.

(2) Acetic acid, methyl ester. Merck. Extra pure grade treated with phosphorous pentoxide several times and distilled several times. Normal boiling point, 57.12°C.

ESTIMATED ERROR:

$\delta T/K = 0.05$

If the gas and solution are assumed to be ideal the fitted equation gives the following thermodynamic values.

T/K	ΔG^o/kJ mol^{-1}	ΔH^o/J mol^{-1}	ΔS^o/J K^{-1} mol^{-1}	ΔC_p^o/J K^{-1} mol^{-1}
273.15	16.045	924	-55.36	17.58
298.15	17.410	1363	-53.82	17.58

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

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

(3) Ethanol; C_2H_6O; [64-17-5]

ORIGINAL MEASUREMENTS:

Kretschmer, C. B.; Nowakowska, J.; Wiebe, R.

Ind. Eng. Chem. 1946, *38*, 506-9.

VARIABLES:

T/K = 273.15 - 323.15
P/kPa = 101.325
Ethanol/vol % = 50

PREPARED BY:

P. L. Long
H. L. Clever

EXPERIMENTAL VALUES:

T/K	Bunsen Coefficient α	Ostwald Coefficient L
273.15	0.2409	0.2409
298.15	0.2338	0.2552
323.15	0.2310	0.2733

The Ostwald coefficients were measured at a total pressure of 101.325 kPa (1 atm). The compiler calculated the Bunsen coefficient value for an oxygen partial pressure of 101.325 kPa (1 atm) assuming the Ostwald coefficient was independent of pressure.

The solvent is acetone in ethanol, 50 per cent by volume.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The apparatus was similar to that of Horiuti (1), it consisted of a gas buret, manometer, and absorption pipet equipped with a magnetic stirrer. All volumes were calibrated by mercury displacement.

The solvent was partly degassed by boiling under reflux. About 40 cm^3 of solvent was admitted into the absorption pipet, and pumped on to complete the degassing. Dry gas, measured in the buret, was admitted, final equilibrium was established after 1 to 3 hours stirring. During the solution process the total pressure was kept at one atm by additions of dry gas.

The solubility value was corrected for the increase of solvent volume with gas absorption, and for the nitrogen impurity in the oxygen.

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. Source not given. Contained 0.4 per cent N_2. Passed through Drierite to dry.

(2) 2-Propanone. Source not given. Treated with Ag_2O, dried over $CaSO_4$, distilled, b.p. (760 mmHg)/°C 56.10-56.14, density, ρ_4^{25}/g cm^{-3} 0.78490.

(3) Ethanol. Source not given. Dried with Mg. Density, ρ/g cm^{-3} 0.78508.

ESTIMATED ERROR:

Gas buret $\delta V/cm^3$ = 0.005
Average deviation from the mean 0.3%, maximum deviation 0.9% (authors).

REFERENCES:

1. Horiuti, J.
J. Sci Papers Inst. Phys. Chem. Res. (Tokyo) 1931, *17*, 125.

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Various solvents (see table below)

ORIGINAL MEASUREMENTS:

Schläpfer, P.; Andykowski, T.; Bukowieck, A.

Schweiz. Arch. Angew. Wiss. Tech. 1949, *15*, 299-307.

VARIABLES:

T/K = 293

PREPARED BY:

R. Battino

EXPERIMENTAL VALUES:

Solvent	L^a
20°C (293K)	
methanol; CH_4O; [67-56-1]	0.247
ethanol; C_2H_6O; [64-17-5]	0.243
1-propanol; C_3H_8O; [540-67-0]	0.214
2-propanol; C_3H_8O; [67-63-0]	0.247
1-butanol; $C_4H_{10}O$; [71-36-3]	0.212
2-propanone (acetone); C_3H_6O; [67-64-1]	0.274
methyl acetate; $C_3H_6O_2$; [79-20-9]	0.269
ethyl acetate; $C_4H_8O_2$; [141-78-6]	0.214
diethyl ether; $C_4H_{10}O$; [60-29-7]	0.450
tetra chloroethane (carbon tetrachloride); CCl_4; [56-23-5]	0.300
tetrachloroethylene; C_2Cl_4; [127-18-4]	0.199
petroleum ether	0.438
olefin poor gasoline	0.334
cracked gasoline	0.326
2,2,4-trimethylpentane (isooctane); C_8H_{18}; [540-84-1]	0.335

continued on following page

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The solvents were saturated with air at 20°C. Then the dissolved oxygen was determined iodimetrically with a thisulfate titration. For five of the solvents the solubility was determined via a physical method (manometric/volumetric, described in the paper) since there were interferences to the iodimetric method.

SOURCE AND PURITY OF MATERIALS:

(1) From air.

(2) The specific gravity is given in the original paper for all of the solvents used.

ESTIMATED ERROR:

$\delta L/L = \pm 0.025$, authors' estimate.

REFERENCES:

COMPONENTS:	EVALUATOR:
(1) Oxygen; O_2; [7782-44-7] (2) Various solvents (see table below)	Schläpfer, P.; Audykowski, T.; Bukowieck, A. *Schweiz. Arch. Angew. Wiss. Tech.* 1949, *15*, 299-307.

CRITICAL EVALUATION: continued

Solvent	L^a
paraffin oil	0.159
benzene; C_6H_6; [71-43-2]	0.219
p-xylene; C_8H_{10}; [106-42-3]	0.220
dimethoxymethane (methylal); $C_3H_8O_2$; [109-87-5]	0.325
castor oil	0.151
water H_2O; [7732-18-5]	0.033
aniline; C_6H_7N; [62-53-3]	0.107^b
1,4-dioxane; $C_4H_8O_2$; [123-91-1]	0.174^b
2,4,6-trimethy-1,3,5-trioxane(paraldehyde); $C_6H_{12}O_3$; [123-63-7]	0.281^b
ethylene glycol; $C_2H_6O_2$; [107-21-1]	0.014^b
1,2,3-propanetriol (glycerin); $C_3H_8O_3$; [56-81-5]	0.008^b

[a] Ostwald coefficient.

[b] Determined by physical method described in paper.

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Tetrachloromethane; CCl_4; [56-23-5]

ORIGINAL MEASUREMENTS:

Metschl, J.

J. Phys. Chem. 1924, *28*, 417-37.

VARIABLES:

T/K = 298.15
P/kPa = 101.325

PREPARED BY:

M. E. Derrick
H. L. Clever

EXPERIMENTAL VALUES:

T/K	Mol Fraction $x_1 \times 10^4$	Bunsen Coefficient α	Ostwald Coefficient L
298.15	9.74	0.225	0.246

The compiler calculated the mole fraction and Ostwald coefficient values.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The degassed solvent is saturated with oxygen at 6 to 10 different pressures between 1.5 and 4.5 atm.

The pressure is reduced to one atm, and the "supersaturated gas" is shaken out of the solvent and measured.

The slope of a plot of the volume of gas reduced to standard conditions shaken out of 100 cm^3 of solvent *vs.* the pressure of saturation is nearly identical to the solubility-pressure graph (Henry's law). The slope of the curve is used to obtain the Bunsen coefficient. From the method of calculation the value represents the volume of gas shaken out of the solvent when the pressure is reduced from 2 to 1 atm.

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. Commercial cylinder. Prepared by Linde process, 97 per cent pure.

(2) Tetrachloromethane. Chemically pure. Dried over KOH and distilled.

ESTIMATED ERROR:

REFERENCES:

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Tetrachloromethane; CCl_4; [56-23-5]

ORIGINAL MEASUREMENTS:

Horiuti, J.

Sci. Papers Inst. Phys. Chem. Res. (Tokyo) (Jpn) 1931/32, *17*, 125-256.

VARIABLES:

T/K = 273.15 - 333.15

Total P/kPa = 101.325

PREPARED BY:

M. E. Derrick
H. L. Clever

EXPERIMENTAL VALUES:

T/K	Mol Fraction $X_1 \times 10^3$	Bunsen Coefficient α	Ostwald Coefficient L
273.15	1.203	0.2865	0.2865
283.15	1.199	0.2823	0.2926
293.15	1.201	0.2792	0.2996
303.15	1.199	0.2754	0.3052
313.15	1.201	0.2725	0.3124
323.15	1.205	0.2701	0.3196
333.15	1.203	0.2661	0.3246

Smoothed Data: $\ln X_1 = -7.8804 + 1.6387/(T/100) + 0.5541 \ln (T/100)$

Standard error about the regression line = 1.89×10^{-6}

T/K	Mol Fraction $X_1 \times 10^3$
273.15	1.202
283.15	1.201
293.15	1.200
303.15	1.200
313.15	1.201
323.15	1.203
333.15	1.205

If the gas and solution are assumed to be ideal the fitted equation gives the following thermodynamic values.

T/K	ΔG^o/kJ mol^{-1}	ΔH^o/J mol^{-1}	ΔS^o/J K^{-1} mol^{-1}	ΔC_p^o/J K^{-1} mol^{-1}
273.15	15.270	-104	-56.3	4.61
298.15	16.671	11	-55.9	4.61

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The apparatus consists of a gas buret, a solvent reservoir, and an absorption pipet. The volume of the pipet was determined at various miniscus heights by weighing a quantity of water. The miniscus height was read with a cathetometer.

The dry gas introduced into the degassed solvent. The gas and solvent are mixed with a magnetic stirrer until saturation. Care taken to prevent solvent vapor from mixing with the solute gas in the gas buret. The volume of gas was determined from a gas buret reading, the volume of the solvent was determined from the miniscus height in the absorption pipet.

The Ostwald coefficient was measured at a total pressure of one atm. The Bunsen coefficient and the mole fraction solubility values were calculated by the compiler for a gas pressure of one atm assuming the gas to behave ideally and the Ostwald coefficient to be independent of pressure.

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. Prepared in the laboratory by heating potassium permanganate (Kahlbaum). Gas fractionated in liquid air.

(2) Tetrachloromethane. Kahlbaum. Dried, and distilled. Normal boiling point 76.74°C.

ESTIMATED ERROR:

$\delta T/K = 0.05$

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Tetrachloromethane; CCl_4; [56-23-5]

ORIGINAL MEASUREMENTS:

Naumenko, N. K.

Candidates thesis, 1970, Leningrad.

VARIABLES:

$T/K = 298.15$
$P/kPa = 101.325$

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

T/K	Mol Fraction $x_1 \times 10^3$	Bunsen Coefficient α	Ostwald Coefficient L
298.15	1.00	0.231	0.252

The mole fraction solubility value is quoted in (1).

The Bunsen and Ostwald coefficients were caclulated by the compiler.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Probably used volumetric method desribed by Naumenko *et al.* (2).

SOURCE AND PURITY OF MATERIALS:

No information.

ESTIMATED ERROR:

REFERENCES:

1. Chaenko, N. V.; Sukhova, G. I.; Naumenko, N. K.; Kedrinskii, I. A. *Zh. Fiz. Khim.* 1979, *53*, 1989.

2. Naumenko, N. K.; Mukhin, N. N. Aleskovskii, V. B. *Zh. Prkl. Khim.* 1969, *42*, 2090.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Oxygen; O_2; [7782-44-7] (2) 1,2-Dibromo-1,1,2,3,3,3-hexafluoropropane; $C_3F_6Br_2$; [661-95-0]	Wesseler, E.P.; Iltis, R.; Clark, L.C. Jr. *J. Fluorine Chem.* 1977, *9*, 137-46.
VARIABLES: T/K = 298	PREPARED BY: C. L. Young

EXPERIMENTAL VALUES:

T/K	Solubility*	Mole fraction + of oxygen x_{O_2}
298.15	51.7	0.00303

* appears to be the Ostwald coefficient x 10^2, units were stated as ml/100 ml (total pressure was the barometric pressure, assumed to be 1 atmosphere)

\+ calculated by compiler for a total pressure of 101.325 kPa using the density given in source

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Oxygen bubbled through fulorocarbon in stirred cell. When saturation achieved samples of liquid remoced with a hypodermic Precision Sampling 50 μl Pressure-Lok syringe. At least 15 samples taken and chromatographed. Average peak height compared with that of average peak height for injection of the same volume of oxygen. Chromatographic column consisted of 13X molecular sieve at 70°C. Helium was used as carrier gas.

SOURCE AND PURITY OF MATERIALS:

(1) No details given.

(2) A 3M sample, boiling pt. 72.8°C.

ESTIMATED ERROR:

$\delta T/K = \pm 0.3$; $\delta x_{O_2} = \pm 2\%$

REFERENCES:

COMPONENTS: (1) Oxygen; O_2; [7782-44-7] (2) 1,1,1,3,3,4,4,5,5,5-decafluoro-2-(trifluoromethyl)-2-pentanol; $C_6HF_{13}O$; [67728-22-7]	ORIGINAL MEASUREMENTS: Lawson, D.D.; Moacanin, J.; Scherer, K.V.; Terranova, T.J.; Ingham, J.D. *J. Fluorine Chem.* 1978, *12*, 221-36.
VARIABLES: T/K = 298	PREPARED BY: C. L. Young

EXPERIMENTAL VALUES:

T/K	Solubility *	Mole fraction + of oxygen x_{O_2}
298.15	44.3	0.00374

* appears to be the Ostwald coefficient x 10^2, units were stated as $cm^3 O_2/100\ cm^3$ (total pressure was assumed to be 1 atmosphere)

\+ calculated by compiler for a total pressure of 101.325 kPa using density given in source

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Oxygen bubbled through fluorocarbon in stirred cell. When saturation achieved sample of liquid analysed by gas chromatography using a molecular sieve to retain the fluorocarbon. Details not given in source but method in ref. (1) was equivalent.

SOURCE AND PURITY OF MATERIALS:

(1) No details given.

(2) Prepared by Jet Propulsion Laboratory, Caltech.

ESTIMATED ERROR:

$\delta T/K = \pm 0.3$; $\delta x_{O_2} = \pm 3\%$

(estimated by compiler)

REFERENCES:

1. Wesseler, E.P.; Iltis, R.; Clark, L.C. Jr.

J. Fluorine Chem. 1977, *9*, 137-146.

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Halobenzenes; C_6H_5X

ORIGINAL MEASUREMENTS:

Naumenko, N. K.; Mukhin, N. N.
Aleskovskii, V. B.

Zh. Prikl. Khim. (Leningrad) 1969, *42*, 2522-8.

J. Appl. Chem. 1969, *42*, 2376-81.

VARIABLES:

T/K = 298.15
O_2 P/kPa = 101.325

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

T/K	Mol Fraction $x_1 \times 10^4$	Bunsen Coefficient α	Ostwald Coefficient L
Fluorobenzene; C_6H_5F; [462-06-6]			
298.15	15.08	0.360	0.393
Chlorobenzene; C_6H_5Cl; [108-90-7]			
298.15	8.98	0.197 ± 0.006	0.215
Bromobenzene; C_6H_5Br; [108-86-1]			
298.15	7.48	0.159 ± 0.004	0.174
Iodobenzene; C_6H_5I; [591-50-4]			
298.15	5.10	0.102 ± 0.005	0.111

The Ostwald coefficient values were calculated by the compiler.

The absolute errors are calculated from the results of three or four determinations.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The oxygen solubility was determined by a volumetric gas method.

The liquids were deaerated for 20 to 30 minutes under reduced pressure with the aid of an oil pump. The deaeration was monitored from the readings of a thermocouple vacuum gage.

The liquids were saturated with oxygen under an oxygen partial pressure of about 760 mmHg at 25°C for 2 hours. The amount of gas absorbed was then determined.

Details of the method are given in an earlier paper (1).

SOURCE AND PURITY OF MATERIALS:

The source and purity of the materials were not given.

ESTIMATED ERROR:

$\delta T/K = 0.1$
$\delta\alpha/\alpha = 0.023$ (relative)

REFERENCES:

1. Naumenko, N. K.; Mukhin, N. N. Aleskovskii, V. B. *Zh. Prikl. Khim.* 1969, *42*, 2090.

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

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

ORIGINAL MEASUREMENTS:

Horiuti, J.

Sci. Papers Inst. Phys. Chem. Res. (Tokyo) (Jpn) 1931/32, *17*, 125-256.

VARIABLES:

T/K = 273.15 - 353.15
Total P/kPa = 101.325

PREPARED BY:

M. E. Derrick
H. L. Clever

EXPERIMENTAL VALUES:

T/K	Mol Fraction $X_1 \times 10^3$	Bunsen Coefficient α	Ostwald Coefficient L
273.15	0.7776	0.1748	0.1748
283.15	0.7815	0.1740	0.1804
293.15	0.7874	0.1736	0.1863
303.15	0.7902	0.1725	0.1915
313.15	0.7966	0.1722	0.1974
323.15	0.8023	0.1717	0.2031
333.15	0.8105	0.1717	0.2094
343.15	0.8213	0.1722	0.2163
353.15	0.8250	0.1712	0.2214

Smoothed Data: $\ln X_1 = -9.51003 + 3.0621/(T/100) + 1.2243 \ln (T/100)$

Standard error about the regression line = 1.63×10^{-6}

T/K	Mol Fraction $X_1 \times 10^3$
273.15	0.7780
283.15	0.7815
293.15	0.7859
303.15	0.7911
313.15	0.7970
323.15	0.8036
333.15	0.8108
343.15	0.8184
353.15	0.8266

The Ostwald coefficient was measured at a total pressure of one atm. The Bunsen coefficient and the mole fraction solubility values were calculated by the compiler for a gas pressure of one atm assuming the gas to behave ideally and the Ostwald coefficient to be independent of pressure.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The apparatus consists of a gas buret, a solvent reservoir, and an absorption pipet. The volume of the pipet was determined at various miniscus heights by weighing a quantity of water. The miniscus height was read with a cathetometer.

The dry gas introduced into the degassed solvent. The gas and solvent are mixed with a magnetic stirrer until saturation. Care taken to prevent solvent vapor from mixing with the solute gas in the gas buret. The volume of gas was determined from a gas buret reading, the volume of the solvent was determined from the miniscus height in the absorption pipet.

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. Prepared in the laboratory by heating potassium permanganate (Kahlbaum). Gas fractionated in liquid air.

(2) Chlorobenzene. Kahlbaum. Dried, and distilled. Normal boiling point 131.96°C.

ESTIMATED ERROR:

$\delta T/K = 0.05$

If the gas and solution are assumed to be ideal the fitted equation gives the following thermodynamic values.

T/K	ΔG°/kJ mol^{-1}	ΔH°/J mol^{-1}	ΔS°/J K^{-1} mol^{-1}	ΔC_p°/J K^{-1} mol^{-1}
273.15	16.258	235.5	-58.66	10.18
298.15	17.713	489.0	-57.77	10.18

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) 1-Chlorohexane; $C_6H_{11}Cl$; [544-10-5]

ORIGINAL MEASUREMENTS:

Guerry, D. Jr.

Ph.D. thesis, 1944, Vanderbilt University, Nashville, TN.

VARIABLES:

T/K = 293-298

P/kPa = 101.325

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

T/K	Mol Fraction $x_1 \times 10^4$	Bunsen Coefficient α	Ostwald Coefficient L
293.15	13.5	0.220	0.236
298.15	13.5	0.220	0.240

The Ostwald coefficients were calculated by the compiler.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

A Van Slyke-Neill Manometric Apparatus manufactured by the Eimer and Amend Co. was used.

The procedure of Van Slyke (1) for pure liquids was modified (2) so that small solvent samples (2 cm^3) could be used with almost complete recovery of the sample.

An improved temperature control system was used.

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. Air Reduction Co. Purity 99.5 per cent.

(2) 1-Chlorohexane. Eastman Kodak Co. Purified, distilled from P_2O_5 in a N_2 atm. B.p. (746.6 mmHg) t/°C 134.66 (corr.). Refractive index, density, and vapor pressure data are in the thesis.

ESTIMATED ERROR:

$\delta T/K = 0.05$

REFERENCES:

1. Van Slyke, D. D.
J. Biol. Chem. 1939, *130*, 545.

2. Ijams, C. C.
Ph.D. thesis, 1941
Vanderbilt University

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Hexafluorobenzene; C_6F_6; [392-56-3]

ORIGINAL MEASUREMENTS:

Evans, D. F.; Battino, R.

J. Chem. Thermodyn. 1971, *3*, 753-60.

VARIABLES:

T/K = 282.92 - 297.81
P/kPa = 101.325

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

T/K	Mol Fraction $X_1 \times 10^3$	Bunsen Coefficient α	Ostwald Coefficient L
282.92	2.479	0.491	0.509
283.21	2.468	0.489	0.507
297.56	2.417	0.469	0.511
297.81	2.422	0.471	0.513

The Bunsen coefficients were calculated by the compiler.

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

Smoothed Data: $\Delta G^\circ/\text{J mol}^{-1} = -RT \ln X_1 = -973.1 + 53.371\ T$

Std. Dev. $\Delta G^\circ = 5.7$, Coef. Corr. = 0.9992

$\Delta H^\circ/\text{J mol}^{-1} = -973.1$, $\Delta S^\circ/\text{J K}^{-1}\text{ mol}^{-1} = 53.371\ T$

T/K	Mol Fraction $X_1 \times 10^3$	$\Delta G^\circ/\text{J mol}^{-1}$
278.15	2.48	13,872
283.15	2.46	14,139
288.15	2.45	14,406
293.15	2.43	14,673
298.15	2.41	14,939

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

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

Degassing. Up to 500 cm^3 of solvent is placed in a flask of such size that the liquid is about 4 cm deep. The liquid is rapidly stirred, and vacuum is intermittently applied through a liquid N_2 trap until the permanent gas residual pressure drops to 5 microns.

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

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. Air Products and Chemicals Co. 99.6 per cent.

(2) Hexafluorobenzene. Imperiel Smelting Co., Avnomouth, U.K. GC purity 99.7%, density, $\rho_{298.15} = 1.60596\ \text{g cm}^{-3}$. Purification described *Anal. Chem.* 1968, *40*, 224.

ESTIMATED ERROR:

$\delta T/K = 0.03$
$\delta P/\text{mmHg} = 0.5$
$\delta X_1/X_1 = 0.005$

REFERENCES:

1. Morrison, T. J.; Billett, F. *J. Chem. Soc.* 1948, 2033.
2. Battino, R.; Evans, F. D.; Danforth, W. F. *J. Am. Oil Chem. Soc.* 1968, *45*, 830.
3. Battino, R.; Banzhof, M.; Bogan, M.; Wilhelm, E. *Anal. Chem.* 1971, *43*, 806.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Oxygen; O_2; [7782-44-7] (2) Hexafluorobenzene; C_6F_6; [392-56-3]	Wesseler, E.P.; Iltis, R.; Clark, L.C. Jr. *J. Fluorine Chem.* 1977, *9*, 137-46.
VARIABLES:	PREPARED BY:
T/K = 298	C. L. Young

EXPERIMENTAL VALUES:

T/K	Solubility *	Mole fraction + of oxygen x_{O_2}
298.15	48.8	0.00232

* appears to be the Ostwald coefficient x 10^2 stated as ml/100 ml (total pressure was the barometer pressure, assumed to be 1 atmosphere)

\+ calculated by compiler for a total pressure of 101.325 kPa using density given in source

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Oxygen bubbled through fluorocarbon in stirred cell. When saturation achieved samples of liquid removed with a hypodermic Precision Sampling 50 µl Pressure-Lok syringe. At least 15 samples taken and chromtographed. Average peak height compared with that of average peak height for injection of the same volume of oxygen. Chromatographic column consisted of 13X molecular sieve at 70°C. Helium was used as carrier gas.

SOURCE AND PURITY OF MATERIALS:

(1) No details given.

(2) Imperial Smelting Co Chemicals Ltd., boiling pt. 81.5°C.

ESTIMATED ERROR:

$\delta T/K = \pm 0.3$; $\delta x_{O_2} = \pm 2\%$

REFERENCES:

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) 1,1,1,2,2,3,3,5,5,5-Decafluoro-4-methoxy-4-(trifluoromethyl)-pentane; $C_7H_3F_{13}O$; [67728-33-0]

ORIGINAL MEASUREMENTS:

Lawson, D.D.; Moacanin, J.; Scherer, K.V.; Terranova, T.F.; Ingham, J.D.

J. Fluorine Chem. 1978, *12*, 221-36.

VARIABLES:

T/K = 298

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	Solubility *	Mole fraction + of oxygen x_{O_2}
298.15	48.1	0.00462

* appears to be the Ostwald coefficient x 10^2, units were stated as $cm^3 O_2/100\ cm^3$ (total pressure was assumed to be 1 atmosphere)

\+ calculated by compiler for a total pressure of 101.325 kPa using density given in source

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Oxygen bubbled through fulorocarbon in stirred cell. When saturation achieved sample of liquid analysed by gas chromatography using a molecular sieve to retain the fluorocarbon. Details not given in source but method in ref. (1) was equivalent.

SOURCE AND PURITY OF MATERIALS:

(1) No details given.

(2) Prepared by Jet Propulsion Laboratory, Caltech.

ESTIMATED ERROR:

$\delta T/K = \pm 0.3$; $\delta x_{O_2} = \pm 3\%$

(estimated by compiler)

REFERENCES:

1. Wesseler, E.P.; Iltis, R.; Clark, L.C. Jr.

J. Fluorine Chem. 1977, *9*, 137-46.

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) 1-Bromoheptane; $C_7H_{15}Br$; [629-04-9]

ORIGINAL MEASUREMENTS:

Ijams, C. C.

Ph.D. thesis, 1941, Vanderbilt University, Nashville, TN.

VARIABLES:

$T/K = 298.15$

$P/kPa = 101.325$

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

T/K	Mol Fraction $x_1 \times 10^3$	Bunsen Coefficient α	Ostwald Coefficient L
298.15	1.32	0.189	0.206

The mole fraction and Ostwald coefficient values were calculated by the compiler.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

A Van Slyke-Neill Manometric Apparatus manufactured by the Eimer and Amend Co. was used.

The procedure of Van Slyke (1) for pure liquids was modified so that small solvent sample (2 cm^3) could be used with almost 100 per cent recovery of the solvent.

An improved temperature control system was used.

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. Air Reduction Co. Purity 99.5 per cent.

(2) 1-Bromoheptane. Purified. Vapor pressure and boiling point also reported in the thesis.

ESTIMATED ERROR:

$\delta T/K = 0.05$

REFERENCES:

1. Van Slyke, D. D. *J. Biol. Chem.* 1939, *130*, 545.

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) 1-Bromo-1,1,2,2,3,3,4,4,5,6,6,6-dodecafluoro-5-(trifluoromethyl)-hexane; $C_7F_{15}Br$; [50279-29-3]

ORIGINAL MEASUREMENTS:

Wesseler, E.P.; Iltis, R.; Clark, L.C. Jr.

J. Fluorine Chem. 1977, *9*, 137-46.

VARIABLES:

T/K = 298

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	Solubility *	Mole fraction + of oxygen x_{O_2}
298.15	51.4	0.00475

* appears to be the Ostwald coefficient x 10^2 stated as ml/100 ml (total pressure was the barometer pressure, assumed to be 1 atmosphere)

\+ calculated by compiler for a total pressure of 101.325 kPa using density given in source

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Oxygen bubbled through fluorocarbon in stirred cell. When saturation achieved samples of liquid removed with a hypodermic Precision Sampling 50 µl Pressure-Lok syringe. At least 15 samples taken and chromatographed. Average peak height compared with that of average peak height for injection of the same volume of oxygen. Chromatographic column consisted of 13X molecular sieve at 70°C. Helium was used as carrier gas.

SOURCE AND PURITY OF MATERIALS:

(1) No details given.

(2) Pennwalt Corp. sample, boiling pt. 120°C.

ESTIMATED ERROR:

$\delta T/K = \pm 0.3$; $\delta x_{O_2} = \pm 2\%$

REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Oxygen; O_2; [7782-44-7] (2) 1-Chloro-1,1,2,2,3,3,4,4,5,6,6,6-dodecafluoro-5-(trifluoromethyl)-hexane; $C_7F_{15}Cl$; [63243-37-8]	Wesseler, E.P.; Iltis, R.; Clark, I.C. Jr. *J. Fluorine Chem.* 1977, *9*, 137- 46.
VARIABLES:	PREPARED BY:
T/K = 298	C. L. Young

EXPERIMENTAL VALUES:

T/K	Solubility *	Mole fraction + of oxygen x_{O_2}
298.15	52.7	0.00490

* appears to be the Ostwald coefficient x 10^2 stated as ml/100 ml (total pressure was the barometer pressure, assumed to be 1 atmosphere)

\+ calculated by compiler for a total pressure of 101.325 kPa using density given in source

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Oxygen bubbled through fluorocarbon in stirred cell. When saturation achieved samples of liquid removed with a hypodermic Precision Sampling 50 µl Pressure-Lok syringe. At least 15 samples taken and chromatographed. Average peak height compared with that of average peak height for injection of the same volume of oxygen. Chromatographic column consisted of 13X molecular sieve at 70°C. Helium was used as carrier gas.

SOURCE AND PURITY OF MATERIALS:

(1) No details given.

(2) Pennwalt Corp. sample boiling pt. 108°C.

ESTIMATED ERROR:

$\delta T/K = \pm 0.3$; $\delta x_{O_2} = \pm 2\%$

REFERENCES:

COMPONENTS: (1) Oxygen; O_2; [7782-44-7] (2) Undecafluoro (trifluoromethyl) cyclohexane, (Perfluoromethylcyclohexane); C_7F_{14}; [355-02-2]	ORIGINAL MEASUREMENTS: Wesseler, E.P.; Iltis, R.; Clark, L.C. Jr. *J. Fluorine Chem.* 1977, *9*, 137-46.
VARIABLES: T/K = 298	PREPARED BY: C. L. Young

EXPERIMENTAL VALUES:

T/K	Solubility *	Mole fraction + of oxygen x_{O_2}
298.15	57.2	0.00456

* appears to be the Ostwald coefficient x 10^2 stated as ml/100 ml (total pressure was the barometer pressure, assumed to be 1 atmosphere)

\+ calculated by compiler for a total pressure of 101.325 kPa using density given in source

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Oxygen bubbled through fluorocarbon in stirred cell. When saturation achieved samples of liquid removed with a hypodermic Precision Sampling 50 μl Pressure-Lok syringe. At least 15 samples taken and chromatographed. Average peak height compared with that of average peak height for injection of the same volume of oxygen. Chromatographic column consisted of 13X molecular sieve at 70°C. Helium was used as carrier gas.

SOURCE AND PURITY OF MATERIALS:

(1) No details given.

(2) ISC Chemicals, Avonmouth, UK sample, boiling pt 76°C.

ESTIMATED ERROR:

$\delta T/K = \pm 0.3$; $\delta x_{O_2} = \pm 2\%$

REFERENCES:

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Hexadecafluoroheptane or Perfluoroheptane; C_7F_{16}; [335-57-9]

ORIGINAL MEASUREMENTS:

Gjaldbaek, J. C.

Acta Chem. Scand. 1952, *6*, 623-33.

VARIABLES:

T/K = 298.11 - 298.15

Total P/kPa = 101.325

PREPARED BY:

J. Chr. Gjaldbaek

EXPERIMENTAL VALUES:

T/K	Mol Fraction $X_1 \times 10^3$	Bunsen Coefficient α	Ostwald Coefficient L
298.11	5.51	0.544	0.594
298.15	5.55	0.548	0.598

The mole fraction and Ostwald solubility values were calculated by the compiler.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

A calibrated all-glass combined manometer and bulb was enclosed in an air thermostat and shaken until equilibrium. Mercury was used for calibration and as the confining liquid. The solvents were degassed in the apparatus. Details are in references 1 and 2.

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

The saturation of the liquid with the gas was carried out close to atmospheric pressure. The solubility values were reported for one atmosphere gas pressure assuming Henry's law is obeyed.

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. Prepared by heating $KMnO_4$, 99.7 percent O_2, 0.3 percent N_2.

(2) Hexadecafluoroheptane. E. I. duPont Co. Distilled, boiling point 82.3 - 82.4°C at 753.7 mmHg.

ESTIMATED ERROR:

$\delta T/K = 0.05$

$\delta X_1/X_1 = 0.015$

REFERENCES:

1. Lannung, A. *J. Am. Chem. Soc.* 1930, *52*, 68.
2. Gjaldbaek, J. C. *Acta Chem. Scand.* 1952, *6*, 623.

COMPONENTS: (1) Oxygen; O_2; [7782-44-7] (2) Benzene,bis(trifluoromethyl)-; $C_6H_4(CF_3)_2$; [26545-61-9]	ORIGINAL MEASUREMENTS: Wesseler, E.P.; Iltis, R.; Clark, L.C. Jr. *J. Fluorine Chem.* 1977, *9*, 137-46.
VARIABLES: T/K = 298	PREPARED BY: C. L. Young

EXPERIMENTAL VALUES:

T/K	Solubility *	Mole fraction + of oxygen x_{O_2}
298.15	35.4	0.00631

* appears to be the Ostwald coefficient x 10^2 stated as ml/100 ml (total pressure was the barometer pressure, assumed to be 1 atmosphere)

\+ calculated by compiler for a total pressure of 101.325 kPa using density given in source

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Oxygen bubbled through fluorocarbon in stirred cell. When saturation achieved samples of liquid removed with a hypodermic Precision Sampling 50 µl Pressure-Lok syringe. At least 15 samples taken and chromatographed. Average peak height compared with that of average peak height for injection of the same volume for oxygen. Chromatographic column consisted of 13X molecular sieve at 70°C. Helium was used as carrier gas.

SOURCE AND PURITY OF MATERIALS:

(1) No details given.

(2) Pierce Chem. Co. sample, boiling pt. 116°C.

ESTIMATED ERROR:

$\delta T/K = \pm 0.3$; $\delta x_{O_2} = \pm 2\%$

REFERENCES:

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) 2-Ethoxy-1,1,1,3,3,4,4,5,5,5-decafluoro-2-(trifluoromethyl)-pentane; $C_8H_5F_{13}O$; [67728-34-1]

ORIGINAL MEASUREMENTS:

Lawson, D.D.; Moacanin, J.; Scherer, K.V.; Terranova, T.F.; Ingham, J.D.

J. Fluorine Chem. 1978, *12*, 221-36.

VARIABLES:

T/K = 298

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	Solubility *	Mole fraction + of oxygen x_{O_2}
298.15	49.9	0.00514

* appears to be the Ostwald coefficient x 10^2 units were stated as $cm^3 O_2/100^3 cm$ (total pressure was assumed to be 1 atmosphere)

\+ calculated by compiler for a total pressure of 101.325 kPa using density given in source

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Oxygen bubbled through fluorocarbon in stirred cell. When saturation achieved sample of liquid analysed by gas chromatography using a molecular sieve to retain the fluorocarbon. Details not given in source but method in ref. (1) was equivalent.

SOURCE AND PURITY OF MATERIALS:

(1) No details given.

(2) Prepared by Jet Propulsion Laboratory, Caltech.

ESTIMATED ERROR:

$\delta T/K = \pm 0.3$; $\delta x_{O_2} = \pm 3\%$

(estimated by compiler)

REFERENCES:

1. Wesseler, E.P.; Iltis, R.; Clark, L.C. Jr.

J. Fluorine Chem. 1977, *9*, 137-46.

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Heptafluorotetrahydro(nonafluorobutyl)-furan or Perfluorobutyl perfluorotetrahydrofuran or FC-80; $C_8F_{16}O$; [40464-54-8]

ORIGINAL MEASUREMENTS:

Tham, M. K.; Walker, R. D. Jr.; Modell, J. H.

J. Chem. Eng. Data 1973, *18*, 385-6.

VARIABLES:

T/K= 298.15 - 323.15
P/kPa= 101.325

PREPARED BY:

T. D. Kittredge
H. L. Clever

EXPERIMENTAL VALUES:

T/K	Mol Fraction $X_1 \times 10^3$	Bunsen Coefficient α	Ostwald Coefficient L
298.15	5.60	0.536	0.585
303.15	5.58	0.530	0.588
310.15	5.50	0.517	0.587
313.15	5.50	0.514	0.589
323.15	5.40	0.497	0.588

The Bunsen and Ostwald coefficients were calculated by the compiler.

Smoothed Data: $\Delta G^0/\text{J mol}^{-1} = -RT \ln X_1 = -1187.0 + 47.073\ T$

Std. dev.ΔG^0 = 6.0, Coef. corr. = 0.9997

$\Delta H^0/\text{J mol}^{-1} = -1187.0$, $\Delta S^0/\text{J K}^{-1}\text{ mol}^{-1} = -47.073$

T/K	Mol Fraction $X_1 \times 10^3$	$\Delta G^0/\text{J mol}^{-1}$
298.15	5.61	12,848
303.15	5.57	13,083
308.15	5.52	13,319
313.15	5.48	13,554
318.15	5.44	13,789
323.15	5.41	14,025

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The apparatus and procedure described by Shoor, Walker and Gubbins (1) were used. The solvent was placed in a saturator immersed in a constant temperature bath. The gas was dispersed through the liquid by a fritted glass disk at a rate of about 40 cm^3 m^{-1}. After an initial equilibration period of 30 minutes, samples were withdrawn with a Hamilton microliter syringe at 15 minute intervals and analyzed chromatographically (Perkin-Elmer 900 gas chromatograph with thermal conductivity detector). The solubility at one atmosphere partial pressure of the gas was the mean value of three consectutive samples which agreed within the limits of experimental error.

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. Source not given. Minimum purity 99.6 per cent.

(2) FC-80. Minnesota Minning and Manufacturing Co. A mixture of several isomers. The authors also measured the density and viscosity of the solvent at several temperatures. At 298.15 K the density is 1.7657 g cm^{-3} and the viscosity is 1.3953 centipoise.

ESTIMATED ERROR:

$\delta T/K = 0.05$
$\delta X_1/X_1 = 0.005$ (Compiler)

REFERENCES:

1. Shoor, S. K.; Walker, R. D. Jr.; Gubbins, K. E. *J. Phys. Chem.* 1969, *73*, 312.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Oxygen; O_2; [7782-44-7] (2) 1-Bromo-1,1,2,2,3,3,4,4,5,5,6,6,7,7,8,8,8-heptadecalfluoro-octane (Perfluorooctyl bromide); $C_8F_{17}Br$; [423-55-2]	Wesseler, E.P.; Iltis, R.; Clark, L.C. Jr. *J. Fluorine Chem.* 1977, *9*,137-46.
VARIABLES:	PREPARED BY:
T/K = 298	C. L. Young

EXPERIMENTAL VALUES:

T/K	Solubility *	Mole fraction + of oxygen x_{O_2}
298.15	52.7	0.00566

* appears to be the Ostwald coefficient x 10^2, units were stated as ml/100 ml (total pressure was the barometric pressure, assumed to be 1 atmosphere)

\+ calculated by compiler for a total pressure of 101.325 kPa using the density given in source

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Oxygen bubbled through fluorocarbon in stirred cell. When saturation achieved samples of liquid removed with a hypodermic Precision Sampling 50 μl Pressure-Lok syringe. At least 15 samples taken and chromatographed. Average peak height compared with that of average peak height for injection of the same volume of oxygen. Chromatographic column consisted of 13X molecular sieve at 70°C. Helium was used as carrier gas.

SOURCE AND PURITY OF MATERIALS:

(1) No details given.

(2) A 3M sample, boiling pt 140.5°C.

ESTIMATED ERROR:

$\delta T/K = \pm 0.3$; $\delta x_{O_2} = \pm 2\%$

REFERENCES:

COMPONENTS: (1) Oxygen; O_2; [7782-44-7] (2) Octadecafluorooctane (Perfluorooctane); C_8F_{18}; [307-34-6]	ORIGINAL MEASUREMENTS: Wesseler, E.P.; Iltis, R.; Clark, L.C. Jr. *J. Fluorine Chem.* 1977, *9*, 137-46.
VARIABLES: T/K = 298	PREPARED BY: C. L. Young

EXPERIMENTAL VALUES:

T/K	Solubility *	Mole fraction + of oxygen x_{O_2}
298.15	52.1	0.00534

* appears to be the Ostwald coefficient x 10^2 stated as ml/100 ml (total pressure was the barometer pressure, assumed to be 1 atmosphere)

\+ calculated by compiler for a total pressure of 101.325 kPa using density given in source

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Oxygen bubbled through fluorocarbon in stirred cell. When saturation achieved samples of liquid removed with a hypodermic Precision Sampling 50 μl Pressure-Lok syringe. At least 15 samples taken and chromatographed. Average peak height compared with that of average peak height for injection of the same volume of oxygen. Chromatographic column consisted of 13X molecular sieve at 70°C. Helium was used as carrier gas.

SOURCE AND PURITY OF MATERIALS:

(1) No details given.

(2) PCR sample boiling pt range 100-105°C. Probably a mixture of isomers.

ESTIMATED ERROR:

$\delta T/K = \pm 0.3$; $\delta x_{O_2} = \pm 2\%$

REFERENCES:

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) FC-75 which is mostly 2,2,3,3,4-4,5-heptafluorotetrahydro-5-(nonafluorobutyl)furan or perfluorobutyltetrahydrofuran; $C_8F_{16}O$; [335-36-4]

ORIGINAL MEASUREMENTS:

Zander, R.

Res. exp. Med. 1974, *164*, 97-109.

VARIABLES:

T/K= 283.15 - 323.15
P/kPa= 12 - 101

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

Temperature Range T/K	Gas Phase[1] Volume Per Cent Oxygen	Oxygen Partial Pressure[2] p/mmHg	Bunsen Coefficient Regression Equation $\alpha/cm^3\ cm^{-3}\ atm^{-1}$	Number of Experimental Points
283.15 - 323.15 (10 - 50 °C)	12	91.2	$\alpha = 0.369 - 0.00041\ t/{}^\circ C$	24
	35	266	$\alpha = 0.466 - 0.00073\ t/{}^\circ C$	20
	100	760	$\alpha = 0.491 - 0.00096\ t/{}^\circ C$	20

[1] The gas phase consists of oxygen, water at its equilibrium vapor pressure, solvent (FC-75) at its equilibrium vapor pressure, and nitrogen to bring the total pressure to near one atm. The per cent oxygen in the gas phase was experimentally determined by a Scholander gas analyzer.

[2] The oxygen partial pressure was calculated by the compiler with the assumption that the gas mixture behaved ideally and that the total pressure was 760 mmHg.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Equilibration bewteen the gas and liquid phases was established in 45 minutes in a Tonometer of the Laue (1) design.

The oxygen content of the gas phase was determined by a Scholander gas analyzer (see footnote 1 above).

The saturated solution was transferred to a Van Slyke apparatus for the solubility determination.

The 64 experimental measurements made at temperatures of 10, 30, and 50 °C were fitted to the equations in the table above. The smoothed data were used to construct a graph of Bunsen coefficient *vs*. oxygen partial pressure, and a nomogram for the volume percent oxygen as a function of oxygen partial pressure and temperature.

The solubility appears to depart from Henry's law above pressures of 100 mmHg oxygen.

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. No information.

(2) FC-75. Minnesota Mining and Manufacturing Co. Used as received.

ESTIMATED ERROR:

$\delta T/K = 0.1$
$\delta\alpha/\alpha =$ 0.03 above 100 mmHg oxygen,
0.05 - 0.10 below 100 mmHg.

REFERENCES:

1. Laue, D.
Pflugers Arch. Gesamte Physiol. Menschen Tiere 1951, *254*, 142.

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) FC-80, which is mostly a mixture of isomers of perfluorobutyltetrahydrofuran. For example 2,2,3,3,4,4,5-heptafluorotetrahydro-5(nonafluorobutyl)furan; $C_8F_{16}O$; [335-36-4]

ORIGINAL MEASUREMENTS:

Sargent, J. W.; Seffl, R. J.

Fed. Proc. 1970, *29*, 1699 - 1703.

VARIABLES:

T/K = 298.15, 310.15
Total P/kPa = 101.325

PREPARED BY:

A. L. Cramer
H. L. Clever

EXPERIMENTAL VALUES:

Temperature		Oxygen Solubility	
t/°C	T/K	g O_2 1000 g^{-1}	cm^3 O_2 100 cm^{-3}
25	298.15	0.361	48.8
37	310.15	0.354	48.5

The authors solubility, cm^3 O_2 100 cm^{-3}, appears to be the Ostwald coefficient times 100.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The equilibrium apparatus is a 50 cm^3 three neck flask equiped with a water condenser, a thermometer, and a gas dispersing tube extending below the fluid surface level. Between 25 and 35 cm^3 of solvent are placed in the flask. Gas is bubbled through the solvent for 2 - 3 h. An 80 microliter sample is slowly taken into a gas tight syringe. The sample is injected into a gas chromatograph. The results of three sampling and analyises are averaged.

The chromatograph is an F and M Model 720 equiped with a thermal conductivity detector at 320 °C, and a 6' by ¼" stainless steel column packed with 13X molecular sieve at room temperature. The apparatus is calibrated with pure gas samples.

Details of the procedure were furnished by R. D. Danielson of the 3 M Co.

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. Source not given. Commercial cylinder.

(2) FC-80. Minnesota Mining and Manufacturing Co. All H in an organic compound are replaced by F by Simons electrochemical process (1)

ESTIMATED ERROR:

$\delta T/K = 0.1$
$\delta c/c = 0.01$
reproducibility = 0.05 absolute

REFERENCES:

1. Simons, J. H., Editor *Fluorine Chemistry* Academic Press, New York, 1950.

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) 1,1,1,2,2,3,3-Heptafluoro-4,4-bis(trifluoromethyl)-heptane; $C_9H_7F_{13}$; [67728-31-8]

ORIGINAL MEASUREMENTS:

Lawson, D.D.; Moacanin, J.; Scherer, K.V.; Terranova, T.F.; Ingham, J.D.

J. Fluorine Chem. 1978, *12*, 221-36.

VARIABLES:

T/K = 298

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	Solubility *	Mole fraction + of oxygen x_{O_2}
298.15	46.7	0.00494

* appears to be the Ostwald coefficient x 10^2, units were stated as $cm^3 O_2/100\ cm^3$ (total pressure was assumed to be 1 atmosphere)

\+ calculated by compiler for a total pressure of 101.325 kPa using density given in source

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Oxygen bubbled through fluorocarbon in stirred cell. When saturation achieved sample of liquid analysed by gas chromatography using a molecular sieve to retain the fluorocarbon. Details not given in source but method in ref.(1) was equivalent.

SOURCE AND PURITY OF MATERIALS:

(1) No details given.

(2) Prepared by Jet Propulsion Laboratory, Caltech.

ESTIMATED ERROR:

$\delta T/K = \pm 0.3$; $\delta x_{O_2} = \pm 3\%$

(estimated by compiler)

REFERENCES:

1. Wesseler, E.P.; Iltis, R.; Clark, L.C. Jr.

J. Fluorine Chem. 1977, 9, 137-146.

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) 1,1,1,2,2,3,3,5,5,5-Decafluoro-4-propoxy-4-(trifluoromethyl)-pentane; $C_9H_7F_{13}O$; [67728-35-2]

ORIGINAL MEASUREMENTS:

Lawson, D.D.; Moacanin, J.; Scherer, K.V.; Terranova, T.F.; Ingham, J.D.

J. Fluorine Chem. 1978, *12*, 221-36.

VARIABLES:

T/K = 298

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	Solubility *	Mole fraction + of oxygen x_{O_2}
298.15	45.8	0.00509

* appears to be the Ostwald coefficient x 10^2, units were stated as $cm^3 O_2/100\ cm^3$ (total pressure was assumed to be 1 atmosphere)

\+ calculated by compiler for a total pressure of 101.325 kPa using density given in source

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Oxygen bubbled through fulorocarbon in stirred cell. When saturation achieved sample of liquid analysed by gas chromatography using a molecular sieve to retain the fluorocarbon. Details not given in source but method in ref. (1) was equivalent.

SOURCE AND PURITY OF MATERIALS:

(1) No details given.

(2) Prepared by Jet Propulsion Laboratory, Caltech.

ESTIMATED ERROR:

$\delta T/K = \pm 0.3$; $\delta x_{O_2} = \pm 3\%$

(estimated by compiler)

REFERENCES:

1. Wesseler, E.P.; Iltis, R.; Clark, L.C. Jr.

J. Fluorine Chem. 1977, *9*, 137-146.

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) 1-Chloro-1,1,2,2,3,3,4,4,5,5,6,6,7,8,8,8-hexadecafluoro-7-(trifluoromethyl)-Octane; $C_9F_{19}Cl$; [63243-38-9]

ORIGINAL MEASUREMENTS:

Wesseler, E.P.; Iltis, R.; Clark, L.C. Jr.

J. Fluorine Chem. 1977, *9*, 137-46.

VARIABLES:

T/K = 298

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	Solubility *	Mole fraction + of oxygen x_{O_2}
298.15	45.6	0.00511

* appears to be the Ostwald coefficient x 10^2 stated as ml/100 ml (total pressure was the barometer pressure, assumed to be 1 atmosphere)

\+ calculated by compiler for a total pressure of 101.325 kPa using density given in source

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Oxygen bubbled through fluorocarbon in stirred cell. When saturation achieved samples of liquid removed with a hypodermic Precision Sampling 50 μl Pressure-Lok syringe. At least 15 samples taken and chromatographed. Average peak height compared with that of average peak height for injection of the same volume for oxygen. Chromatographic column consisted of 13X molecular sieve at 70°C. Helium was used as carrier gas.

SOURCE AND PURITY OF MATERIALS:

(1) No details given.

(2) Pennwalt Corp. boiling pt. 151°C.

ESTIMATED ERROR:

$\delta T/K = \pm 0.3$; $\delta x_{O_2} = \pm 2\%$

REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Oxygen; O_2; [7782-44-7] (2) Eicosafluorononane, (Perfluorononane); C_9F_{20}; [375-96-2]	Wesseler, E.P.; Iltis, R.; Clark, L.C. Jr. *J. Fluorine Chem.* 1977, *9*, 137-46.
VARIABLES:	**PREPARED BY:**
T/K = 298	C. L. Young

EXPERIMENTAL VALUES:

T/K	Solubility *	Mole fraction + of oxygen x_{O_2}
298.15	49.6	0.00535

* appears to be the Ostwald coefficient x 10^2 stated as ml/100 ml (total pressure was the barometer pressure, assumed to be 1 atmosphere)

\+ calculated by compiler for a total pressure of 101.325 kPa using density given in source

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Oxygen bubbled through fluorocarbon in stirred cell. When saturation achieved samples of liquid removed with a hypodermic Precision Sampling 50 μl Pressure-Lok syringe. At least 15 samples taken and chromatographed. Average peak height compared with that of average peak height for injection of the same volume of oxygen. Chromatographic column consisted of 13X molecular sieve at 70°C. Helium was used as carrier gas.

SOURCE AND PURITY OF MATERIALS:

(1) No details given.

(2) Armageddon Chem. Co., purified, boiling pt. 119°C

ESTIMATED ERROR:

$\delta T/K = \pm 0.3$; $\delta x_{O_2} = \pm 2\%$

REFERENCES:

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) 1,1,1,2,2,3,3,4,4,5,5,6,6-Tridecafluoro-6-[1,2,2,2-tetrafluoro-1-(trifluoromethyl)ethoxy]-hexane or Perfluoro-1-isopropoxy hexane or Caroxin-F; $C_9F_{20}O$; [37340-18-4] or [41719-16-8]

ORIGINAL MEASUREMENTS:

Tham, M. K.; Walker, R. D. Jr.; Modell, J. H.

J. Chem. Eng. Data 1973, *18*, 385-6.

VARIABLES:

T/K = 298.15 - 323.15
P/kPa = 101.325

PREPARED BY:

T. D. Kittredge
H. L. Clever

EXPERIMENTAL VALUES:

T/K	Mol Fraction $X_1 \times 10^3$	Bunsen Coefficient α	Ostwald Coefficient L
298.15	6.60	0.515	0.562
303.15	6.57	0.509	0.565
310.15	6.48	0.497	0.564
313.15	6.47	0.494	0.566
323.15	6.30	0.474	0.561

The Bunsen and Ostwald coefficients were calculated by the compiler.

Smoothed Data: $\Delta G^0/\text{J mol}^{-1} = -RT \ln X_1 = -1495.4 + 46.727\ T$

Std. dev. $\Delta G^{\text{¢}} = 9.9$, Coef. corr. 0.9997

$\Delta H^0/\text{J mol}^{-1} = -1495.4$, $\Delta S^0/\text{J K}^{-1}\text{ mol}^{-1} = -46.727$

T/K	Mol Fraction $X_1 \times 10^3$	$\Delta G^0/\text{J mol}^{-1}$
298.15	6.63	12,436
303.15	6.56	12,670
308.15	6.50	12,903
313.15	6.44	13,137
318.15	6.38	13,371
323.15	6.32	13,604

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The method of Shoor, Walker and Gubbins (1) was used. The solvent was placed in a saturator immersed in a constant temperature bath. The gas was dispersed through the liquid by a fritted glass disk at a rate of about 40 $cm^3\ m^{-1}$. After an initial equilibration period of 30 minutes, samples were withdrawn at 15 minute intervals and analyzed chromatographically (Perkin-Elmer 900 gas chromatograph with thermal conductivity detector). The solubility at one atmosphere partial pressure of the gas was the mean value of three consecutive samples which agreed within the limits of experimental error.

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. Source not given. Minimum purity 99.6 per cent.

(2) Caroxin-F. Allied Chemical Corp. Purity > 99.9 per cent as supplied. The authors also measured the density and viscosity of the solvent at several temperatures. At 298.15 K the density is 1.7449 g cm^{-3} and the viscosity is 1.5405 centipoise.

ESTIMATED ERROR:

$\delta T/K = 0.05$
$\delta X_1/X_1 = 0.005$ (compiler)

REFERENCES:

1. Shoor, S. K.; Walker, R. D. Jr.; Gubbins, K. E. *J. Phys. Chem.* 1969, *73*, 312.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Oxygen; O_2; [7782-44-7] (2) 1,1,1,2,2,3,3-Heptafluoro-4,4-bis (trifluoromethyl)-octane; $C_{10}H_9F_{13}$; [67728-32-9]	Lawson, D.D.; Moacanin, J.; Scherer, K.V.; Terranova, T.F.; Ingham, J.D. *J. Fluorine Chem.* 1978, *12*, 221-36.
VARIABLES:	PREPARED BY:
T/K = 298	C. L. Young

EXPERIMENTAL VALUES:

T/K	Solubility *	Mole fraction + of oxygen x_{O_2}
298.15	46.6	0.00530

* appears to be the Ostwald coefficient x 10^2, units were stated as $cm^3 O_2/100\ cm^3$ (total pressure was assumed to be 1 atmosphere)

\+ calculated by compiler for a total pressure of 101.325 kPa using density given in source

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Oxygen bubbled through fluorocarbon in stirred cell. When saturation achieved sample of liquid analysed by gas chromatography using a molecular sieve to retain the fluorocarbon. Details not given in source but method in ref. (1) was equivalent.

SOURCE AND PURITY OF MATERIALS:

(1) No details given.

(2) Prepared by Jet Propulsion Laboratory, Caltech.

ESTIMATED ERROR:

$\delta T/K = \pm 0.3$; $\delta x_{O_2} = \pm 3\%$

(estimated by compiler)

REFERENCES:

1. Wesseler, E.P.; Iltis, R.; Clark, L.C. Jr.

J. Fluorine Chem. 1977, *9*, 137-46.

COMPONENTS: (1) Oxygen; O_2; [7782-44-7] (2) 1,1,1,2,2,3,3-Heptafluoro-6-methyl-4,4-bis (trifluoromethyl)-heptane; $C_{10}H_9F_{13}$; [67728-33-0]	ORIGINAL MEASUREMENTS: Lawson, D.D.; Moacanin, J.; Scherer. K.V.; Terranova, T.F.; Ingham, J.D. *J. Fluorine Chem.* 1978, *12*, 221-36.
VARIABLES: T/K = 298	PREPARED BY: C. L. Young

EXPERIMENTAL VALUES:

T/K	Solubility *	Mole fraction + of oxygen x_{O_2}
298.15	43.6	0.0502

* appears to be the Ostwald coefficient x 10^2, units were stated as $cm^3 O_2/100\ cm^3$ (total pressure was assumed to be 1 atmosphere)

\+ calculated by compiler for a total pressure of 101.325 kPa using density given in source

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Oxygen bubbled through fluorocarbon in stirred cell. When saturation achieved sample of liquid analysed by gas chromatography using a molecular sieve to retain the fluorocarbon. Details not given in source but method in ref. (1) was equivalent.

SOURCE AND PURITY OF MATERIALS:

(1) No details given.

(2) Prepared by Jet Propulsion Laboratory, Caltech.

ESTIMATED ERROR:

$\delta T/K = \pm 0.3$; $\delta x_{O_2} = \pm 3\%$

(estimated by compiler)

REFERENCES:

1. Wesseler, E.P.; Iltis, R.; Clark, L.C. Jr.

J. Fluorine Chem. 1977, *9*, 137-46.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Oxygen; O_2; [7782-44-7] (2) Octadecafluorodecahydronaphthalene, (Perfluorodecalin); $C_{10}F_{18}$; [306-94-5]	Wesseler, E.P.; Iltis, R.; Clark, L.C. Jr. *J. Fluorine Chem.* 1977, *9*, 137-46.
VARIABLES:	**PREPARED BY:**
T/K = 298	C. L. Young

EXPERIMENTAL VALUES:

T/K	Solubility *	Mole fraction + of oxygen x_{O_2}
298.15	40.3	0.00390

* appears to be the Ostwald coefficient x 10^2 stated as ml/100 ml (total pressure was the barometer pressure, assumed to be 1 atmosphere)

\+ calculated by compiler for a total pressure of 101.325 kPa using density given in source

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Oxygen bubbled through fluorocarbon in stirred cell. When saturation achieved samples of liquid removed with a hypodermic Precision Sampling 50 μl Pressure-Lok syringe. At least 15 samples taken and chromatographed. Average peak height compared with that of average peak height for injection of the same volume of oxygen. Chromatographic column consisted of 13X molecular sieve at 70°C. Helium was used as carrier gas.

SOURCE AND PURITY OF MATERIALS:

(1) No details given.

(2) Imperial Smelting Co Chemicals Ltd, boiling pt. 142°C.

ESTIMATED ERROR:

$\delta T/K = \pm 0.3$; $\delta x_{O_2} = \pm 2\%$

REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Oxygen; O_2; [7782-44-7] (2) 1,1,2,2,3,3,4,4-Octafluoro-1,4-bis(1,2,2,2-tetrafluoro-1-(trifluoromethyl)ethoxy) butane or Perfluoro-1,4- diisopropoxy butane or Caroxin-D; $C_{10}F_{22}O_2$; [23228-90-2]	Tham, M. K.; Walker, R. D. Jr.; Modell, J. H. *J. Chem. Eng. Data* 1973, *18*, 385-6.
VARIABLES: T/K= 298.15 - 323.15 P/kPa =101.325	PREPARED BY: T. D. Kittredge H. L. Clever

EXPERIMENTAL VALUES:

T/K	Mol Fraction $X_1 \times 10^3$	Bunsen Coefficient α	Ostwald Coefficient L
298.15	6.50	0.449	0.490
303.15	6.40	0.439	0.487
310.15	6.30	0.428	0.486
313.15	6.28	0.424	0.486
323.15	6.20	0.412	0.487

Smoothed Data: $\Delta G^0/J\ mol^{-1} = -RT \ln X_1 = -1489.7 + 46.900\ T$

Std. dev. $\Delta G^0 = 8.9$, Coef. corr. = 0.9999

$\Delta H^0/J.mol^{-1} = -1489.7$, $\Delta S^0/J\ K^{-1}\ mol^{-1} = -46.900$

T/K	Mol Fraction $X_1 \times 10^3$	$\Delta G^0/J\ mol^{-1}$
298.15	6.47	12,494
303.15	6.41	12,728
308.15	6.35	12,963
313.15	6.29	13,197
318.15	6.23	13,432
323.15	6.18	13,666

The Bunsen and Ostwald coefficients were calculated by the compiler.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The method of Shoor, Walker and Gubbins was used (1). The solvent was placed in a saturator immersed in a constant temperature bath. The gas was bubbled through the liquid by a fritted glass disk for 30 minutes, then analyzed at 15 minute intervals by gas chromatography. The solubility corrected to one atm partial pressure of the gas was the mean value of three consecutive samples which agree within the limits of experimental error.

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. Source not given. Minimum purity 99.6 per cent.

(2) Caroxin-D. Allied Chemical Corp. Purity > 99.9 per cent as supplied. The authors also measured the density and viscosity of the solvent. At 298.15 K the density is 1.7465 g cm^{-3} and the viscosity is 2.0579 centi poise.

ESTIMATED ERROR:

$\delta T/K = 0.05$

$\delta X_1/X_1 = 0.005$ (compiler)

REFERENCES:

1. Shoor, S. K.; Walker, R. D.; Gubbins, K. E. *J. Phys. Chem.* 1969, *73*, 312.

COMPONENTS: (1) Oxygen; O_2; [7782-44-7] (2) 1,1,1,2,3,3-hexafluoro-2 (heptafluoropropoxy)-3-[1,2,2-trifluoro-2-(1,2,2,2-tetrafluoroethoxy)-1-(trifluoromethyl) ethoxy]-propane; $C_{11}HF_{23}O_3$; [3330-16-3]	ORIGINAL MEASUREMENTS: Wesseler, E.P.; Iltis, R; Clark, L.C. Jr. *J. Fluorine Chem.* 1977, *9*, 137-46.
VARIABLES: T/K =298	PREPARED BY: C. L. Young

EXPERIMENTAL VALUES:

T/K	Solubility *	Mole fraction + of oxygen x_{O_2}
298.15	47.3	0.00683

* appears to be the Ostwald coefficient x 10^2 stated as ml/100 ml (total pressure was the barometer pressure, assumed to be 1 atmosphere)

\+ calculated by compiler for a total pressure of 101.325 kPa using density given in source

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Oxygen bubbled through fluorocarbon in stirred cell. When saturation achieved samples of liquid removed with a hypodermic Precision Sampling 50 μl Pressure-Lok syringe. At least 15 samples taken and chromatographed. Average peak height compared with that of average peak height for injection of the same volume for oxygen. Chromatographic column consisted of 13X molecular sieve at 70°C. Helium was used as carrier gas.

SOURCE AND PURITY OF MATERIALS:

(1) No details given.

(2) DuPont sample, boiling pt. 152°C.

ESTIMATED ERROR:

$\delta T/K = \pm 0.3$; $\delta x_{O_2} = \pm 2\%$

REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Oxygen; O_2; [7782-44-7] (2) 1,1,1,7,7,7-Hexafluoro-2,2,6,6-tetrakis (trifluoromethyl)-heptane; $C_{11}H_6F_{18}$; [67728-37-4]	Lawson, D.D.; Moacanin, J.; Scherer, K.V.; Terranova, T.F.; Ingham, J.D. *J. Fluorine Chem.* 1978, *12*, 221-36.
VARIABLES:	PREPARED BY:
T/K = 298	C. L. Young

EXPERIMENTAL VALUES:

T/K	Solubility *	Mole fraction + of oxygen x_{O_2}
298.15	35.8	0.00478

* appears to be the Ostwald coefficient x 10^2, units were stated as $cm^3 O_2/100\ cm^3$ (total pressure was assumed to be 1 atmosphere)

\+ calculated by compiler for a total pressure of 101.325 kPa using density given in source

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Oxygen bubbled through fluorocarbon in stirred cell. When saturation achieved sample of liquid analused by gas chromatography using a molecular sieve to retain the fluorocarbon. Details not given in source but method in ref.(1) was equivalent.

SOURCE AND PURITY OF MATERIALS:

(1) No details given.

(2) Prepared by Jet Propulsion Laboratory, Caltech.

ESTIMATED ERROR:

$\delta T/K = \pm 0.3$; $\delta x_{O_2} = \pm 3\%$

(estimated by compiler)

REFERENCES:

1. Wesseler, E.P.; Iltis, R.; Clark, L.C. Jr.

J. Fluorine Chem. 1977, *9*, 137-46.

COMPONENTS:

(1) Oxygen; O_2; [7782-44-3]

(2) Heptadecafluorodecahydro (trifluoromethyl)-Naphthalene, (Perfluoromethyldecalin); $C_{11}F_{20}$; [51294-16-7]

ORIGINAL MEASUREMENTS:

Wesseler, E.P.; Iltis, R.; Clark, L.C. Jr.

J. Fluorine Chem. 1977, *9*,137-46.

VARIABLES:

T/K = 298

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	Solubility *	Mole fraction + of oxygen x_{O_2}
298.15	38.4	0.00406

* appears to be the Ostwald coefficient x 10^2 stated as ml/100 ml (total pressure was the barometer pressure, assumed to be 1 atmosphere)

\+ calculated by compiler for a total pressure of 101.325 kPa using density given in source

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Oxygen bubbled through fluorocarbon in stirred cell. When saturation achieved samples of liquid removed with a hypodermic Precision Sampling 50 μl Pressure-Lok syringe. At least 15 samples taken and chromatographed. Average peak height compared with that of average peak height for injection of the same volume of oxygen. Chromatographic column consisted of 13X molecular sieve at 70°C. Helium was used as carrier gas.

SOURCE AND PURITY OF MATERIALS:

(1) No details given.

(2) Imperial Smelting Co. Chemicals Ltd. sample, boiling pt. 160°C.

ESTIMATED ERROR:

$\delta T/K = \pm 0.3$; $\delta x_{O_2} = \pm 2\%$

REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Oxygen; O_2; [7782-44-7] (2) Tricyclo[3,3,1,3,7] decane tetradecafluorobis (trifluoromethyl)-(Perfluorodomethyladamatane); $C_{12}F_{20}$; [63267-58-3]	Wesseler, E.P.; Iltis, R.; Clark, L.C. Jr. *J. Fluorine Chem.* 1977, *9*, 137-46.
VARIABLES:	PREPARED BY:
T/K = 298	C. L. Young

EXPERIMENTAL VALUES:

T/K	Solubility *	Mole fraction + of oxygen x_{O_2}
298.15	39.4	0.00420

* appears to be the Ostwald coefficient x 10^2 stated as ml/100 ml (total pressure was the barometer pressure, assumed to be 1 atmosphere)

\+ calculated by compiler for a total pressure of 101.325 kPa using density given in source

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Oxygen bubbled through fluorocarbon in stirred cell. When saturation achieved samples of liquid removed with a hypodermic Precision Sampling 50 μl Pressure-Lok syringe. At least 15 samples taken and chromatographed. Average peak height compared with that of average peak height for injection of the same volume of oxygen. Chromatographic column consisted of 13X molecular sieve at 70°C. Helium was used as carrier gas.

SOURCE AND PURITY OF MATERIALS:

(1) No details given.

(2) Sun Ventures (Penn) sample, boiling pt. 175-180°C.

ESTIMATED ERROR:

$\delta T/K = \pm 0.3$; $\delta x_{O_2} = \pm 2\%$

REFERENCES:

COMPONENTS: (1) Oxygen; O_2; [7782-44-7] (2) 3,6,9,12-Tetraoxapentadecane, 1,1,1,2,4,4,5,7,7,8,10,10,11,13, 13,14,14,15,15,15-eicosafluoro-5,8,11-tris(trifluoromethyl)- $C_{14}HF_{29}O_4$; [26738-51-2]	ORIGINAL MEASUREMENTS: Wesseler, E.P.; Iltis, R.; Clark, L.C. Jr. *J. Fluorine Chem.* 1977, *9*, 137-46.
VARIABLES: T/K = 298	PREPARED BY: C. L. Young

EXPERIMENTAL VALUES:

T/K	Solubility *	Mole fraction + of oxygen x_{O_2}
298.15	42.2	0.00759

* appears to be the Ostwald coefficient x 10^2 stated as ml/100 ml (total pressure was the barometer pressure, assumed to be 1 atmosphere)

\+ calculated by compiler for a total pressure of 101.325 kPa using density given in source

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Oxygen bubbled through fluorocarbon in stirred cell. When saturation achieved samples of liquid removed with a hypodermic Precision Sampling 50 μl Oressure-Lok syringe. At least 15 samples taken and chromatographed. Average peak height compared with that of average peak height for injection of the same volume of oxygen. Chromatographic column consisted of 13X molecular sieve at 70°C. Helium was used as carrier gas.

SOURCE AND PURITY OF MATERIALS:

(1) No details given.

(2) DuPont sample, boiling pt. 194°C.

ESTIMATED ERROR:

$\delta T/K = \pm 0.3$; $\delta x_{O_2} = \pm 2\%$

REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Oxygen; O_2; [7782-44-7] (2) 3,6,9,12,15-Pentaoxaoctadecane, 1,1,1,2,4,4,5,7,7,8,10,10,11,13, 13,14,16,16,17,17,18,18,18-tricosafluoro-5,8,11,14-tetrakis (trifluoromethyl)-; $C_{17}HF_{35}O_5$; [37486-69-4]	Wesseler, E.P.; Iltis, R.; Clark, L.C. Jr. *J. Fluorine Chem.* 1977, *9*, 137-46.
VARIABLES:	**PREPARED BY:**
T/K = 298	C. L. Young

EXPERIMENTAL VALUES:

T/K	Solubility *	Mole fraction + of oxygen x_{O_2}
298.15	39.7	0.00853

* appears to be the Ostwald coefficient x 10^2 stated as ml/100 ml (total pressure was the barometer pressure, assumed to be 1 atmosphere)

\+ calculated by compiler for a total pressure of 101.325 kPa using density given in source

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:	SOURCE AND PURITY OF MATERIALS:
Oxygen bubbled through fluorocarbon in stirred cell. When saturation achieved samples of liquid removed with a hypodermic Precision Sampling 50 μl Pressure-Lok syringe. At least 15 samples taken and chromatographed. Average peak height compared with that of average peak height for injection of the same volume of oxygen. Chromatographic column consisted of 13X molecular sieve at 70°C. Helium was used as carrier gas.	(1) No details given. (2) Du Pont sample, boiling pt. 224°C.
	ESTIMATED ERROR:
	$\delta T/k = \pm 0.3$; $\delta x_{O_2} = \pm 2\%$
	REFERENCES:

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) 3,6,9,12,15,21,24,27-Nonaoxatriacontane, 1,1,1,2,4,4,5,7,7,8,10,10,11,13,13,14,16,16,17,19,19,20,22,22,23,25,25,26,28,28,29,29,30,30,30,-pentacontafluoro- 5,8,11,14,17,20,23,26,octakis (trifluoromethyl) $C_{29}HF_{59}O_9$; [58979-41-2]

VARIABLES:

T/K = 298

ORIGINAL MEASUREMENTS:

Wesseler, E.P; Iltis, R.; Clark, L.C. Jr.

J. Fluorine Chem. 1977, *9*, 137-46.

PREPARED BY:

C.L. Young

EXPERIMENTAL VALUES:

T/K	Solubility*	Mole fraction+ of oxygen x_{O_2}
298.15	33.3	0.0118

* appears to be the Ostwald coefficient x 10^2, units were stated as ml/100 ml (total pressure was the barometric pressure, assumed to be 1 atmosphere).

\+ calculated by compiler for a total pressure of 101.325 kPa using the density given in source.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Oxygen bubbled through fluorocarbon in stirred cell. When saturation achieved samples of liquid removed with a hypodermic Precision Sampling 50 µl Pressure-Lok syringe. At least 15 samples taken and chromatographed. Average peak height compared with that of average peak height for injection of the same volume of oxygen. Chromatographic column consisted of 13X molecular sieve at 70°C. Helium was used as carrier gas.

SOURCE AND PURITY OF MATERIALS:

(1) No details given.

(2) Dupont sample, density 1.848g cm^{-3} at 25°C.

ESTIMATED ERROR:

$\delta T/K = \pm 03$; $\delta x_{O_2} = \pm 2\%$

REFERENCES:

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Carbon disulfide; CS_2; [75-15-0]

ORIGINAL MEASUREMENTS:

Gjaldbaek, J. C.

Acta Chem. Scand. 1952, *6*, 623-33.

VARIABLES:

T/K = 297.97 - 298.15
Total P/kPa = 101.325

PREPARED BY:

J. Chr. Gjaldbaek

EXPERIMENTAL VALUES:

T/K	Mol Fraction $X_1 \times 10^3$	Bunsen Coefficient α	Ostwald Coefficient L
297.97	0.445	0.164	0.179
298.15	0.439	0.162	0.177

The mole fraction and Ostwald solubility values were calculated by the compiler.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

A calibrated all-glass combined manometer and bulb was enclosed in an air thermostat and shaken until equilibrium. Mercury was used for calibration and as the confining liquid. The solvents were degassed in the apparatus. Details are in references 1 and 2.

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

The saturation of the liquid with the gas was carried out close to atmospheric pressure. The solubility values were reported for one atmosphere gas pressure assuming Henry's law is obeyed.

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. Prepared by heating $KMnO_4$, 99.7 percent O_2, 0.3 percent N_2.

(2) Carbon disulfide. Merck Co. Analytical reagent grade, boiling point 46.21 - 46.26°C.

ESTIMATED ERROR:

$\delta T/K = 0.05$
$\delta X_1/X_1 = 0.015$

REFERENCES:

1. Lannung, A. *J. Am. Chem. Soc.* 1930, *52*, 68.

2. Gjaldbaek, J. C. *Acta Chem. Scand.* 1952, *6*, 623.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Oxygen; O_2; [7782-44-7] (2) Sulfinylbismethane or Dimethyl Sulfoxide; C_2H_6OS (CH_3SOCH_3); [67-68-5]	Dymond, J. H. *J. Phys. Chem.* 1967, *71*, 1829-31.
VARIABLES:	**PREPARED BY:**
T/K = 298.15 P/kPa = 101.325 (1 atm)	M. E. Derrick H. L. Clever

EXPERIMENTAL VALUES:

T/K	Mol Fraction $x_1 \times 10^4$	Bunsen Coefficient α	Ostwald Coefficient L
298.15	1.57	0.0494	0.0539

The Bunsen and Ostwald coefficients were calculated by the compiler.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The liquid is saturated with the gas at a gas partial pressure of 1 atm.

The apparatus is that described by Dymond and Hildebrand (1). The apparatus uses an all-glass pumping system to spray slugs of degassed solvent into the gas. The amount of gas dissolved is calculated from the initial and final gas pressure.

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. Stuart Oxygen Co. Dried.

(2) Dimethyl Sulfoxide. Matheson, Coleman, and Bell Co. Spectroquality reagent, dried, and a fraction frozen out. Melting pt.: 18.37°C.

ESTIMATED ERROR:

REFERENCES:

1. Dymond, J.; Hildebrand, J. H. *Ind. Eng. Chem. Fundam.* 1967, *6*, 130.

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Sulfinylbismethane or dimethyl sulfoxide; C_2H_6OS; [67-68-5]

ORIGINAL MEASUREMENTS:

Baird, W. R.; Foley, R. T.

J. Chem. Eng. Data 1972, *17*, 355-7.

VARIABLES:

T/K = 298.15
P/kPa = 101.325

PREPARED BY:

P. L. Long
H. L. Clever

EXPERIMENTAL VALUES:

T/K	Mol Fraction $x_1 \times 10^3$	Bunsen Coefficient $\alpha \times 10^2$	Ostwald Coefficient $L \times 10^2$
298.15	0.109	3.42 ± 0.08[1]	3.73

[1] Average of four measurements ± average deviation.

The compiler calculated the mole fraction and Ostwald coefficient values.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The apparatus and procedure used were based on those described by Morrison and Billett (1). Gas saturation is achieved by allowing a thin film of solvent to flow down a glass helix containing the gas and solvent vapor at a total pressure of one atm. About 100 cm^3 of solvent is saturated at a flow rate of 2 - 3 $cm^3\ m^{-1}$.

The authors solubility values for oxygen dissolved in water and in dimethylsulfoxide were 3.5 and 21 per cent lower, respectively, than values reported by other workers.

The authors reported a Bunsen coefficient which they had calculated from their measured Ostwald coefficients.

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. No information.

(2) Dimethyl sulfoxide. Matheson, Coleman and Bell. Fractionally distilled under reduced pressure through spinning band column. Use 40 percent from the center of an initial one liter sample.

ESTIMATED ERROR:

$\delta T/K = 0.5$
$\delta\alpha/\alpha = 0.023 - 0.050$ (authors)

REFERENCES:

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

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Sulfinylbismethane or dimethyl sulfoxide; C_2H_6OS; [67-68-5]

ORIGINAL MEASUREMENTS:

Chaenko, N. V.; Sukhova, G. I.; Naumenko, N. K.; Kedrinskii, I. A.

Zh. Fiz. Khim. 1979, *53*, 1989-92.

Russ. J. Phys. Chem. 1979, *53*, 1133-4.

VARIABLES:

T/K = 298.15 (?)

O_2 P/kPa = ∿21.3 (air at one atm)

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

T/K	Mol Fraction $x_1 \times 10^4$	Absorption Coefficient $cm^3(STP)\ cm^{-3}$
298.15[1]	1.96	0.063 ± 0.010

[1] The temperature is not given in the paper. However, the authors quote values from another of their papers in which all values were measured at 298.15 K.

The solvent was saturated with dry air at a total pressure of one atm. The oxygen partial pressure in dry air is ∿0.21 atm. The solubility values above are for that partial pressure of oxygen.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The oxygen concenrtation was determined by an electrochemical sensor. The sensor was calibrated against oxygen saturated ethanol. The Bunsen coefficient of oxygen in ethanol was taken to be 0.213 $cm^3\ cm^{-3}\ atm^{-1}$.

Solutions were saturated in a 20 cm^3 cell in 3 hours without stirring.

The solvent water content was determined by the Fisher method. Water content of 0.0053 - 0.017 % had no effect on the oxygen solubility.

The sensitivity of the method with respect to oxygen is 3 μg dm^{-3}.

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. Dry air.

(2) Dimethylsulfoxide. Freshly distilled after special purification.

ESTIMATED ERROR:

The authors state that the relative error in O_2 concentration is 9.9 per cent.

REFERENCES:

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Nitromethane; CH_3NO_2; [75-52-5]

ORIGINAL MEASUREMENTS:

Chaenko, N. V.; Sukhova, G. I.; Naumenko, N. K.; Kedrinskii, I. A.

Zh. Fiz. Khim. 1979, *53*, 1989-92.

Russ. J. Phys. Chem. 1979, *53*, 1133-4.

VARIABLES:

T/K = 298.15 (?)
O_2 P/kPa = 21.3 (air at one atm)

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

T/K	Mol Fraction $x_1 \times 10^4$	Absorption Coefficient cm^3(STP) cm^{-3}
298.15[1]	4.64	0.194 ± 0.004

[1] The temperature is not given in the paper. However, the authors quote values from another of their papers which were measured at 298.15.

The solvent was saturated with dry air at a total pressure of one atm. The oxygen partial pressure in dry air is ∿0.21 atm. The solubility values above are for the partial pressure of oxygen in air.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The oxygen concentration was determined by an electrochemical sensor. The sensor was calibrated against oxygen saturated ethanol solution. The Bunsen coefficent of oxygen in ethanol was taken as 0.213 cm^3cm^{-3} atm^{-1}.

Solutions were saturated in three hours without stirring.

The solvent water content was determined by the Fisher method. Water content of 0.0053 - 0.017 % had no effect on the oxygen solubility.

The sensitivity of the method with respect to oxygen is 3 μg dm^{-3}.

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. Dry air.

(2) Nitromethane. Freshly distilled after special purification.

ESTIMATED ERROR:

The authors state that the relative error in O_2 concentration is 4 - 5 per cent.

REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Oxygen; O_2; [7782-44-7] (2) N-methyl-N-nitroso-methanamine or N-nitroso-dimethylamine; $C_2H_6N_2O$; [62-75-9]	Baird, W. R.; Foley, R. T. *J. Chem. Eng. Data* 1972, *17*, 355-7.
VARIABLES:	**PREPARED BY:**
T/K = 298.15 P/kPa = 101.325	P. L. Long H. L. Clever

EXPERIMENTAL VALUES:

T/K	Mol Fraction $x_1 \times 10^3$	Bunsen Coefficient $\alpha \times 10^2$	Ostwald Coefficient $L \times 10^2$
298.15	0.200	6.05 ± 0.20[1]	6.60

[1] Average of four measurements ± average deviation.

The mole fraction and Ostwald coefficient values were calculated by the compiler.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The apparatus and procedure used were based on those described by Morrison and Billett (1). Gas saturation is achieved by allowing a thin film of solvent to flow down a glass helix containing the gas and solvent vapor at a total pressure of one atm. About 100 cm^3 of solvent is saturated at a flow rate of 2 - 3 cm^3 m^{-1}.

The authors solubility values for oxygen dissolved in water and in dimethylsulfoxide were 3.5 and 21 per cent lower, respectively, than values reported by other workers.

The authors reported a Bunsen coefficient which they had calculated from their measured Ostwald coefficients.

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. No information.

(2) N-nitroso-dimethylamine. Matheson, Coleman and Bell. Fractionally distilled under reduced pressure through spinning band column. Use 40 percent from the center of an initial one liter sample.

ESTIMATED ERROR:

$\delta T/K = 0.5$
$\delta\alpha/\alpha = 0.023 - 0.050$
(authors)

REFERENCES:

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

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Nitric acid, propyl ester or 1-propyl nitrate; $C_3H_7NO_3$; [627-13-4]

ORIGINAL MEASUREMENTS:

Amster, A. B.; Levy, J. B.

J. Am. Rocket Soc. 1959, *29*, 870-1.

VARIABLES:

T/K = "Room temperature"
P/kPa = 28.0 - 84.66

PREPARED BY:

M. E. Derrick
H. L. Clever

EXPERIMENTAL VALUES:

Pressure		Solubility[1]	Mol Fraction	Bunsen Coefficient	Ostwald Coefficient
P/mmHg[1]	P/kPa	mol g^{-1} x 10^6	x_1 x 10^4	α	L
210	28.0	1.9	2.0	0.17	0.18
225	30.0	2.0	2.1	0.16	0.17
230	30.7	1.9	2.0	0.15	0.16
400	53.3	4.2	4.4	0.19	0.20
410	54.7	4.1	4.3	0.18	0.19
425	56.7	4.5	4.7	0.19	0.20
440	58.7	3.8	4.0	0.16	0.17
620	82.7	7.3	7.7	0.21	0.23
630	84.0	7.1	7.5	0.20	0.22
635	84.7	7.2	7.6	0.20	0.22

[1] The compiler read values of pressure and solubility from a graph in the author's paper. The pressure is the total pressure minus the equilbrium vapor pressure of pure nitric acid propyl ester.

The compiler calculated the mole fraction, Bunsen coefficient, and the Ostwald ceofficient values assuming a temperature of 293.15 K. Density values for the solvent were available at the temperature.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The apparatus consists of an absorption flask connected by a flexible spiral to a mercury filled capillary (1).

The gas is shaken with the degassed liquid. A weighed quantity of liquid is placed in the flask. The volume of the gas is taken as the volume of the flask minus the liquid volume. The solubility is calculated from

Solubility/mol g^{-1} = $V\Delta P/WRT$

where V is the gas volume,
ΔP is the pressure change,
W is the weight of liquid.

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. Technical grade. 99.5 per cent. Passed through a drying tube.

(2) Nitric acid, propyl ester. Source and purity not given.

ESTIMATED ERROR:

δP/mmHg = 5
δT/K = 2
$\delta\alpha/\alpha$ = 0.15

REFERENCES:

1. Levy, J. B.; Taft, R. W. Jr.; Aaron, D.; Hammett, L. P. *J. Am. Chem. Soc.* 1953, *75*, 3955.

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Cyclic amines; C_4H_9N, C_5H_5N, and $C_5H_{10}N$

ORIGINAL MEASUREMENTS:

Guerry, D. Jr.

Ph.D. thesis, 1944, Vanderbilt University, Nashville, TN.

VARIABLES:

T/K = 293-298

P/kPa = 101.325

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

T/K	Mol Fraction $x_1 \times 10^4$	Bunsen Coefficient α	Ostwald Coefficient L
Pyrrolidine; C_4H_9N; [123-75-1]			
293.15	6.04	0.163	0.175
298.15	6.06	0.163	0.178
Pyridine; C_5H_5N; [110-86-1]			
293.15	4.55	0.127	0.136
298.15	4.58	0.127	0.139
Piperidine; $C_5H_{11}N$; [110-89-4]			
293.15	7.44	0.169	0.181
298.15	7.35	0.166	0.181

The Ostwald coefficients were calculated by the compiler.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

A Van Slyke-Neill Manometric Apparatus manufactured by the Eimer and Amend Co. was used.

The procedure of Van Slyke (1) for pure liquids was modified (2) so that small solvent samples (2 cm^3) could be used with almost complete recovery of the sample.

An improved temperature control system was used.

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. Air reduction Co. Purity 99.5 per cent.

(2) Cyclic amines. The pyridine and pyrrolidine were distilled from BaO under a N_2 atmosphere. The piperidine was distilled from KOH under a N_2 atmosphere. Experimental data on refractive index, density and vapor pressure are in the thesis.

SOURCE AND PURITY OF MATERIALS:

Pyrrolidine. Pyrrole was prepared and catalytically reduced to pyrrolidine. B.p. (750 mmHg) t/°C 88.12 - 88.26 (corr.).

Pyridine. Mallincrodt Chemical Co. Purified and distilled. B.p. (743.9 mmHg) t/°C 114.96 - 115.06 (corr.).

Piperidine. Part was a commercial sample (Eastman Kodak Co.), part prepared by reduction of pyridine. B.p. (752.4 mmHg) t/°C 106.00 - 106.17.

ESTIMATED ERROR:

$\delta T/K = 0.05$

REFERENCES:

1. Van Slyke, D. D. *J. Biol. Chem.* 1939, *130*, 545.
2. Ijams, C. C. Ph.D. thesis, 1941 Vanderbilt University

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Nitrobenzene; $C_6H_5NO_2$; [98-95-3]

ORIGINAL MEASUREMENTS:

Naumenko, N. K.; Mukhin, N. N. Aleskovskii, V. B.

Zh. Prikl. Khim. (Leningrad) 1969, *42*, 2522-8.

J. Appl. Chem. USSR, 1969, *42*, 2376-81.

VARIABLES:

T/K = 298.15

O_2 P/kPa = 101.325 (1 atm)

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

T/K	Mol Fraction $x_1 \times 10^4$	Bunsen Coefficient α	Ostwald Coefficient L
298.15	4.95	0.108 ± 0.0041	0.118

The Ostwald coefficient values were calculated by the compiler.

The absolute errors are calculated from the results of three or four determinations.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The oxygen solubility was determined by a volumetric gas method.

The liquids were deaerated for 20 to 30 minutes under reduced pressure with the aid of an oil pump. The deaeration was monitored from the readings of a thermocouple vacuum gage.

The liquids were saturated with oxygen under an oxygen partial pressure of about 760 mmHg at 25°C for 2 hours. The amount of gas absorbed was then determined.

Details of the method are given in an earlier paper (1).

SOURCE AND PURITY OF MATERIALS:

The source and purity of the materials were not given.

ESTIMATED ERROR:

$\delta T/K = 0.1$

$\delta\alpha/\alpha = 0.023$ (relative)

REFERENCES:

1. Naumenko, N. K.; Mukhin, N. N. Aleskovskii, V. B. *Zh. Prikl. Khim.* 1969, *42*, 2090.

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Aromatic amines; C_6H_7N, C_7H_9N, $C_8H_{11}N$, and $C_{10}H_{15}N$

ORIGINAL MEASUREMENTS:

Naumenko, N. K.; Mukhin, N. N.
Aleskovskii, V. B.

Zh. Prikl. Khim. (Leningrad) 1969, *42*, 2522-28.

J. Appl. Chem. USSR, 1969, *42*, 2376-81.

VARIABLES:

T/K = 298.15
O_2 P/kPa = 101.325

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

T/K	Mol Fraction $x_1 \times 10^4$	Bunsen Coefficient α	Ostwald Coefficient L
Benzenamine or aniline; C_6H_7N; [62-53-3]			
298.15	2.26	0.0552 ± 0.00056	0.0603
N-Methylbenzenamine; C_7H_9N; [100-61-8]			
298.15	2.91	0.0603 ± 0.002	0.0658
2-Methylbenzenamine; C_7H_9N; [95-53-4]			
298.15	3.18	0.0663 ± 0.0011	0.0724
3-Methylbenzenamine; C_7H_9N; [108-44-1]			
298.15	3.95	0.0817 ± 0.0046	0.0892
N,N-Dimethylbenzenamine; $C_8H_{11}N$; [121-69-7]			
298.15	7.18	0.127 ± 0.0040	0.139
N-Ethylbenzenamine; $C_8H_{11}N$; [103-69-5]			
298.15	7.66	0.136 ± 0.0036	0.148
N,N-Dimethylbenzenamine; $C_{10}H_{15}N$; [91-66-7]			
298.15	9.62	0.135 ± 0.0035	0.147

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The oxygen solubility was determined by a volumetric gas method.

The liquids were deaerated for 20 to 30 minutes under reduced pressure with the aid of an oil pump. The deaeration was monitored from the readings of a thermocouple vacuum gage.

The liquids were saturated with oxygen under an oxygen partial pressure of about 760 mmHg at 25°C for 2 hours. The amount of gas absorbed was then determined.

Details of the method are given in an earlier paper (1).

SOURCE AND PURITY OF MATERIALS:

The source and purity of the materials were not given.

The Ostwald coefficient values were calculated by the compiler.

The absolute errors are calculated from the results of three or four determinations.

ESTIMATED ERROR:

$\delta T/K = 0.1$
$\delta\alpha/\alpha = 0.023$ (relative)

REFERENCES:

1. Naumenko, N. K.; Mukhin, N. N. Aleskovskii, V. B. *Zh. Prikl. Khim.* 1969, *42*, 2090.

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) N,N,N-Triethyl ethanaminium bromide or tetraethyl ammonium bromide; $C_8H_{20}NBr$; [71-91-0]

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

ORIGINAL MEASUREMENTS:

Morrison, T. J.; Johnstone, N. B. B.

J. Chem. Soc. 1955, 3655-9.

VARIABLES:

$T/K = 298.15$

$P/kPa = 101.325$

$m_{C_8H_{20}NBr}/\text{mol kg}^{-1} = 0, 1.0$

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

T/K	$k_S =$ $(1/m)\log(S^0/S)$	$k_{Sx} =$ $(1/m)\log(x^0/x)$
298.15	-0.046	-0.031

The salt effect parameter was calculated from two measurements. The solubility of oxygen in water, $S^0/\text{cm}^3(\text{STP})\ \text{kg}^{-1}$, and in one molal salt solution, $S/\text{cm}^3(\text{STP})\ \text{kg}^{-1}$. Neither solubility value is given in the paper. Only the k_S value is given. The compiler calculated the value of the salt effect parameter using the mole fraction oxygen solubility ratio.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The degassed salt solution flows in a thin film down as absorption helix containing the oxygen gas and solvent vapor at a total pressure of one atm. The volume of gas absorbed is measured in an attached buret system (1,2).

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. British Oxygen Co., Ltd.

(2) Tetraethyl ammonium bromide. No information given.

(3) Water. No information given.

ESTIMATED ERROR:

$\delta k_S = 0.010$ (authors)

REFERENCES:

1. Morrison, T. J.; Billett, F. *J. Chem. Soc.* 1948, 2033; *ibid.* 1952, 3819.

COMPONENTS: (1) Oxygen; O_2; [7782-44-3] (2) 1,1,2,2,3,3,4,4-nonafluoro-N,N-bis (nonafluorobutyl) -1-butanamine, (Perfluorotributylamine); $C_{12}F_{27}N$; [311-89-7]	ORIGINAL MEASUREMENTS: Wesseler, E.P.; Iltis, R.; Clark, L. C. Jr. *J. Fluorine Chem.* 1977, *9*, 134-46.
VARIABLES: T/K = 298	PREPARED BY: C. L. Young

EXPERIMENTAL VALUES:

T/K	Solubility *	Mole fraction + of oxygen x_{O_2}
298.15	38.4	0.00552

* appears to be the Ostwald coefficient x 10^2, units were stated as ml/100 ml (total pressure was the barometric pressure, assumed to be 1 atmosphere)

\+ calculated by compiler for a total pressure of 101.325 kPa using the density given in source

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Oxygen bubbled through fluorocarbon in stirred cell. When saturation achieved samples of liquid remoced with a hypodermic Precision Sampling 50 μl Pressure-Lok syringe. At least 15 samples taken and chromatographed. Average peak height compared with that of average peak height for injection of the same volume of oxygen. Chromatographic column consisted of 13X molecular sieve at 70°C. Helium was used as carrier gas.

SOURCE AND PURITY OF MATERIALS:

(1) No details given.

(2) A 3M sample, boiling pt 174°C.

ESTIMATED ERROR:

$\delta T/K = \pm 0.3$; $\delta x_{O_2} = \pm 2\%$

REFERENCES:

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) FC-47, which is largely perfluorotributylamine or 1,1,2,2,3,3,4,4,4-nonafluoro-N,N-bis(nonafluorobutyl)-1-butanamine $C_{12}F_{27}N$; [311-89-7]

ORIGINAL MEASUREMENTS:

Sargent, J. W.; Seffl, R. J.

Fed. Proc. 1970, *29*, 1699 - 1703.

VARIABLES:

T/K = 298-310
Total P/kPa = 101.325

PREPARED BY:

A. L. Cramer
H. L. Clever

EXPERIMENTAL VALUES:

Temperature		Oxygen Solubility	
t/°C	T/K	g O_2 1000 g^{-1}	cm^3 O_2 100 cm^{-3}
25	298.15	0.272	38.9
37	310.15	0.276	40.3

The authors solubility, cm^3 O_2 100 cm^{-3}, appears to be the Ostwald coefficient times 100.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The equilibrium apparatus is a 50 cm^3 three neck flask equipped with a water condenser, a thermometer, and a gas dispersing tube extending below the fluid surface level. Between 25 and 35 cm^3 of solvent are placed in the flask. Gas is bubbled through the solvent for 2 - 3 h. An 80 microliter sample is slowly taken into a gas tight syringe. The sample is injected into a gas chromatograph. The results of three sampling and analyses are averaged.

The chromatograph is an F and M Model 720 equipped with a thermal conductivity detector at 320 °C, and a 6' by ¼" stainless steel column packed with 13X molecular sieve at room temperature. The apparatus is calibrated with pure gas samples.

Details of the procedure were furnished by R. D. Danielson of the 3 M Co.

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. Source not given. Commercial cylinder.

(2) FC-47. Minnesota Mining and Manufacturing Co. All H in an organic compound are replaced by F by Simons electrochemical process (1).

ESTIMATED ERROR:

$\delta T/K = 0.1$
$\delta c/c = 0.01$ (reproducibility)
$= 0.05$ (absolute)

REFERENCES:

1. Simons, J. H., Editor *Fluorine Chemistry* Academic Press, New York, 1950.

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) 1,1,2,2,3,3,4,4,4-Nonafluoro-N,N-bis(nonafluorobutyl)-1-butamine; $(C_4F_9)_3N$; [311-89-7]

ORIGINAL MEASUREMENTS:

Kobatake, Y.; Hildebrand, J. H.

J. Phys. Chem. 1961, *65*, 331-5.

VARIABLES:

T/K = 278.80 - 304.65
P/kPa = 101.325

PREPARED BY:

M. E. Derrick
H. L. Clever

EXPERIMENTAL VALUES:

T/K	Mol Fraction $X_1 \times 10^3$	Bunsen Coefficient α	Ostwald Coefficient L
278.80	5.542	0.365	0.373
287.50	5.395	0.349	0.367
297.16	5.218	0.330	0.359
304.65	5.096	0.317	0.358

The Bunsen and Ostwald coefficients were calculated by the compiler.

Smoothed Data: $\Delta G^o/J\ mol^{-1} = -RT \ln X_1 = -2,312.6 + 51.480\ T$

Std. Dev. ΔG^o = 2.9, Coef. Corr. = 0.9999

$\Delta H^o/J\ mol^{-1} = -2,312.6$, $\Delta S^o/J\ K^{-1}\ mol^{-1} = -51.480$

T/K	Mol Fraction $X_1 \times 10^3$	$\Delta G^o/J\ mol^{-1}$
283.15	5.465	12,264
288.15	5.372	12,521
293.15	5.285	12,779
298.15	5.201	13,036
303.15	5.122	13,294

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The apparatus consists of a gas-measuring buret, an absorption pipet, and reservoir for solvent. The buret is thermostated at 25°C, the pipet at any temperature from 5 to 30°C.

The solvent is degassed by freezing with liquid nitrogen, evacuating, then boiling with a heat lamp. The solvent never comes into contact with stopcock grease.

The amount of gas is determined by P-V measurements in the gas buret before and after admission of the gas into the pipet. No solvent vapor is allowed into the buret system. The solvent is magnetically stirred for up to 24 hours until equilibrium is reached.

Ideal gas behavior and Henry's law are assumed to calculate the mole fraction solubility at a gas partial pressure of one atm.

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. Linde Oxygen Co. Standard grade, 99.7 % oxygen.

(2) $(C_4F_9)_3N$. Minnesota Mining and Manufacturing Co. dried, fractionated, bp. 178.5 - 179.0°C.

ESTIMATED ERROR:

$\delta X_1/X_1 = 0.003$

REFERENCES:

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) FC-43 which is 1,1,2,2,3,3,4,4,4-nonafluoro-N,N-bis(nonafluorobutyl)-1-butanamine or perfluorotributylamine; $C_{12}F_{27}N$; [311-89-7]

ORIGINAL MEASUREMENTS:

Zander, R.

Res. exp. Med. 1974, *164*, 97-109.

VARIABLES:

T/K = 283.15 - 323.15
P/kPa = 6 - 101

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

Temperature Range, T/K	Gas Phase[1] Volume Per Cent Oxygen	Oxygen Partial Pressure[2] p/mmHg	Bunsen Coefficient Regression Equation $\alpha/cm^3\ cm^{-3}\ atm^{-1}$	Number of Experimental Points
283.15 - 323.15	6	45.6	$\alpha = 0.223+0.00005\ t/^{0}C$	38
	12	91.2	$\alpha = 0.282-0.00021\ t/^{0}C$	25
	25	190	$\alpha = 0.353-0.00071\ t/^{0}C$	31
	50	380	$\alpha = 0.383-0.00083\ t/^{0}C$	59
	100	760	$\alpha = 0.398-0.00093\ t/^{0}C$	82

[1] The gas phase consists of oxygen, water at its equilibrium vapor pressure, solvent (FC-43) at its equilibrium vapor pressure, and nitrogen to bring the total pressure near one atm. The per cent oxygen in the gas phase was experimentally determined by a Scholander gas analyzer.

[2] The oxygen partial pressure was calculated by the compiler with the assumptions that the gas mixture behaved ideally and that the total pressure was 760 mmHg.

In an abstract the author (1) reported the Bunsen coefficient at 310.15 K (37 °C) to be 0.362 ± 0.007. The 100 % O_2 equation above gives 0.364.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Equilibration between the gas and liquid phases was established in 45 minutes in a Tonometer of the Laue (2) design.

The oxygen content of the gas phase was determined by a Scholander gas analyzer (see footnote [1] above).

The saturated solution was transferred to a Van Slyke apparatus for the solubility determination.

The 235 experimental measurements were fitted to the equations in the table above. The smoothed data were used to construct a graph of Bunsen coefficient *vs.* oxygen partial pressure and a nomogram for the volume per cent of oxygen as a function of oxygen partial pressure and temperature.

The solubility appears to depart from Henry's law above 100 mmHg O_2.

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. No information.

(2) FC-43. Minnesota Mining and Manufacturing Co. Used as received.

The solubility measurements were made at the five temperatures 10, 20, 30, 40, and 50 °C.

ESTIMATED ERROR:

$\delta T/K = 0.1$
$\delta\alpha/\alpha = 0.03$ above 100 mmHg O_2
0.05 - 0.10 below.

REFERENCES:

1. Zander, R.
Pflug. Arch. 1973, *343*, R5.

2. Laue, D.
Pflugers Arch. Gesamte Physiol. Menschen Tiere 1951, *254*, 142.

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) 1-Hexadecanaminium, N,N,N-trimethyl bromide (Cetyl trimethyl ammonium bromide or CTAB); $C_{19}H_{42}N.Br$; [57-09-0]

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

ORIGINAL MEASUREMENTS:

Matheson, I. B. C.; King, A. D.

J. Coll. Interface Sci. 1978, *66*, 464-9.

VARIABLES:

T/K = 298.15

P/kPa =273.7 - 954.9 (39.7-138.5 psig)

CTAB/mol kg^{-1} H_2O= 0 - 0.300

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

T/K	1-Hexadecanaminium,N,N,N-trimethyl ammonium bromide mol kg^{-1} H_2O	Pressure pounds per square inch, gauge	Volume gas evolved ml	Ambient Pressure mmHg	Ambient Temperature °C	Henry's constant K x 10^3 mol Ar kg^{-1} H_2O atm^{-1}
298.15	0	49.3	12.5	746.3	25.1	
		71.5	18.0	743.5	25.2	
		74.7	18.6	745.5	24.8	
		108.5	26.2	747.0	24.8	
		122.0	29.7	745.5	25.9	1.41±0.02
	0.100	46.0	12.2	745.3	25.8	
		81.3	21.8	747.1	27.0	
		88.3	23.4	747.0	25.1	
		122.0	31.3	746.6	26.1	
		138.5	36.1	742.0	24.7	1.50±0.02
	0.200	41.0	11.5	745.8	23.0	
		78.3	22.4	747.9	22.0	
		100.5	28.2	747.8	22.4	1.64±0.02
	0.300	39.7	13.1	735.9	23.0	
		71.0	21.9	743.7	22.5	
		92.3	28.9	742.6	22.5	1.82±0.03

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The apparatus consists of a jacketed thermostated thick-walled cylindrical brass bomb which rests on a variable speed magnetic stirrer. An inlet line to the bomb is connected to a gas manifold, and an exit line is connected to a Warburg manometer. Bourden gauges are used to record the pressure.

The solution, consisting of 100 g of water and the colloidal electrolyte, is contained in a glass liner inside of the bomb. The solution is degassed by evacuation to just above water vapor pressure and then stirring for several hours. The gas is introduced over the solution at the desired pressure and the solution is stirred for a minimum of five hours.

The gas is vented to atmospheric pressure. The gas from the supersaturated solution is collected in the Warburg manometer and its volume measured at atmospheric pressure and ambient temperature. Corrections for gas lost during venting and thermal equilibration and for water vapor pressure are made. The solubility is reported as Henry's constant, K/mol gas kg^{-1} water atm^{-1} = gas molality/pressure, m/p.

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. Source not given. Chemically pure or equivalent of 99.5 mol per cent purity or better.

(2) 1-Hexadecanaminium, N,N,N-trimethyl bromide. Eastman Chemical. Technical grade, recrystallized from ethyl acetate-ethanol mixture and dried <u>in vacuo</u>.

(3) Water. Laboratory distilled.

ESTIMATED ERROR:

$\delta K/K = 0.02$

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Triglyceride oil (herring)

ORIGINAL MEASUREMENTS:

Ke, P. J.; Ackman, R. G.

J. Am. Oil Chemists' Soc. 1973, *50*, 429-35.

VARIABLES:

T/K = 293.15 - 353.15
P/kPa = partial pressure of oxygen in air at 101.325 kPa

PREPARED BY:

P. L. Long
H. L. Clever

EXPERIMENTAL VALUES:

Temperature t/°C	Temperature T/K	Density ρ/g cm^{-3}	Peroxide Value meq kg^{-1}	Bunsen Coefficient/α[1] Polarographic Exponential Dilution Method	Bunsen Coefficient/α[1] Chemical Method[2]	Bunsen Coefficient/α[1] Displacement Method[3]
40[sic]		0.9114	63.8	0.113(±6%)	0.192(±19%)	---
20	293.15	0.9151	2.0	0.110(±6%)	0.124(±11%)	0.113(±8%)
20		0.9151	21.4	0.108(±6%)	0.149(±18%)	0.119(±7%)
20		0.9151	79.5	0.113(±6%)	0.214 (-)	---
40	313.15	0.9034	2.3	0.128(±6%)	0.141(±9%)	---
40		0.9034	84.0	0.122(±6%)	0.289 (-)	---

[1] Values are the average of three determinations. Numbers in ( ) are the percentage relative error.

[2] Chemical method of McDowell, A. K. R. *J. Dairy Res.* 1963, *30*, 399.

[3] Displacement method of Becker, E.; Neiderstebruch, A. *Fett Seifen Anstrichm.* 1966, *68*, 135. Details of neither method given in the paper.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Polarographic exponential dilution method (1).

The oil was degassed by the method of Battino et al. (2).

A 155-159 cm^3 sample of degassed oil was transferred to a glass vessel and weighed. The vessel was so constructed that the ratio $V_{top\ air\ space}/V_{oil}$ was between 0.0704 and 0.0981. A magnetic stirring bar (120 rpm) and a polarographic oxygen sensor were placed in the sample. Air was bubbled through the sample at 15 cm^3 m^{-1} for two hours. The air was stopped, and helium gas preheated to the sample temperature was introduced into the oil at a rate of 7-10 cm^3 m^{-1}. The oxygen concentration was measured as a function of the volume of helium passed through the solution. A plot of log (O_2) *vs.* V_{helium} is linear. The slope is a function of the Ostwald coefficient. The Ostwald coefficient was converted to Bunsen coefficient.

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. Breathing grade compressed air.

(2) Herring oil. Oil from whole herring (chipea harengus) obtained from local commercial reduction plant in Nova Scotia.

ESTIMATED ERROR:

REFERENCES:

1. Aho, L.; Wahlroos, O. *J. Am. Oil Chem. Soc.* 1967, *44*, 65.
2. Battino, R.; Banzhof, M.; Bogan, M.; Wilhelm, E. *Anal. Chem.* 1971, *45*, 806.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Oxygen; O_2; [7782-44-7] (2) Triglyceride oils	Ke, P. J.; Ackman, R. G. *J. Am. Oil Chemists' Soc.* 1973, *50*, 429-35.
VARIABLES:	PREPARED BY:
T/K =293.15 - 353.15 P/kPa =Oxygen at partial pressure in air at 101.325 (1 atm).	P. L. Long H. L. Clever

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. Breathing grade compressed air.

(2) Triglyceride oils.
Redfish oil.[3] Oil from redfish (sebastes marinus) viscera and scrap.
Capelin oil.[3] Oil from whole capelin (mallofus villosus).
Herring oil.[4] Oil from whole herring (chipea harengus).
Mackerel oil.[3] Oil from mackerel (scomber scombrus).
Harp seal oil.[4] Oil from harp seal (Phoca groenlandica) blubber.
Flounder oil.[3] Oil from flounder (Pseudopleuronectes americanus) viscera and scrap.
Cod liver oil.[4] Oil from cod (Gadus morhua) livers.

[3] Oils obtained from local commercial reduction plants in Nova Scotia.

[4] Oils produced in a pilot scale reduction plant at the Vancouver Lab of The Fisheries Research Board of Canada.

All oils were kept under nitrogen in cold storage (3°C) except when the experiment was in progress.

continued on following page

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Polarographic exponential dilution method (1).

The oil was degassed by the method of Battino *et al.* (2).

A 155 - 159 cm^3 sample of degassed oil was transferred to a glass vessel and weighed. The vessel was so constructed that the ratio $V_{top\ air\ space}/V_{oil}$ was between 0.0704 and 0.0981. A magnetic stirring bar (120 rpm) and a polarographic oxygen sensor were placed in the sample. Air was bubbled through the sample at 15 cm^3 m^{-1} for two hours. The air was stopped, and helium gas preheated to the sample temperature was introduced into the oil at a rate of 7 - 10 cm^3 m^{-1}. The oxygen concentration was measured as a function of the volume of helium passed through the solution. A plot of log (O_2) *vs.* V_{helium} is linear. The slope is a function of the Ostwald coefficient. The Ostwald coefficient was converted to Bunsen coefficient.

SOURCE AND PURITY OF MATERIALS:

See above.

ESTIMATED ERROR:

Solubility values are the average of three determinations with relative standard deviation of 7 % or less.

REFERENCES:

1. Aho, L.; Wahlroos, O. *J. Am. Oil Chem. Soc.* 1967, *44*, 65.
2. Battino, R.; Banzhof, M.; Bogan, M.; Wilhelm, E. *Anal. Chem.* 1971, *45*, 806.

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Triglyceride oils

ORIGINAL MEASUREMENTS:

Ke, P. J.; Ackman, R. G.

J. Am. Oil Chemists' Soc. 1973, *50*, 429-35.

EXPERIMENTAL VALUES: continued

Temperature t/°C	T/K	Density ρ/g cm^{-3}	Bunsen Coefficient[1] α	Parts per Millon[2] μg g^{-1}	cm^3(STP) O_2 100 cm^{-3} of oil[2]
Redfish oil					
20	293.15	0.9184	0.074	24.2	1.55
40	313.15	0.9061	0.078	25.8	1.64
60	333.15	0.8931	0.088	29.6	1.84
80	353.15	0.8814	0.012	4.1	0.25
Capelin oil					
20	293.15	0.9163	0.060	19.5	1.25
40	313.15	0.9049	0.081	26.6	1.68
60	333.15	0.8920	0.103	34.4	2.14
80	353.15	0.8798	0.025	8.5	0.52
Herring oil					
20	293.15	0.9151	0.110	35.8	2.29
40	313.15	0.9034	0.128	42.2	2.26
60	333.15	0.8904	0.135	45.2	2.81
80	353.15	0.8785	0.076	25.8	1.58
Mackerel oil					
20	293.15	0.9192	0.042	13.6	0.87
40	313.15	0.9074	0.078	25.6	1.62
60	333.15	0.8952	0.086	28.7	1.79
80	353.15	0.8828	0.011	3.7	0.23
Harp seal oil					
20	293.15	0.9220	0.090	29.1	1.87
40	313.15	0.9087	0.108	35.7	2.26
60	333.15	0.8970	0.114	37.9	2.37
80	353.15	0.8844	0.030	10.1	0.62
Flounder oil					
20	293.15	0.9234	0.075	23.2	1.55
40	313.15	0.9115	0.078	25.6	1.63
60	333.15	0.8977	0.081	26.9	1.69
80	353.15	0.8853	0.029	9.6	0.59
Cod liver oil					
20	293.15	0.9205	0.124	39.9	2.58
40	313.15	0.9139	0.146	47.6	3.04
60	333.15	0.9002	0.130	43.0	2.70
80	353.15	0.8896	0.018	6.0	0.37

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[1] The Bunsen coefficients are for an oxygen partial pressure of 101.325 kPa (1 atm or 760 mmHg).

[2] The parts per million and the volume O_2 (STP) per 100 cm^3 oil are for the partial pressure of oxygen in air (ca. 0.21 atm or 160 mmHg).

COMPONENTS:

(1) Oxygen: O_2; [7782-44-7]

(2) Soybean Oil

ORIGINAL MEASUREMENTS:

Tomoto, N.; Kusano, K.

Yukagaku 1967, *16*, 108-13.
Chem. Abstr. 1967, *66*, 106141z.

VARIABLES:

T/K = 303-343

PREPARED BY:

R. Battino

EXPERIMENTAL VALUES:

t/°C	T^a/K	α^b/cm^3(STP)cm^{-3}atm^{-1}
30	303	0.141
50	323	0.143
70	343	0.251

[a] Calculated by compiler.

[b] Bunsen coefficient.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Described in the paper

SOURCE AND PURITY OF MATERIALS:

(1)

(2) Saponification value: 192.0; acid value: 0.17; iodine value: 128.5; unsaponifiable: 0.33%; d_{30}: 0.9132 g cm^{-3}; M.W.: 877 g mol^{-1}; molar volume: 960.4 cm^3 mol^{-1}.

ESTIMATED ERROR:

$\delta\alpha/\alpha = \pm 0.02$, compiler's estimate.

REFERENCES:

COMPONENTS: (1) Oxygen; O_2; [7782-44-7] (2) Vegetable oils	ORIGINAL MEASUREMENTS: Aho, L.; Wahlroos, O. *J. Am. Oil Chemists' Soc.* 1967, *44*, 65-6.
VARIABLES: T/K = 295 - 296	PREPARED BY: P. L. Long H. L. Clever

EXPERIMENTAL VALUES:

Temperature t/°C	T/K	Ostwald Coefficient L
Soybean oil, raw		
22-23	∿295.6	0.173
Soybean oil, refined		
22-23	∿295.6	0.170
Sunflower seed oil, raw		
22-23	∿295.6	0.151
Sunflower seed oil, refined		
22-23	∿295.6	0.100

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The apparatus consisted of a sample vessel with magnetic stirrer, a gas buret, a silver/gold oxygen sensing electrode, and various recorders.

Exponential dilution method. The apparatus was filled with a known volume of liquid. Helium, flow rate 4 - 7 $cm^3\ m^{-1}$, was the dilution gas. The gas volumes which had flowed through, and the oxygen electrode readings were corrected for the pressure of gas in the buret.

The method was tested on $O_2 + H_2O$ with argon as the carrier gas. A distribution (Ostwald) coefficient of 0.031 was measured at 22 °C.

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. No information.

(2) Vegetable oils. No information. The peroxide values of each oil were measured.

ESTIMATED ERROR:

Standard deviation 3 % (authors)

REFERENCES:

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Animal and vegetable oils

ORIGINAL MEASUREMENTS:

Vibrans, F. C.

Oil and Soap 1935, *12*, 14-5.

VARIABLES:

T/K = 296-299, 318.15
P/kPa = 101.3

PREPARED BY:

P. L. Long
H. L. Clever

EXPERIMENTAL VALUES:

T/K	Solubility, cm^3 (273.15 K, 1 atm) O_2 100 cm^{-3} Experiment				Av.
Corn oil					
296.16-299.15	11.30	11.24	11.08		11.21
318.15	10.90	10.80	11.08		10.93
Cottonseed oil					
296.15-299.15	11.1	11.0			11.05
318.15	10.73	10.80			10.77
Hydrogenated cottonseed oil					
318.15	11.36	11.08	11.12	11.28	11.21
Steam rendered lard					
318.15	11.32	10.78	11.14	11.44	11.17

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Van Slyke manometric method (1).

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. From commercial cylinders. Source or purity not stated.

(2) Corn oil. Commercial sample bought on market. Representative of its class.

Cottonseed oil. Commercial sample bought on market. Representative of its class.

Lard. From a mixture of killing and cutting fats. Steam rendered.

ESTIMATED ERROR:

$\delta T/K$ = 3 at room temperature
2 at 318 K (45 °C)
$\delta c/c$ = 0.04 (author)

REFERENCES:

1. Van Slyke, D. D.; *et al.* *J. Biol. Chem.* 1924, *61*, 523 and 575.

COMPONENTS:

(1) Oxygen; O_2;[7782-44-7]

(2) Animal and vegetable oils

ORIGINAL MEASUREMENTS:

Schaffer, P. S.; Haller, H. S.

Oil and Soap 1943, *20*, 161-2.

VARIABLES:

T/K =313.15, 333.15
P/kPa =101.325

PREPARED BY:

P. L. Long
H. L. Clever

EXPERIMENTAL VALUES:

T/K	cm^3 (273.15 K, 1 atm) O_2 100 cm^{-3}
Cottonseed oil	
313.15	12.7
Butter oil	
313.15	14.2
333.15	12.7
Lard	
313.15	11.5

The authors solubility unit is the Bunsen coefficient x 100.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The apparatus consists of a reaction flask connected to a water jacketed gas buret, a mercury leveling bulb, and a differential manometer. The reaction vessel is attached to a shaking mechanism in an air bath.

A 50 cm^3 sample of oil is placed in the flask. Heat and vacuum are applied to remove dissolved gases. The sample is cooled to the temperature of the measuremnt. Oxygen gas is admitted, a zero reading is taken. The system is shaken until the sample takes up no more gas at a pressure of 1 atm. Three determinations were made on each sample.

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. From commercial cylinders, source and purity not given, used as received.

(2) Cottonseed oil. Good grade commercial product.

Butter oil. Obtained from butter prepared in the lab from fresh cream.

Lard. Good grade commercial product.

ESTIMATED ERROR:

$\delta T/K = 0.5$
$\delta c/c = 0.003$ (authors, error among three determinations)

REFERENCES:

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Olive Oil, Tetralin, Lard

ORIGINAL MEASUREMENTS:

Davidson, D.; Eggleton, P.; Foggie, P.

Quart. J. Exptl. Physiol. 1952, *37*, 91-105.

VARIABLES:

T/K = 299, 323

PREPARED BY:

R. Battino

EXPERIMENTAL VALUES:

t/°C	T^a/K	L^b
	Olive Oil	
25.3	298.5	0.1117
	Tetralin	
25.3	298.5	0.1186
	Lard (liquid)	
50	323	0.114

[a] Calculated by compiler.

[b] Ostwald coefficient.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Combined with diffusion measurements. Measurement based on knowing gas phase and liquid phase volumes and the initial (before any gas dissolved) pressure and the final equilibrium pressure.

SOURCE AND PURITY OF MATERIALS:

No details given.

ESTIMATED ERROR:

$\delta L/L = \pm 0.08$, compiler's estimate.

$\delta T/K = \pm 0.01$, but reported to 0.1°C or 1°C.

REFERENCES:

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Olive Oil

ORIGINAL MEASUREMENTS:

Battino, R.; Evans, F. D.; Danforth, W. F.

J. Am. Oil Chemists' Soc. 1968, *45*, 830-3.

VARIABLES:

$T/K = 298.26 - 327.93$

$P/kPa = 101.325$

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

T/K	Mol Fraction $X_1 \times 10^3$	Bunsen Coefficient α	Ostwald Coefficient L
298.26	5.07	0.1162	0.1269
308.20	5.10	0.1171	0.1312
318.53	5.22	0.1185	0.1382
327.93	5.29	0.1195	0.1434

Smoothed Data: $\Delta G^\circ/J\ mol^{-1} = -RT \ln X_1 = 1240.9 + 39.809\ T$

Std. Dev. $\Delta G^\circ = 11.2$, Coef. Corr. = 0.9999

$\Delta H^\circ/J\ mol^{-1} = 1240.9$, $\Delta S^\circ/J\ K^{-1}\ mol^{-1} = -39.809$

T/K	Mol Fraction $X_1 \times 10^3$	$\Delta G^\circ/J\ mol^{-1}$
298.15	5.05	13,110
308.15	5.13	13,508
318.15	5.21	13,906
328.15	5.29	14,304

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The apparatus is based on the design by Morrison and Billett (1) and the version used is a modification of the apparatus of Clever, Battino, Saylor and Gross (2).

Degassing. The solvent is sprayed into an evacuated chamber of an all glass apparatus; it is stirred and heated until the pressure drops to the vapor pressure of the liquid.

Solubility Determination. The degassed liquid passes in a thin film down a glass spiral tube at a total pressure of one atm of solute gas plus solvent vapor. The gas absorbed is measured in the attached buret system, and the solvent is collected in a tared flask and weighed.

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. Matheson Co., Inc. min. vol. % purity 99.999.

(2) Olive Oil. A. U.S.P., Fisher Scientific Company., 0.58% free fatty acid.
B. Nutritional Biochemicals Corp., 0.30% free fatty acid.
The density was measured and fitted to the equation
$\rho/g\ cm^{-3} = 0.9152 - 0.000468\ t/C$.
The average mol wt is 884 ± 45 (3).

ESTIMATED ERROR:

$\delta T/K = 0.03$

$\delta P/mmHg = 0.5$

$\delta X_1/X_1 = 0.005$

REFERENCES:

1. Morrison, T. J.; Billett, F. *J. Chem. Soc.* 1948, 2033.
2. Clever, H. L.; Battino, R.; Saylor, J. H.; Gross, P. M. *J. Phys. Chem.* 1957, *61*, 1078.
3. Johnson, L. F.; Shoolery, J. N. *Anal. Chem.* 1962, *34*, 1136.

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Olive oil.

ORIGINAL MEASUREMENTS:

Power, G.G.; Stegall, H.

J. Appl. Physiol. 1970, *19*, 145-9.

VARIABLES:

T/K = 285-310

PREPARED BY:

C.L. Young

EXPERIMENTAL VALUES:

T/K	Bunsen coefficient, α	S.D.*	No. of measurements
310.15	0.117	0.002	5
298.15	0.119	0.001	5
285.15	0.121	0.002	5

* Standard deviation.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Liquid saturated with gas in a stirred cell. 5.0 cm^3 samples of liquid removed in a calibrated syringe and amount of gas extracted by two extraction in a van Slyke apparatus determined. Details in source and ref. (1).

SOURCE AND PURITY OF MATERIALS:

(1) Matheson Co. sample, purity better than 99.7 mole per cent.

(2) No details given.

ESTIMATED ERROR:

$\delta T/K = \pm 0.1$

REFERENCES:

1. Power, G.G.
   J. Appl. Physiol. 1968, *24*, 468.

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Olive oil

ORIGINAL MEASUREMENTS:

Ke, P. J.; Ackman, R. G.

J. Am. Oil Chemists'Soc. 1973, *50*, 429-35.

VARIABLES:

T/K = 293.15 - 353.15

P/kPa = partial pressure of oxygen in air at 101.325 kPa

PREPARED BY:

P. L. Long
H. L. Clever

EXPERIMENTAL VALUES:

Temperature		Density	Peroxide Value	Bunsen Coefficient/α[1]		
t/°C	T/K	ρ/g cm^{-3}	meq kg^{-1}	Polarographic Exponential Dilution Method	Chemical Method[2]	Displacement Method [3]
20	293.15	0.9235	0.9	0.102(±6%)	0.109(±8%)	0.098(±6%)
		0.9235	41.5	0.106(±6%)	0.150(±15%)	0.107(±8%)
40	313.15	0.9114	1.0	0.110(±5%)	0.121(±10%)	---

[1] Values are the average of three determinations. Numbers in ( ) are the percentage relative error.

[2] Chemical method of McDowell, A. K. R. *J. Dairy Res.* 1963, *30*, 399.

[3] Displacement method of Becker, E.; Neiderstebruch, A. *Fett Seifen Anstrichm.* 1966, *68*, 135. Details of neither method given in the paper.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Polarographic exponential dilution method (1).

The oil was degassed by the method of Battino et al. (2).

A 155-159 cm^3 sample of degassed oil was transferred to a glass vessel and weighed. The vessel was so constructed that the ratio $V_{top\ air\ space}/V_{oil}$ was between 0.0704 and 0.0981. A magnetic stirring bar (120 rpm) and a polarographic oxygen sensor were placed in the sample. Air was bubbled through the sample at 15 cm^3 m^{-1} for two hours. The air was stopped, and helium gas preheated to the sample temperature was introduced into the oil at a rate of 7-10 cm^3m^{-1}. The oxygen concentration was measured as a function of the volume of helium passed through the solution. A plot of log (O_2) *vs.* V_{helium} is linear. The slope is a function of the Ostwald coefficient. The Ostwald coefficient was converted to Bunsen coefficient.

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. Breathing grade compressed air.

(2) Olive oil. Italian origin. Bought in retail store.

ESTIMATED ERROR:

Solubility values are the average of three determinations with relative standard deviation of 7% or less.

REFERENCES:

1. Aho, L.; Wahlroos, O. *J. Am. Oil Chem. Soc.* 1967, *44*, 65.
2. Battino, R.; Banzhof, M.; Bogan, M.; Wilhelm, E. *Anal. Chem.* 1971, *43*, 806.

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Human blood

ORIGINAL MEASUREMENTS:

Power, G. G.

J. Appl. Physiol. 1968, *24*, 468-74.

VARIABLES:

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K = 310.15

Treatment	P_{O_2}/mmHg	P_{O_2}/kPa	Bunsen Coefficient, $\alpha/cm^3 (STP) cm^{-3} atm^{-1}$	Corrected Bunsen Coefficient, $\alpha/cm^3 (STP) cm^{-3} atm^{-1}$
$K_3Fe(CH)_6$, 3.2g/100 ml saponin	706	94.1	0.0231	0.0249
$K_3Fe(CN)_6$, 3.2g/100 ml Triton-X	375	50.0	0.0218	0.0236
	382	50.9	0.0204	0.0222
	382	50.9	0.0209	0.0227
	382	50.9	0.0202	0.0220
$NaNO_2$, 0.05g/100 ml	398	53.1	0.0221	0.0225
	398	53.1	0.0216	0.0220
	398	53.1	0.0216	0.0220
$NaNO_2$, 1.0g/100 ml	382	50.9	0.0219	0.0227
	382	50.9	0.0217	0.0225
	382	50.9	0.0219	0.0227
	382	50.9	0.0221	0.0229
	382	50.9	0.0215	0.0223
$NaNO_2$, (1.0g/100 ml) freeze-thaw hemolysis	366	48.8	0.0234	0.0242
	366	48.8	0.0223	0.0231
	366	48.8	0.0217	0.0225
	366	48.8	0.0228	0.0236
	366	48.8	0.0229	0.0237
	366	48.8	0.0233	0.0241

Average .. 0.0230 ± 0.0008

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Liquid samples were equilibrated with gas and then the dissolved gas was stripped out under vacuum and measured in a manometric Van Slyke apparatus. Various amounts of $K_3Fe(CN)_6$ or $NaNO_2$ were added to the blood to prevent the formation of oxyhemoglobin. The above results have been corrected for the decrease in solubility due to the presence of these salts.

SOURCE AND PURITY OF MATERIALS:

Details given under method.

ESTIMATED ERROR:

$\delta T/K = \pm 0.03$.

REFERENCES:

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Human blood

(3) Krebs-Henseleit solution, human blood, and human plasma with added $NaNO_2$

ORIGINAL MEASUREMENTS:

Christoforides, C.; Hedley-Whyte, J.

J. Appl. Physiol. 1969, *27*, 592-6.

VARIABLES:

T/K = 291-310

Concentration

PREPARED BY:

R. Battino

EXPERIMENTAL VALUES:

$10^2\alpha^a/cm^3(STP)cm^{-3}atm^{-1}$

Hb^b concn./(g/100 ml)	t/°C 18	28	37
2.5	2.90	2.49	2.19
7.8	2.93	2.50	2.20
13.3	2.96	2.52	2.22
17.1	2.99	2.55	2.25
20.5	3.04	2.60	2.29
27.8	3.14	2.70	2.38*

[a] Bunsen coefficient. Values are averages of 14 determinations, except the asterisked value which is for 13 determinations.

[b] Hemoglobin concentration.

$10^2\alpha^a/cm^3(STP)cm^{-3}atm^{-1}$

Solvent	No. Detns.	$NaNO_2$ concn/(g/100 ml) 0	0.01	0.5	1.0
Krebs-Henseleit	14	2.27		2.25	2.20
Human Blood	14			2.225	2.18
Human Plasma	12		2.16	2.135	2.085

[a] Bunsen coefficient.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Solubilities determined by the Van Slyke method. Smoothed recommended values for oxygen solubility in human blood reported 15-40°C in 1K intervals, and for four H_b concentrations.

SOURCE AND PURITY OF MATERIALS:

(1) Argon-free, 99.99%, from Precision Gas Products.

(2) From each of six normal and healthy men, aged 22-42 years. See original paper for details.

ESTIMATED ERROR:

$\delta T/K = \pm 0.05$

$\delta\alpha/\alpha = \pm 0.01$

REFERENCES:

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Human blood

ORIGINAL MEASUREMENTS:

Roughton, F.J.W.; Severinghaus, J.W.

J. Appl. Physiol. 1973, 35, 861-9.

VARIABLES:

T/K = 273 - 310

PREPARED BY:

R. Battino

EXPERIMENTAL VALUES:

t/°C	T/K[a]	Bunsen Coefficient $10^2 \alpha$/cm^3(STP)cm^{-3}atm^{-1}	Ostwald Coefficient[a]
0	273	4.59[b]	4.59
0	273	4.58[c]	4.58
22	295	2.91[d]	3.14
37	310	2.387[e]	2.710

[a] Calculated by compiler.

[b] Mean of 27 determinations using electrode method.

[c] Mean of 4 determinations using Van Slyke method.

[d] Mean of 10 determinations using electrode method.

[e] Mean of 22 determinations using electrode method.

[f] α(t°C, blood) = α(t°C, water) x (0.9373 + 0.00160 t/°C); relationship given by authors relating solubility in pure water to that in human blood.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

They used the Van Slyke method for checking at 0°C. The other measurements were made using a Radiometer oxygen electrode which was covered with 25 micron polyethylene. Temperature was controlled to ±0.05°C. Solutions were degassed by shaking in oiled syringes with a vacuum. Details are given in the paper.

SOURCE AND PURITY OF MATERIALS:

(1) No details given.

(2) 50 cm^3 of venous blood drawn each from four normal non-smoking males into a heparinized glass syringe. Hb concentration averaged 15.5 g/100 cm^3 (range 15.0 - 16.8).

ESTIMATED ERROR:

$\delta\alpha/\alpha$ = ±0.03 (compiler's estimate)

REFERENCES:

COMPONENTS: (1) Oxygen; O_2; [7782-44-7] (2) Human blood	ORIGINAL MEASUREMENTS: Christoforides, C.; Hedley-Whyte, J. *J. Appl. Physiol.* 1976, *40*, 815-8.
VARIABLES: T/K = 273-295 Concentration	PREPARED BY: R. Battino

EXPERIMENTAL VALUES:

	$10^2\alpha^a/cm^3(STP)cm^{-3}atm^{-1}$		
Hb^b concn/(g/100 ml)	t/°C		
	0	6	12
5.6	4.40	3.76	3.23
10.2	4.43	3.78	3.28
15.7	4.52	3.86	3.34
22.5	4.67	4.05	3.45

[a] Bunsen coefficient.

[b] Hemoglobin concentration.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE: Solubilities determined by the van Slyke method. Smoothed recommended values at four Hb concentrations and 0 to 15°C at 1K intervals also given.	SOURCE AND PURITY OF MATERIALS: (1) Argon-free, 99.99%, from Precision Gas Products. (2) From four healthy non-smoking men, aged 25-41. See original paper for details of handling.
	ESTIMATED ERROR: $\delta T/K = \pm 0.05$ $\delta\alpha/\alpha = \pm 0.01$
	REFERENCES:

COMPONENTS:

(1) Oxygen: O_2; [7782-44-7]

(2) Human blood plasma

ORIGINAL MEASUREMENTS:

Christoforides, C.; Laasberg, L.H.; Hedley-Whyte, J.

J. Appl. Physiol. 1969, <u>26</u>, 56-60. (cf. <u>ibid.</u> <u>1969</u>, 26, R12 for corrn.)

VARIABLES:

T/K = 291 - 310

P/kPa = 20 - 98

PREPARED BY:

R. Battino

EXPERIMENTAL VALUES:

t^a/°C	T/K^b	P_{O_2}/mm Hg	$10^2 L^{b,c}$	$10^2 \alpha^d$/cm^3(STP) $cm^{-3} atm^{-1}$	No. Detns.[e]	σ^f
18	291.15	737.4	3.04	2.85	10	0.009
28	301.15	724.4	2.71	2.46	12	0.017
37	310.15	149.6	2.42	2.13	11	0.012
37	310.15	355.2	2.43	2.14	10	0.006
37	310.15	534.1	2.44	2.15	12	0.006
37	310.15	705.6	2.44	2.15	13	0.008

[a] Controlled to ±0.05 K.

[b] Calculated by compiler.

[c] Ostwald coefficient.

[d] Bunsen coefficient.

[e] Number of determinations at that partial pressure of oxygen.

[f] Authors' calculated standard deviation.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Standard van Slyke manometric technique employed. Also some measurements made with an oxygen electrode. Paper reports calculated values at 1K intervals from 0 to 40°C.

SOURCE AND PURITY OF MATERIALS:

(1) Argon-free, 99.99% from Precision Gas Products

(2) Blood obtained from a 31 year-old healthy man, and the plasma separated. Details given in the original paper.

ESTIMATED ERROR:

$\delta T/K = \pm 0.05$

$\delta\alpha/\alpha = \pm 0.01$, authors' estimate

REFERENCES:

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Human hemoglobin

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

ORIGINAL MEASUREMENTS:

Wise, D.L.; Houghton, G.

Biophys. J. 1969, 9,36-53.

VARIABLES:

T/K = 283 - 333 concentration

PREPARED BY:

R. Battino

EXPERIMENTAL VALUES:

t/°C	T/K^a	$10^2L^{a,b}$	$10^2\alpha^c$/ $cm^3(STP)cm^{-3}atm^{-1}$	$S_o{}^d$
		5 wt % packed red cells		
10	283.2	4.78	4.61	46.1
20	293.2	3.96	3.69	37.0
30	303.2	3.33	3.00	30.1
40	313.2	3.10	2.70	27.2
50	323.2	3.04	2.57	26.0
60	333.2	2.85	2.34	23.8
		10 wt % packed red cells		
10	283.2	6.85	6.61	66.1
20	293.2	5.36	4.99	49.9
30	303.2	4.67	4.21	42.3
40	313.2	4.10	3.58	36.1
50	323.2	4.01	3.39	34.3
60	333.2	3.56	2.92	29.7
		20 wt % packed red cells		
10	283.2	9.59	9.25	92.6
20	293.2	8.08	7.53	75.4
30	303.2	6.75	6.08	61.1
40	313.2	5.62	4.90	49.4
50	323.2	4.74	4.01	40.6
60	333.2	4.21	3.45	35.6

continued on following page

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Used an adaptation of the Morrison and Billett apparatus(1), but with the gas capacity of the manometer-buret system being about 15 cm^3. The storage spiral, the absorption spiral, and the manometer-buret system were thermostatted in glass jackets through which water from a thermostat circulated.

SOURCE AND PURITY OF MATERIALS:

(1) No details given.

(2) Prepared from just out-dated human red blood cells. Mixed with degassed water to make up solutions.

(3) Boiled and deionized.

ESTIMATED ERROR:

$\delta\alpha/\alpha = \pm 0.01$

$\delta T/K = \pm 0.1$

REFERENCES:

1. Morrison, T.J.; Billett, F. *J. Chem. Soc.* 1952, 3819-22.

COMPONENTS:	EVALUATOR:
(1) Oxygen; O_2; [7782-44-7] (2) Human hemoglobin (3) Water; H_2O; [7732-18-5]	Wise, D.L.; Houghton, G. *Biophys. J.* <u>1969</u>, 9, 36-53.

CRITICAL EVALUATION: continued

[a] Calculated by compiler.

[b] Ostwald coefficient.

[c] Bunsen coefficient.

[d] Solubility in cm^3(STP)/1000 g of solution. Solubilities fitted to: $\log_{10} S_\circ = -A + B/(T/K) + C \log_{10}(T/K)$.

wt %	A	B	C
5	19.497	1406.59	6.59453
10	16.1187	1339.30	5.37665
20	-0.9971	724.42	-0.64668

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Hemoglobin

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

ORIGINAL MEASUREMENTS:

Zander, R.

Z. Naturforsch., C: Biosci. 1976, *31C*, 339-52.

VARIABLES:

$T/K = 310.15$
$P/kPa = 101.325$ (1 atm)

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

T/K	Hemoglobin g 100 cm^{-3}	Bunsen Coefficient $10^4\alpha/cm^3cm^{-3}\ atm^{-1}$	Constant[1] $k=(1/c)\ \ln(\alpha/\alpha_0)$
310.15	0	241	
	10	241 ± 7	
	20	245 ± 8	
	25	245 ± 10	
			+0.00070

[1] $k/g^{-1}100\ cm^3$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Classical Van Slyke method (1).

The apparatus sample volume and constant gas volume are carefully calibrated. The correction for unextracted gas is made, but the reabsorption correction is not necessary for oxygen.

Equilibration is undertaken in a thermostated tonometer. A 2 cm^3 sample is directly transferred to the Van Slyke apparatus for analysis.

The solubility of oxygen in water value is from the authors analysis of ten literature values (2).

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. Linde Co. Purity 99.9 per cent by volume.

(2) Hemoglobin. No information.

(3) Water. Distilled.

ESTIMATED ERROR:

$\delta T/K = 0.1$
$\delta\alpha/\alpha = 0.01$

REFERENCES:

1. Van Slyke, D. D.; Neill, J. M. *J. Biol. Chem.* 1924, *61*, 523.
2. Zander, R.; Euler, R. *Measurement of Oxygen*, Edited by Degn, H.; Balslev, I.; Brook, R. Elsevier, Amsterdam, 1976, p.271.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Oxygen; O_2; [7782-44-7] (2) Human Serum (3) Corticosteroids; [50-04-4], [125-04-2], [151-73-5], [1715-33-9], [2375-03-3], and [2392-39-4]	Gainer, J. V. Jr.; Gainer, J. L.; Kelly, R. *Steroids* 1976, *28*, 307-10.
VARIABLES: T/K = 298.15 O_2 P/kPa = about 101.325 Corticosteroid/μg cm^{-3} = 0 - 200	PREPARED BY: H. L. Clever

EXPERIMENTAL VALUES:

continued on following page

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Reconstituted human serum was placed in a beaker, antifoaming agent (Antifoamer-A, Dow Corning) was added, oxygen was bubbled through the solution for 10 minutes, and a sample was taken in an airtight syringe. The sample was injected into a gas chromatograph for the determination of the oxygen by the method of Navarri (1). The sample passed through a drying tube of $CaSO_4$. The chromatograph used a Beckman GC2A thermal conductiviety detector and was fitted with a molecular sieve column. Preliminary tests showed that the O_2 solubility was the same in plasma and serum, that the antifoamer did not change the solubility, and that O_2 was not absorbed in the drying column.

Data read from small graphs.

Evaluator's Comment. The large changes in O_2 solubility with small concentrations of corticosteroids are startling. Confirmation by other workers is desirable.

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. Source not given. 99 per cent purity.

(2) Human serum. Lyophilized human serum was reconstituted for use.

(3) Corticosteroids. Commercial samples. Sources given in table above, along with Chem. Abstr. index formulas.

ESTIMATED ERROR:

$\delta T/K = 1$

Authors say values were average of repeated tests with values falling within a 5 per cent range.

REFERENCES:

1. Navarri, R. M.
Mass Transport in Biological Systems. Ph.D. Dissertation, University of Virginia, Charlottesville, VA 1970.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Oxygen; O_2; [7782-44-7] (2) Human Serum (3) Corticosteroids; [50-04-4], [125-04-2], [151-73-5], [1715-33-9], [2375-03-3], and [2392-39-4]	Gainer, J. V. Jr.; Gainer, J. L.; Kelly, R. *Steroids* 1976, *28*, 307-10.

EXPERIMENTAL VALUES:

continued

9-Fluoro-11β,17,21-trihydroxy-16a-methyl-1,4-pregnadiene-3,20-dione or Dexamethasone sodium phosphate or Decadron^R, Merck, Sharpe and Dohme; $C_{22}H_{30}FO_8P.2Na$; [2392-39-4]

Solubility Ratio:

(O_2 in serum + steroid/O_2 in serum)x100	+42	+38	+37	+ 5	- 5
Steroid/μg cm^{-3}	0.5	2.5	5.	25.	100.

9-Fluoro-11β, 17, 21-trihydroxy-16β-methyl-1,4-pregnadiene-3, 20-dione or Betamethasone sodium phosphate or Celestone^R, Schering; $C_{22}H_{30}FO_8P.2Na$; [151-73-5]

Solubility Ratio:

(O_2 in serum + steroid/O_2 in serum)x100	+42	+38	+35	+15	+ 2
Steroid/μg cm^{-3}	0.625	2.5	5.	10.	20.

Cortisone acetate, Upjohn Co.; $C_{23}H_{30}O_6$; [50-04-4]

Solubility Ratio:

(O_2 in serum + steroid/O_2 in serum)x100	0	-20	-19	-10	-12
Steroid/μg cm^{-3}	1.	12.	30.	110.	225.

11β, 17, 21-trihydroxy-1,4-pregnadiene-3, 20-dione or Presnisolone sodium succinate or Meticortelone^R, Schering, Co.; $C_{25}H_{32}O_8.Na$; [1715-33-9]

Solubility Ratio:

(O_2 in serum + steroid/O_2 in serum)x100	-20	-17	-24	-12
Steroid/μg cm^{-3}	2.5	5.	40.	80.

The two compounds listed below were stated to behave similarly to the cortisone and the prednisolone but no data were given.

Hydrocortisone sodium succinate or Solu Cortef^R, Upjohn Co.; $C_{25}H_{34}O_8.Na$; [125-04-2]

11β,17,21-trihydroxy-6a-methyl-1,4-pregnadiene-3,20-dione or Methylprednisolone sodium succinate or Solu Medrol^R, Upjohn Co.; $C_{26}H_{34}O_8.Na$; [2375-03-3]

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Phosphate buffer and human red cell ghosts in phosphate buffer.

ORIGINAL MEASUREMENTS:

Power, G.G.; Stegall, H.

J. Appl. Physiol. 1970, *29*, 145-9.

VARIABLES:

T/K = 310

PREPARED BY:

C.L. Young

EXPERIMENTAL VALUES:

T/K	Bunsen coefficient, α	S.D.*	No. of measurements.
	Phosphate Buffer		
310.15	0.02375	0.00055	7
	Ghosts suspension in buffer		
310.15	0.02440	0.00128	6
310.15	0.0252§	0.0011	3

* Standard deviation

§ Disrupted membranes

$\alpha°$ ghost = (α ghost suspension $-\alpha$ buffer) / g ghost cm^{-3}
= 0.113 ± 0.097

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

5 to 12 cm^{-3} samples placed in a stirrer cell and gas, saturated with water vapor passed through liquid for 30 -60 mins. Samples of saturated liquid withdrawn and transferred to Van Slyke apparatus. Dissolved gas removed under reduced pressure. Red cell ghosts prepared by centrifugation of human blood and lysing the cells using phosphate buffer of pH 7.4. Ghost separated by high speed centrifugation. Washed with phosphate buffer containing 0.01M sodium nitrite.

SOURCE AND PURITY OF MATERIALS:

(1) Matheson sample, purity better than 99.7 mole per cent.

(2) See method.

ESTIMATED ERROR:

$\delta T/K = \pm 0.1$

REFERENCES:

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Human pulmonary tissue

ORIGINAL MEASUREMENTS:

Power, G. G.

J. Appl. Physiol. 1968, *24*, 468-74.

VARIABLES:

T/K = 310

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K = 310.15

Treatment	P_{O_2}/mmHg	P_{O_2}/kPa	Bunsen Coefficient, $\alpha/\mathrm{cm^3(STP)cm^{-3}atm^{-1}}$	Corrected Bunsen Coefficient, $\alpha/\mathrm{cm^3(STP)cm^{-3}atm^{-1}}$
$NaNO_2$, 1.0g/100 ml	372	49.6	0.0212	0.0220
	372	49.6	0.0201	0.0209
	372	49.6	0.0198	0.0206
	372	49.6	0.0220	0.0228
	372	49.6	0.0224	0.0232
	372	49.6	0.0204	0.0212
	372	49.6	0.0202	0.0210
	372	49.6	0.0205	0.0213
$K_3Fe(CN)_6$, 3.2g/100 ml saponin	365	48.7	0.0194	0.0212
	365	48.7	0.0190	0.0208
	365	48.7	0.0195	0.0213
	365	48.7	0.0186	0.0204
	365	48.7	0.0184	0.0202
	365	48.7	0.0199	0.0217
	365	48.7	0.0186	0.0204
	365	48.7	0.0206	0.0224

Average .. 0.0213 ± 0.0008

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Sample of tissue homogenised; no effort was made to remove blood. Samples were equilibrated with gas and then dissolved gas was stripped out under vacuum and measured in a manometric Van Slyke apparatus. Various amounts of $K_3Fe(CN)_6$ or $NaNO_2$ were added to the tissue to prevent formation of oxyhemoglobin. The above results have been corrected for the decrease in solubility due to the presence of these salts.

SOURCE AND PURITY OF MATERIALS:

Details given under method.

ESTIMATED ERROR:

$\delta T/K = \pm 0.03$.

REFERENCES:

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Sheep placental tissue

ORIGINAL MEASUREMENTS:

Power, G. G.

J. Appl. Physiol. 1968, *24*, 468-74.

VARIABLES:

T/K = 310

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K = 310.15

Treatment	P_{O_2}/mmHg	P_{O_2}/kPa	Bunsen Coefficient, $\alpha/\text{cm}^3(\text{STP})\text{cm}^{-3}\text{atm}^{-1}$	Corrected Bunsen Coefficient, $\alpha/\text{cm}^3(\text{STP})\text{cm}^{-3}\text{atm}^{-1}$
$K_3Fe(CN)_6$,	366	48.8	0.0198	0.0214
2.9g/100 ml	366	48.8	0.0207	0.0223
Triton-X	366	48.8	0.0198	0.0214
$NaNO_2$,	366	48.8	0.0217	0.0244
0.9g/100 ml	366	48.8	0.0214	0.0221
Triton-X	366	48.8	0.0206	0.0213
$NaNO_2$,	368	49.1	0.0178	0.0186
1.0g/100 ml	368	49.1	0.0189	0.0197
	368	49.1	0.0194	0.0202
	368	49.1	0.0183	0.0191
			Average ..	0.0209 ± 0.0012

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Samples of tissue homogenised; no effort was made to remove blood. Samples were equilibrated with gas and then dissolved gas stripped out under vacuum and measured in a manometric Van Slyke apparatus. Various amounts of $K_3Fe(CN)_6$ or $NaNO_2$ were added to the tissue to prevent formation of oxyhemoglobin. The above results have been corrected for the decrease in solubility due to the presence of these salts.

SOURCE AND PURITY OF MATERIALS:

Details given under method.

ESTIMATED ERROR:

$\delta T/K = \pm 0.03$.

REFERENCES:

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Krebs solution

(3) FC-80 which is mostly a mixture of isomers of perfluorobutyltetrahydrofuran; $C_8F_{16}O$; e.g. see [335-36-4]

ORIGINAL MEASUREMENTS:

Wong, S. S.; DiMicco, J. A.; Standaert, D. G.; Dretchen, K. L.

J. Gen. Physiol. 1977, *69*, 655-66.

VARIABLES:

T/K = 310.15
P/kPa =91.9 - 94.8

FC-80 emulsion/per cent = 20

PREPARED BY:

A. L. Cramer
H. L. Clever

EXPERIMENTAL VALUES:

T/K	Oxygen Tension p/mmHg	Time after oxygen bubbling ceases, t/m	Volume Per Cent Oxygen, cm^3 100 cm^{-3}
	Krebs solution		
310.15	690.0 ± 11.6	0	2.23 ± 0.03
	graph	60	1.43 ± 0.03
	Emulsion: 80 per cent Krebs solution, 20 per cent FC-80		
310.15	711.6 ± 9.29	0	8.03 ± 0.44
	graph	60	7.53 ± 0.41

The uncertainties are standard error.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The emulsion was formed by sonicating a mixture of FC-80 and Krebs solution for 30 minutes.

The Krebs solution or the emulsion were thermostated at 36 - 38 °C. A mixture of 95 per cent oxygen and 5 per cent carbon dioxide was bubbled through the solvent for 60 minutes.

Total oxygen was measured with an oxygen analyzer and oxygen tension was measured with a pO_2 electrode.

The Krebs solution composition in g dm^{-3} was:

NaCl	
KCl	0.35
$MgSO_4 \cdot 7H_2O$	0.29
$CaCl_2$	0.28
KH_2PO_4	0.16
$NaHCO_3$	2.1
Dextrose	

Emulsiving agent was Pluronic F68 150 mg per 100 cm^3

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. No information.

(2) Krebs solution. Prepared in distilled water. See bottom of left column.

(3) FC-80. Minnesota Mining and Manufacturing Co. Used as received.

ESTIMATED ERROR:

$\delta T/K = 1$

The maximum standard error is 5.5 % of the mean.

REFERENCES:

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Aqueous physiologic salt solution

(3) FC-47, which is largely 1,1,2,2,3,3,4,4,4-nonafluoro-N,N-bis(nonafluorobutyl)-1-butanamine; $C_{12}F_{27}N$; [311-89-7]

ORIGINAL MEASUREMENTS:

Navari, R. M.; Rosenblum, W. I.; Kontos, H. A.; Patterson, J. L.

Res. Exp. Med. 1977, *170*, 169-80.

VARIABLES:

$T/K = 310.15$
$P/kPa = 6.66 - 101.325$

Emulsion of several concentrations

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

T/K	Oxygen Pressure p/mmHg	Emulsion Composition g FC-47 per 100 cm^3	Oxygen Solubility[1] cm^3 O_2/cm^3	Diffusion Coefficient[2] $10^{-5}D/cm^2s^{-1}$
310.15	50	22	0.0040±0.0010	2.43±0.07
	100		0.0090±0.0010	2.79±0.10
	150		0.0143±0.0011	2.88±0.08
	760		0.0797±0.0011	2.93±0.09
	150	25	0.0180±0.0010	2.84±0.01
	760		0.0932±0.0011	3.03±0.09
	150	33	0.0200±0.0010	2.96±0.09
	760		0.1173±0.0082	3.21±0.14
	50	*[3]	0.23[4]	
	100		0.28[4]	
	150		0.31[4]	
	760		0.36[4]	

[1] Mean of five determinations ± standard deviation.
[2] Mean of three determinations ± standard deviation.
[3] Pure FC-47, not an emulsion.
[4] Values read from a graph (Fig 2) in the paper.

The solubility values read from the graph appear to be Bunsen coefficients. The authors call it a solubility coefficient. They do not describe how it is calculated.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The solubilities were measured by the gas chromatograph method of Shoor *et al.* (1). The gas, presaturated with solvent vapor, was passed through the degassed liquid in the saturation cell at a rate of 50 ml m^{-1}. Twenty microliter samples of the gas-saturated liquid were withdrawn and analyzed chromatographically at 15 m intervals. When readings remained constant for one hour the solution was assumed to be saturated. The time for saturation was less than 2 hours. The apparatus was calibrated with pure dry oxygen.

The results confirm the report of Zander (2) that oxygen solubility in FC-47 does not obey Henry's law in either the pure liquid or the emulsion. The departure from Henry's law appears to be more pronounced at oxygen partial pressures below 150 mmHg.

Emulsion prepared by sonication.

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. No information.

(2) Physiologic salt solution.

Ion	Na	K	Ca	Cl	Lactate
meq dm^{-3}	154	4	3	109	28

A non-ionic detergent, Pluronic F-68/g dm^{-3} 48; Tris buffer to adjust the pH to 7.30 ± 0.10. Emulsion osmolarity/mOsm dm^{-3} 272 - 292.

(3) FC-47. 3 M Co.

ESTIMATED ERROR:

REFERENCES:

1. Shoor, S. K.; Walker, R. D. Jr.; Gubbins, K. E.
J. Phys. Chem. 1969, *73*, 312.

2. Zander, R.
Res. Exp. Med. 1974, *164*, 97.

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Globulins, bovine

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

ORIGINAL MEASUREMENTS:

Zander, R.

Z. Naturforsch., C: Biosci. 1976, *31C*, 339-52.

VARIABLES:

T/K = 310.15
P/kPa = 101.325 (1 atm)

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

T/K	Globulins, bovine g 100 cm^{-3}	Bunsen Coefficient $10^4\alpha/cm^3 cm^{-3}$ atm^{-1}	Constant[1] $k=(1/c)$ ln (α/α_0)
	α-Globulin, bovine		
310.15	0	241	
	5	237 ± 4	
	10	224 ± 5	
			-0.00703
	β-Globulin, bovine		
310.15	0	241	
	10	220 ± 5	
	15	213 ± 5	
			-0.00856
	-Globulin, bovine		
310.15	0	241	
	10	232 ± 3	
	20	214 ± 7	
			-0.00589

[1] $k/g^{-1} 100$ cm^3

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Classical Van Slyke method (1).

The apparatus sample volume and constant gas volume are carefully calibrated. The correction for unextracted gas is made, but the reabsorption correction is not necessary for oxygen.

Equilibration is undertaken in a thermostated tonometer. A 2 cm^3 sample is directly transferred to the Van Slyke apparatus for analysis.

The solubility of oxygen in water value is from the authors analysis of ten literature values (2).

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. Linde Co. Purity 99.9 per cent by volume.

(2) Globulins, bovine. No information.

(3) Water. Distilled.

ESTIMATED ERROR:

δT/K = 0.1
δα/α = 0.01

REFERENCES:

1. Van Slyke, D. D.; Neill, J. M. *J. Biol. Chem.* 1924, *61*, 523.
2. Zander, R.; Euler, R. *Measurement of Oxygen*, Edited by Degn, H.; Balslev, I.; Brook, R. Elsevier, Amsterdam, 1976, p.271.

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Various solutions - see below

ORIGINAL MEASUREMENTS:

Shkolʹnikova, R.I.

Uch. Zap. Leningr. Gos. Univ., Ser. Khim. Nauk. 1959, [18], 64-86.

Chem. Abstr. 1961, 55, 25443b.

VARIABLES:

T/K = 283-313
P/kPa = 101
Concentration

PREPARED BY:

V. Katovic

EXPERIMENTAL VALUES:

Solubility of Oxygen in Serum Albumin

		0.575%		1.15%		1.68%		1.99%	
t/°C	T^a/K	$10^3\alpha^b$	10^3L^c	$10^3\alpha$	10^3L	$10^3\alpha$	10^3L	$10^3\alpha$	10^3L
10	283	34.8	36.1	30.9	32.0	28.2	29.2	26.3	27.3
15	288	31.1	32.8	28.1	29.6	26.0	27.4	24.5	25.8
20	293	28.3	30.4	24.3	26.1	22.1	23.7	21.4	23.0
25	298	25.7	28.1	23.0	25.1	20.4	22.3	18.1	19.8
30	303	23.1	25.6	21.9	24.3	18.2	20.2	17.8	19.7
35	308	21.3	24.0	20.4	23.0	17.8	20.1	16.2	18.4
40	313	19.6	22.5	18.1	20.7	16.0	18.4	15.4	17.6

[a] Calculated by compiler.

[b] Bunsen coefficient in cm^3(STP) cm^{-3} atm^{-1}.

[c] Ostwald coefficient.

continued on following page

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Solubility determined by a manometric/volumetric apparatus described in the paper.

SOURCE AND PURITY OF MATERIALS:

(1) 99.98-99.99% pure

(2) Serum and egg albumin were purified by dialysis.

ESTIMATED ERROR:

$\delta\alpha/\alpha$ = ±0.015, author's estimate

REFERENCES:

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Various solutions - see below

EVALUATOR:

Shkol'nikova, R.I.

Uch. Zap. Leningr. Gos. Univ., Ser. Khim. Nauk. 1959, [18], 64-86.

Chem. Abstr. 1961, 55, 25443b.

CRITICAL EVALUATION:

continued

Solubility of Oxygen in Gelatin

		1%		5%		10%	
t/°C	T^a/K	$10^3\alpha^b$	10^3L^c	$10^3\alpha$	10^3L	$10^3\alpha$	10^3L
10	283	34.9	36.2	29.4	30.5	26.2	27.2
15	288	32.3	34.7	28.0	29.2	24.1	25.5
20	293	30.0	32.2	26.9	28.9	22.6	24.2
25	298	26.6	29.0	22.4	24.4	19.3	22.1
30	303	21.0	23.3	18.1	20.2	16.0	17.7
35	308	19.3	21.8	17.9	20.0	14.7	16.6
40	313	17.1	19.6	14.5	16.6	12.9	14.3

[a] Calculated by compiler.

[b] Bunsen coefficient in cm^3(STP) cm^{-3} atm^{-1}.

[c] Ostwald coefficient.

Solubility of Oxygen in Egg Albumin

		0.575%		1.15%	
t/°C	T^a/K	$10^3\alpha^b$	10^3L^c	$10^3\alpha$	10^3L
10	283	35.5	36.8	31.4	32.5
15	288	33.4	35.2	29.5	31.1
20	293	29.8	31.9	26.0	27.9
25	298	27.2	29.7	25.0	27.3
30	303	25.2	27.9	22.8	25.3
35	308	24.1	27.2	21.4	24.1
40	313	22.4	25.7	19.6	22.5

[a] Calculated by compiler.

[b] Bunsen coefficient in cm^3(STP) cm^{-3} atm^{-1}.

[c] Ostwald coefficient.

		Hydrated Iron Oxide $10^3\ {}^b$			Hydrated Aluminum Oxide $10^3\ {}^b$		
t/°C	T^aK	0.1%	0.5%	0.8%	0.1%	0.35%	0.42%
20	293	30.1	29.6	27.9	31.0	28.7	26.0
30	303	25.3	21.5	20.1	26.5	26.5	21.1
40	313	21.3	16.1	13.0	23.1	23.1	16.5

[a] Calculated by compiler.

[b] Bunsen coefficient in cm^3(STP) cm^{-3} atm^{-1}.

[c] Concentrations are presumably in wt per cent.

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Serum Albumin

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

ORIGINAL MEASUREMENTS:

Shkol'nikova, R. I.

Uch. Zap. Leningr. Gos. Univ., Ser. Khim. Nauk. 1959, Nr. *18*, 64-86.

Chem. Abstr. 1961, *55*, 25443b.

VARIABLES:

T/K = 283.15 - 313.15
P/kPa = 101.325
serum albumin/Wt % = 0.575 - 1.99

PREPARED BY:

A. L. Cramer
H. L. Clever

EXPERIMENTAL VALUES:

T/K	Serum Albumin			
	0.575 wt %		1.15 wt %	
	Bunsen Coefficient	Ostwald Coefficient	Bunsen Coefficient	Ostwald Coefficient
283.15	34.8	36.1	30.9	32.0
288.15	31.1	32.8	28.1	29.6
293.15	28.3	30.4	24.3	26.1
298.15	25.7	28.1	23.0	25.1
303.15	23.1	25.6	21.9	24.3
308.15	21.3	24.0	20.4	23.0
313.15	19.6	22.5	18.1	20.7

T/K	Serum Albumin			
	1.68 wt %		1.99 wt %	
	Bunsen Coefficient	Ostwald Coefficient	Bunsen Coefficient	Ostwald Coefficient
283.15	28.2	29.2	26.3	27.3
288.15	26.0	27.4	24.5	25.8
293.15	22.1	23.7	21.4	23.0
298.15	20.4	22.3	18.1	19.8
303.15	18.2	20.2	17.8	19.7
308.15	17.8	20.1	16.2	18.4
313.15	16.0	18.4	15.4	17.6

The enthalpy of solution of oxygen was calculated from the temperature coefficient of the Bunsen coefficient. It is 2780, 3350, 2710, 2510, and 2110 cal mol^{-1} in water, and 0.575, 1.15, 1.68, and 1.99 wt % serum albumin respectively.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The apparatus and procedure of Lannung were modified (1).

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. Source not given. Stated to be 99.98 - 99.99 per cent.

(2) Serum albumin. No information.

(3) Water. No information.

ESTIMATED ERROR:

REFERENCES:

1. Lannung, A.
J. Am. Chem. Soc. 1930, *52*, 68.

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Ovalbumin

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

ORIGINAL MEASUREMENTS:

Shkol'nikova, R. I.

Uch. Zap. Leningr. Gos. Univ., Ser. Khim. Nauk. 1959, Nr. *18*, 64-86.

Chem. Abstr. 1961, *55*, 25443b.

VARIABLES:

T/K = 283.15 - 313.15
P/kPa = 101.325
Ovalbumin/Wt % = 0.515, 1.15

PREPARED BY:

A. L. Cramer
H. L. Clever

EXPERIMENTAL VALUES:

T/K	Ovalbumin/Wt % 0.515		Ovalbumin/Wt % 1.15	
	Bunsen Coefficient $\alpha \times 10^3$	Ostwald Coefficient $L \times 10^3$	Bunsen Coefficient $\alpha \times 10^3$	Ostwald Coefficient $L \times 10^3$
283.15	35.5	36.8	31.4	32.5
288.15	33.4	35.2	29.5	31.1
293.15	29.8	31.9	26.0	27.9
298.15	27.2	29.7	25.0	27.3
303.15	25.2	27.9	22.8	25.3
308.15	24.1	27.2	21.4	24.1
313.15	22.4	25.7	19.6	22.5

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The apparatus and procedure of Lannung were modified (1).

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. Source not given. Stated to be 99.98 - 99.99 per cent.

(2) Ovalbumin. No information.

(3) Water. No information.

ESTIMATED ERROR:

REFERENCES:

1. Lannung, A.
J. Am. Chem. Soc. 1930, *52*, 68.

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Albumins

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

ORIGINAL MEASUREMENTS:

Zander, R.

Z. Natruforsch., C: Biosci. 1976, *31C*, 339-52.

VARIABLES:

$T/K = 310.15$
$P/kPa = 101.325$ (1 atm)

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

T/K	Albumins g 100 cm^{-3}	Bunsen Coefficient $10^4\alpha/cm^3 cm^{-3}$ atm^{-1}	Constant[1] $k=(1/c)\ \ln\ (\alpha/\alpha_0)$
	Albumin, bovine		
310.15	0	241	
	10	232 ± 4	
	20	221 ± 2	
			-0.00417
	Ovalbumin		
310.15	0	241	
	10	221 ± 6	
	20	209 ± 8	
			-0.00744

[1] $k/g^{-1} 100\ cm^3$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Classical Van Slyke method (1).

The apparatus sample volume and constant gas volume are carefully calibrated. The correction for unextracted gas is made, but the reabsorption correction is not necessary for oxygen.

Equilibration is undertaken in a thermostated tonometer. A 2 cm^3 sample is directly transferred to the Van Slyke apparatus for analysis.

The solubility of oxygen in water value is from the authors analysis of ten literature values (2).

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. Linde Co. Purity 99.9 per cent by volume.

(2) Albumins. No information.

(3) Water. Distilled

ESTIMATED ERROR:

$\delta T/K = 0.1$
$\delta\alpha/\alpha = 0.01$

REFERENCES:

1. Van Slyke, D. D.; Neill, J. M. *J. Biol. Chem.* 1924, *61*, 523.

2. Zander, R.; Euler, R. *Measurement of Oxygen*, Edited by Degn, H.; Balslev, I.; Brook, R. Elsevier, Amsterdam, 1976, p.271.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Oxygen; O_2; [7782-44-7] (2) 2-Methyl-1-propanol or Isobutanol; $C_4H_{10}O$; [78-83-1] (3) Cholest-5-en-3β-ol or Cholesterol; $C_{27}H_{46}O$; [57-88-5]	Byrne, J. E.; Battino, R.; Danforth, W. F. *J. Chem. Thermodyn.* 1974, *6*, 245-50.
VARIABLES: T/K = 310.65 Total P/kPa = 101.325	PREPARED BY: H. L. Clever

EXPERIMENTAL VALUES:

T/K	Mass Fraction Cholesterol W_3	Ostwald Coefficient L	"Salting Out" Parameter $k = (1/W_3)\log(L_o/L_w)$
310.65	0.0	0.221	
310.64	0.0522	0.220	
310.63	0.0522	0.221	0.0

L_o and L_w are the oxygen Ostwald coefficients in Isobutanol and in the isobutanol + cholesterol solution, respectively.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

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

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

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

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. Matheson Co., Inc. 99.995 per cent.

(2) 2-methyl-1-propanol or isobutanol. Fisher Scientific Certified. 99 mol per cent.

(3) Cholesterol. Source not given. Recrystalized from benzene.

ESTIMATED ERROR:

$\delta T/K = 0.01$

$\delta P/mmHg = 0.5$

$\delta L_o/L_o = 0.01$

$\delta L_w/L_w = 0.02$

REFERENCES:

1. Morrison, T. J.; Billett, F. *J. Chem. Soc.* 1948, 2033.
2. Battino, R.; Evans, F. D.; Danforth, W. F. *J. Am. Oil Chem. Soc.* 1968, *45*, 830.
3. Battino, R.; Banzhof, M.; Bogan, M.; Wilhelm, E. *Anal. Chem.* 1971, *43*, 806.

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Benzene; C_6H_6; [71-43-2]

(3) Cephalin

ORIGINAL MEASUREMENTS:

Byrne, J. E.; Battino, R.; Danforth, W. F.

J. Chem. Thermodyn. 1974, *6*, 245-50.

VARIABLES:

T/K = 310.65
Total P/kPa = 101.325

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

T/K	Mass Fraction Cephalin W_3	Ostwald Coefficient L	"Salting Out" Parameter $k = (1/W_3) \log (L_o/L_w)$
310.59	0.0	0.2379	
310.61	0.0	0.2349	
310.64	0.0	0.2326	
310.66	0.0	0.2318	
310.60	0.1008	0.222	
310.63	0.1008	0.221	0.25 ± 0.09
310.65	0.1996	0.204	
310.68	0.1996	0.205	0.30 ± 0.05
310.62	0.3015	0.191	
310.63	0.3015	0.186	0.32 ± 0.03
310.65	1.0	0.112*	

*Extrapolated oxygen solubility in hypothetical liquid cephalin.

L_o and L_w are the oxygen Ostwald coefficients in benzene and in the benzene + cephalin solution, respectively.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

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

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

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

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. Matheson Co., Inc. 99.995 per cent.

(2) Benzene. J. T. Baker Analyzed Reagent Grade. 99.9 mol per cent, thiophene free.

(3) Cephalin. Nutritional Biochemicals Corp. Homostatic phosphatide obtained from bovine brain tissue, used as received.

ESTIMATED ERROR:

$\delta T/K = 0.01$
$\delta P/mmHg = 0.5$
$\delta L_o/L_o = 0.01$
$\delta L_W/L_W = 0.02$

REFERENCES:

1. Morrison, T. J.; Billett, F. *J. Chem. Soc.* 1948, 2033.
2. Battino, R.; Evans, F. D.; Danforth, W. F. *J. Am. Oil Chem. Soc.* 1968, *45*, 830.
3. Battino, R.; Banzhof, M.; Bogan, M.; Wilhelm, E. *Anal. Chem.* 1971, *43*, 806.

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Benzene; C_6H_6; [71-43-2]

(3) Lecithin.

ORIGINAL MEASUREMENTS:

Byrne, J. E.; Battino, R.; Danforth, W. F.

J. Chem. Thermodyn. 1974, *6*, 245-50.

VARIABLES:

T/K = 310.65
Total P/kPa = 101.325

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

T/K	Mass Fraction Lecithin W_3	Ostwald Coefficient L	"Salting Out" Parameter $k = (1/W_3) \log (L_o/L_w)$
310.59	0.0	0.2379	
310.61	0.0	0.2349	
310.64	0.0	0.2326	
310.66	0.0	0.2318	
310.62	0.1007	0.216	
310.63	0.1007	0.217	0.34 ± 0.09
310.63	0.2025	0.203	
310.64	0.2025	0.206	0.29 ± 0.05
310.59	0.2993	0.193	
310.61	0.2993	0.192	0.28 ± 0.03
310.59	0.3986	0.178	
310.60	0.3986	0.178	0.30 ± 0.02
310.65	1.0	0.117*	

*Extrapolated oxygen solubility in hypothetical liquid lecithin.

L_o and L_w are the oxygen Ostwald coefficients in benzene and in the benzene + lecithin solution, respectively.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

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

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

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

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. Matheson Co., Inc. 99.995 per cent.

(2) Benzene. J. T. Baker Analyzed Reagent Grade. 99.9 mol per cent, thiophene free.

(3) Lecithin. Nutritional Biochemicals Corp. Vegetable source, about 95 per cent, used as received.

ESTIMATED ERROR:

$\delta T/K = 0.01$
$\delta P/mmHg = 0.5$
$\delta L_o/L_o = 0.01$
$\delta L_w/L_w = 0.02$

REFERENCES:

1. Morrison, T. J.; Billett, F. *J. Chem. Soc.* 1948, 2033.
2. Battino, R.; Evans, F. D.; Danforth, W. F. *J. Am. Oil Chem. Soc.* 1968, *45*, 830.
3. Battino, R.; Banzhof, M.; Bogan, M.; Wilhelm, E. *Anal. Chem.* 1971, *43*, 806.

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Benzene; C_6H_6; [71-43-2]

(3) Cholest-5-en-3β-ol or Cholesterol; $C_{27}H_{46}O$; [57-88-5]

ORIGINAL MEASUREMENTS:

Byrne, J. E.; Battino, R.; Danforth, W. F.

J. Chem. Thermodyn. 1974, *6*, 245-50.

VARIABLES:

T/K = 310.65
Total P/kPa = 101.325

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

T/K	Mass Fraction Cholesterol W_3	Ostwald Coefficient L	"Salting Out" Parameter $k = (1/W_3) \log (L_o/L_w)$
310.59	0.0	0.2379	
310.61	0.0	0.2349	
310.64	0.0	0.2326	
310.66	0.0	0.2318	
310.61	0.0525	0.225	
310.63	0.0525	0.225	0.33 ± 0.17
310.64	0.1052	0.220	
310.67	0.1052	0.218	0.28 ± 0.09
310.57	0.1920	0.207	
310.58	0.1920	0.208	0.27 ± 0.05
310.65	1.0	0.126	

*Extrapolated oxygen solubility in hypothetical liquid cholesterol.

L_o and L_w are the oxygen Ostwald coefficients in benzene and in the benzene + cholesterol solution, respectively.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

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

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

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

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. Matheson Co., Inc. 99.995 per cent.

(2) Benzene. J. T. Baker Analyzed Reagent Grade. 99.9 mol per cent, thiophene free.

(3) Cholesterol. Source not given. Recrystalized from benzene.

ESTIMATED ERROR:

$\delta T/K = 0.01$
$\delta P/mmHg = 0.5$
$\delta L_o/L_o = 0.01$
$\delta L_w/L_w = 0.02$

REFERENCES:

1. Morrison, T. J.; Billett, F. *J. Chem. Soc.* 1948, 2033.
2. Battino, R.; Evans, F. D.; Danforth, W. F. *J. Am. Oil Chem. Soc.* 1968, *45*, 830.
3. Battino, R.; Banzhof, M.; Bogan, M.; Wilhelm, E. *Anal. Chem.* 1971, *43*, 806.

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Various substances given in table below

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

ORIGINAL MEASUREMENTS:

Zander, R.

Z. Naturforsch., C: Biosci. 1976, 31C, 339-52.

EXPERIMENTAL VALUES:

The solubility of oxygen at 310.15 K (37 °C) in some complex aqueous mixtures.

Solute, g per 100 cm^3 / Component	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
D-Glucose; $C_6H_{12}O_6$; [50-99-7]	10	10	-	-	10	7.5	-	5	10	10
Sodium chloride; NaCl; [7647-14-5]	2.9	2.9	1.34	2.5	0.18	2.41	-	1.16	5	7.5
Ovalbumin	10	-	-	-	-	-	10	4	-	-
4-Hydroxyproline; $C_5H_9NO_3$; [6912-67-0]	-	10	-	-	-	-	-	4	-	-
Albumin, bovine	-	-	2	-	-	-	-	-	-	-
Choline chloride; $C_6H_{15}N_2O_2$.Cl [51-83-2]	-	-	8	4	-	-	-	-	15	15
Lysine; $CH_{14}N_2O_2$; [6899-06-5]	-	-	10	-	-	-	-	-	10	10
α-Globin, bovine	-	-	-	1	2	1	-	-	-	-
γ-Globin, bovine	-	-	-	-	-	2	-	-	-	-
Chondroitinsulfuric acid	-	-	-	4	4	-	-	-	-	-
Urea; CHN_2O; [57-13-6]	-	-	-	-	-	-	15	6	20	20
Bunsen coefficient $10^4\alpha/cm^3\ cm^{-3}\ atm^{-1}$	174±3	138±4	143±4	182±3	188±3	188±3	195±10	180±3	37±6	9±4

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Urea; CH_4N_2O; [57-13-6]

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

ORIGINAL MEASUREMENTS:

Zander, R.

Z. Naturforsch., C: Biosci. 1976, *31C*, 339-52.

VARIABLES:

T/K = 310.15
P/kPa = 101.325

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

T/K	Urea g 100 cm^{-3}	Bunsen Coefficient $10^4\alpha/cm^3 cm^{-3}$ atm^{-1}	Constant[1] $k=(1/c)$ ln (α/α_0)
310.15	0	241	
	10	222 $\pm$ 3	
	20	206 $\pm$ 5	
	30	183 $\pm$ 3	
	40	173 $\pm$ 2	
	50	154 $\pm$ 1	
	60	146 $\pm$ 4	
			-0.00862[2]

[1] $k/g^{-1}100$ cm^3

[2] The constant was determined from solubility data between 0 and 30 g 100 cm^{-3}.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Classical Van Slyke method (1).

The apparatus sample volume and constant gas volume are carefully calibrated. The correction for unextracted gas is made, but the reabsorption correction is not necessary for oxygen.

Equilibration is undertaken in a thermostated tonometer. A 2 cm^3 sample is directly transferred to the Van Slyke apparatus for analysis.

The solubility of oxygen in water value is from the authors analysis of ten literature values (2).

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. Linde Co. Purity 99.9 per cent by volume.

(2) Urea. No information.

(3) Water. Distilled.

ESTIMATED ERROR:

$\delta T/K = 0.1$
$\delta\alpha/\alpha = 0.01$

REFERENCES:

1. Van Slyke, D. D.; Neill, J. M. *J. Biol. Chem.* 1924, *61*, 523.
2. Zander, R.; Euler, R. *Measurement of Oxygen*, Edited by Degn, H.; Balslev, I.; Brook, R. Elsevier, Amsterdam, 1976, p.271.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Oxygen; O_2; [7782-44-7] (2) Urea; CH_4N_2O; [57-13-6] (3) Water; H_2O; [7732-18-5]	Popovic, M.; Niebelschutz, H.; Reuss, M. *European. J. Appl. Microbiol. Biotechnol.* 1979, *8*, 1-15.
VARIABLES: Concentration T/K = 298	PREPARED BY: C.L. Young

EXPERIMENTAL VALUES:

T/K	Concentration /g dm^{-3}	Oxygen solubility $S \times 10^3$/mol dm^{-3}
298.15	6.75	1.239
	13.50	1.217

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Stirred equilibrium cell. Volumetric apparatus in which known volume of gas was added to a known volume of liquid and the equilibrium pressure measured. Details in source and ref. (1).

SOURCE AND PURITY OF MATERIALS:

No details given.

ESTIMATED ERROR:

$\delta T/K = \pm 0.1$; $\delta S = \pm 2\%$
(estimated by compiler).

REFERENCES:

1. Krauss, W.; Gestrich, W. *Chem. Ing. Techn.* 1977, *6*, 35.

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Amino acids

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

ORIGINAL MEASUREMENTS:

Zander, R.

Z. Naturforsch., C: Biosci. 1976, *31C*, 339-52.

VARIABLES:

$T/K = 310.15$
$P/kPa = 101.325$

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

T/K	Amino acids g 100 cm^{-3}	Bunsen Coefficient $10^4\alpha/cm^3\,cm^{-3}\,atm^{-1}$	Constant[1] $k=(1/c)\ \ln\ (\alpha/\alpha_0)$
Glycine; $C_2H_5NO_2$; [56-40-6]			
310.15	0	241	
	10	177 ± 2	
	20	139 ± 1	
			-0.02868
4-Hydroxyproline; $C_5H_9NO_3$; [6912-67-0]			
310.15	0	241	
	10	202 ± 1	
	20	168 ± 1	
			-0.01799
L-Alanine; $C_3H_7NO_2$; [56-41-7]			
310.15	0	241	
	10	190 ± 2	
	20	149 ± 4	
	30	117 ± 1	
			-0.02390
Cysteine; $C_3H_7NO_2S$; [4371-52-2], see [52-90-4]			
310.15	0	241	
	10	128 ± 3	
	20	97 ± 4	
			-0.05255

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Classical Van Slyke method (1).

The apparatus sample volume and constant gas volume are carefully calibrated. The correction for unextracted gas is made, but the reabsorption correction is not necessary for oxygen.

Equilibration is undertaken in a thermostated tonometer. A 2 cm^3 sample is directly transferred to the Van Slyke apparatus for analysis.

The solubility of oxygen in water value is from the authors analysis of ten literature values (2).

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. Linde Co. Purity 99.9 per cent by volume.

(2) Amino acids. No information.

(3) Water. Distilled.

ESTIMATED ERROR:

$\delta T/K = 0.1$
$\delta\alpha/\alpha = 0.01$

REFERENCES:

1. Van Slyke, D. D.; Neill, J. M. *J. Biol. Chem.* 1924, *61*, 523.
2. Zander, R.; Euler, R. *Measurement of Oxygen*, Edited by Degn, H.; Balslev, I.; Brook, R. Elsevier, Amsterdam, 1976, p.271.

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[1] $k/g^{-1}100\ cm^3$

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Lysine; $C_6H_{14}N_2O_2$; [6899-06-5]

see also [56-87-1] and [70-54-2]

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

ORIGINAL MEASUREMENTS:

Zander, R.

Z. Naturforsch., C: Biosci. 1976, *31C*, 339-52.

VARIABLES:

T/K = 310.15
P/kPa = 101.325

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

T/K	Lysine g 100 cm^{-3}	Bunsen Coefficient $10^4\alpha/cm^3 cm^{-3}$ atm^{-1}	Constant[1] $k=(1/c)\ \ln(\alpha/\alpha_0)$
310.15	0	241	
	10	177 ± 5	
	20	133 ± 4	
	30	92 ± 2	
	40	51 ± 4	
	50	24 ± 1	
			-0.03097[2]

[1] $k/g^{-1}100\ cm^3$

[2] Constant determined from values between 0-30 g 100 cm^{-3}

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Classical Van Slyke method (1).

The apparatus sample volume and constant gas volume are carefully calibrated. The correction for unextracted gas is made, but the reabsorption correction is not necessary for oxygen.

Equilibration is undertaken in a thermostated tonometer. A 2 cm^3 sample is directly transferred to the Van Slyke apparatus for analysis.

The solubility of oxygen in water value is from the authors analysis of ten literature values (2).

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. Linde Co. Purity 99.9 per cent by volume.

(2) Lysine. No information.

(3) Water. Distilled.

ESTIMATED ERROR:

$\delta T/K = 0.1$
$\delta\alpha/\alpha = 0.01$

REFERENCES:

1. Van Slyke, D. D.; Neill, J. M. *J. Biol. Chem.* 1924, *61*, 523.
2. Zander, R.; Euler, R. *Measurement of Oxygen*, Edited by Degn, H.; Balslev, I.; Brook, R. Elsevier, Amsterdam, 1976, p.271.

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) N-(Aminoiminomethyl)-N-methylglycine or creatine; $C_4H_9N_3O_2$; [57-00-1]

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

ORIGINAL MEASUREMENTS:

Zander, R.

Z. Naturforsch., C: Biosci. 1976, *31C*, 339-52.

VARIABLES:

T/K = 310.15
P/kPa = 101.325 (1 atm)

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

T/K	Creatine c_3/g 100 cm^{-3}	Bunsen Coefficient $10^4\alpha/cm^3 cm^{-3}$ atm^{-1}	Constant[1] $k=(1/c)\ \ln(\alpha/\alpha_0)$
310.15	0	241	
	5	226 ± 1	
	10	209 ± 3	
			-0.01392

[1] k/g^{-1}100 cm^3

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Classical Van Slyke method (1).

The apparatus sample volume and constant gas volume are carefully calibrated. The correction for unextracted gas is made, but the reabsorption correction is not necessary for oxygen.

Equilibration is undertaken in a thermostated tonometer. A 2 cm^3 sample is directly transferred to the Van Slyke apparatus for analysis.

The solubility of oxygen in water value is from the authors analysis of ten literature values (2).

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. Linde Co. Purity 99.9 per cent by volume.

(2) Creatine. No information.

(3) Water. Distilled.

ESTIMATED ERROR:

$\delta T/K = 0.1$
$\delta\alpha/\alpha = 0.01$

REFERENCES:

1. Van Slyke, D. D.; Neill, J. M. *J. Biol. Chem.* 1924, *61*, 523.
2. Zander, R.; Euler, R. *Measurement of Oxygen*, Edited by Degn, H.; Balslev, I.; Brook, R. Elsevier, Amsterdam, 1976, p.271.

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Cholines

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

ORIGINAL MEASUREMENTS:

Zander, R.

Z. Naturforsch., C: Biosci. 1976, *31C*, 339-52.

VARIABLES:

T/K = 310.15
P/kPa = 101.325 (1 atm)

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

T/K	Choline g 100 cm^{-3}	Bunsen Coefficient $10^4\alpha/cm^3\,cm^{-3}\,atm^{-1}$	Constant[1] $k=(1/c)\ln(\alpha/\alpha_0)$
	2-Hydroxy-N,N,N-trimethyl ethanaminium chloride or choline chloride; $C_5H_{14}NOCl$; [67-48-1]		
310.15	0	241	
	10	208 ± 2	
	20	182 ± 3	
	30	171 ± 2	
	50	125 ± 2	
	70	100 ± 2	
			-0.01261[2]
	2-Acetoxy-N,N,N-trimethyl ethanaminium chloride or acetylcholine chloride; $C_7H_{16}NO_2Cl$; [60-31-1][3]		
310.15	0	241	
	10	211 ± 3	
	20	182 ± 6	
	30	159 ± 7	
			-0.01389

[1] $k/g^{-1}\,100\ cm^3$

[2] The value of k is based on solubility data between 0 and 30 g 100 cm^{-3}.

[3] The author used the name acetylcholine. The compiler assumed it was the chloride.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Classical Van Slyke method (1).

The apparatus sample volume and constant gas volume are carefully calibrated. The correction for unextracted gas is made, but the reabsorption correction is not necessary for oxygen.

Equilibration is undertaken in a thermostated tonometer. A 2 cm^3 sample is directly transferred to the Van Slyke apparatus for analysis.

The solubility of oxygen in water value is from the authors analysis of ten literature values (2).

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. Linde Co. Purity 99.9 per cent by volume.

(2) Cholines. No information.

(3) Water. Distilled.

ESTIMATED ERROR:

$\delta T/K = 0.1$
$\delta\alpha/\alpha = 0.01$

REFERENCES:

1. Van Slyke, D. D.; Neill, J. M. *J. Biol. Chem.* 1924, *61*, 523.
2. Zander, R.; Euler, R. *Measurement of Oxygen*, Edited by Degn, H.; Balslev, I.; Brook, R. Elsevier, Amsterdam, 1976, p.271.

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) ADP and ATP

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

ORIGINAL MEASUREMENTS:

Zander, R.

Z. Naturforsch., C: Biosci. 1976, *31C*, 339-52.

VARIABLES:

T/K = 310.15
P/kPa = 101.325 (1 atm)

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

T/K	ADP and ATP g 100 cm^{-3}	Bunsen Coefficient $10^4\alpha/cm^3 cm^{-3}$ atm^{-1}	Constant[1] $k=(1/c) \ln (\alpha/\alpha_0)$
Adenosine 5'-(trihydrogen diphosphate) or ADP; $C_{10}H_{15}N_5O_{10}P_2$; [58-64-0]			
310.15	0	241	
	5	225 ± 7	
	10	202 ± 5	
	20	190 ± 2	
			-0.01463
Adenosine 5'-(tetrahydrogen triphosphate) or ATP; $C_{10}H_{16}N_5O_{13}P_3$; [56-65-5]			
310.15	0	241	
	5	220 ± 4	
	10	207 ± 6	
	20	174 ± 6	
			-0.01634

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[1] $k/g^{-1} 100\ cm^3$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Classical Van Slyke method (1).

The apparatus sample volume and constant gas volume are carefully calibrated. The correction for unextracted gas is made, but the reabsorption correction is not necessary for oxygen.

Equilibration is undertaken in a thermostated tonometer. A 2 cm^3 sample is directly transferred to the Van Slyke apparatus for analysis.

The solubility of oxygen in water value is from the authors analysis of ten literature values (2).

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. Linde Co. Purity 99.9 per cent by volume.

(2) ADP and ATP. No information.

(3) Water. Distilled.

ESTIMATED ERROR:

$\delta T/K = 0.1$
$\delta\alpha/\alpha = 0.01$

REFERENCES:

1. Van Slyke, D. D.; Neill, J. M. *J. Biol. Chem.* 1924, *61*, 523.
2. Zander, R.; Euler, R. *Measurement of Oxygen*, Edited by Degn, H.; Balslev, I.; Brook, R. Elsevier, Amsterdam, 1976, p.271.

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Carbohydrates

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

ORIGINAL MEASUREMENTS:

Zander, R.

Z. Naturforsch., C: Biosci. 1976, *31C*, 339-52.

VARIABLES:

$T/K = 310.15$
$P/kPa = 101.325$

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

T/K	Carbohydrates g 100 cm^{-3}	Bunsen Coefficient $10^4\alpha/cm^3 cm^{-3}\ atm^{-1}$	Constant[1] $k=(1/c)\ \ln(\alpha/\alpha_0)$
	Glycogen		
310.15	0	241	
	2	233 ± 3	
	10	209 ± 5	
	20	188 ± 2	
	25	157 ± 9	
			-0.01517
	Glycosamine		
310.15	0	241	
	10	191 ± 1	
	20	143 ± 4	
	30	108 ± 4	
			-0.02586
	Chondroitin sulfuric acid		
310.15	0	241	
	10	184 ± 5	
	20	146 ± 5	
			-0.02558

[1] $k/g^{-1} 100\ cm^3$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Classical Van Slyke method (1).

The apparatus sample volume and constant gas volume are carefully calibrated. The correction for unextracted gas is made, but the reabsorption correction is not necessary for oxygen.

Equilibration is undertaken in a thermostated tonometer. A 2 cm^3 sample is directly transferred to the Van Slyke apparatus for analysis.

The solubility of oxygen in water value is from the authors analysis of ten literature values (2).

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. Linde Co. Purity 99.9 per cent by volume.

(2) Carbohydrates. No information.

(3) Water. Distilled.

ESTIMATED ERROR:

$\delta T/K = 0.1$
$\delta\alpha/\alpha = 0.01$

REFERENCES:

1. Van Slyke, D. D.; Neill, J. M. *J. Biol. Chem.* 1924, *61*, 523.
2. Zander, R.; Euler, R. *Measurement of Oxygen*, Edited by Degn, H.; Balslev, I.; Brook, R. Elsevier, Amsterdam, 1976, p.271.

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Carbohydrates

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

ORIGINAL MEASUREMENTS:

Zander, R.

Z. Naturforsch., C: Biosci. 1976, *31C*, 339-52.

VARIABLES:

$T/K = 310.15$
$P/kPa = 101.325$

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

T/K	Carbohydrates g 100 cm^{-3}	Bunsen Coefficient $10^4\alpha/cm^3 cm^{-3}\ atm^{-1}$	Constant[1] $k=(1/c)\ \ln\ (\alpha/\alpha_0)$
	Dextrin		
310.15	0	244	
	10	219 ± 5	
	20	189 ± 4	
			-0.01155
	Inuline		
310.15	0	244	
	2	233 ± 1	
	10	212 ± 5	
	20	189 ± 4	
			-0.01262
	Starch		
310.15	0	244	
	2	229 ± 2	
	10	206 ± 4	
	20	183 ± 3	
			-0.01462

[1] $k/g^{-1}100\ cm^3$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Classical Van Slyke method (1).

The apparatus sample volume and constant gas volume are carefully calibrated. The correction for unextracted gas is made, but the reabsorption correction is not necessary for oxygen.

Equilibration is undertaken in a thermostated tonometer. A 2 cm^3 sample is directly transferred to the Van Slyke apparatus for analysis.

The solubility of oxygen in water value is from the authors analysis of ten literature values (2).

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. Linde Co. Purity 99.9 per cent by volume.

(2) Carbohydrates. No information

(3) Water. Distilled.

ESTIMATED ERROR:

$\delta T/K = 0.1$
$\delta\alpha/\alpha = 0.01$

REFERENCES:

1. Van Slyke, D. D.; Neill, J. M. *J. Biol. Chem.* 1924, *61*, 523.
2. Zander, R.; Euler, R. *Measurement of Oxygen*, Edited by Degn, H.; Balslev, I.; Brook, R. Elsevier, Amsterdam, 1976, p.271.

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) α-D-Glucopyranose, 1-(dihydrogen phosphate) or α-Glucose-1-phosphate; $C_6H_{13}O_9P$; [59-56-3]

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

ORIGINAL MEASUREMENTS:

Zander, R.

Z. Naturforsch., C: Biosci. 1976, *31C*, 339-52.

VARIABLES:

T/K = 310.15
P/kPa = 101.325

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

T/K	α-Glucose-1-phosphate C_3/g 100 cm^{-3}	Bunsen Coefficient $10^4\alpha/cm^3 cm^{-3}$ atm^{-1}	Constant[1] $k=(1/c)\ \ln\ (\alpha/\alpha_0)$
310.15	0	241	
	5	212 ± 1	
	10	183 ± 1	
	20	139 ± 2	
			-0.02733

[1] $k/g^{-1}100\ cm^3$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Classical Van Slyke method (1).

The apparatus sample volume and constant gas volume are carefully calibrated. The correction for unextracted gas is made, but the reabsorption correction is not necessary for oxygen.

Equilibration is undertaken in a thermostated tonometer. A 2 cm^3 sample is directly transferred to the Van Slyke apparatus for analysis.

The solubility of oxygen in water value is from the authors analysis of ten literature values (2).

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. Linde Co. Purity 99.9 per cent by volume.

(2) α-Glucose-1-phosphate. No information.

(3) Water. Distilled.

ESTIMATED ERROR:

δT/K = 0.1
δα/α = 0.01

REFERENCES:

1. Van Slyke, D. D.; Neill, J. M. *J. Biol. Chem.* 1924, *61*, 523.
2. Zander, R.; Euler, R. *Measurement of Oxygen*, Edited by Degn, H.; Balslev, I.; Brook, R. Elsevier, Amsterdam, 1976, p.271.

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Gelatin

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

ORIGINAL MEASUREMENTS:

Shkol'nikova, R. I.

Uch. Zav. Leningr. Gos. Univ., Ser. Khim. Nauk. 1959, Nr. *18*, 64-86.

Chem. Abstr. 1961, *55*, 25443b.

VARIABLES:

$T/K = 283.15 - 313.15$
$P/kPa = 101.325$
Gelatin/Wt % = 1 - 10

PREPARED BY:

A. L. Cramer
H. L. Clever

EXPERIMENTAL VALUES:

T/K	Gelatin/Wt % 1 Bunsen Coefficient	Gelatin/Wt % 1 Ostwald Coefficient	Gelatin/Wt % 5 Bunsen Coefficient	Gelatin/Wt % 5 Ostwald Coefficient
283.15	34.9	36.2	29.4	30.5
288.15	32.3	34.7	28.0	29.2
293.15	30.0	32.2	26.9	28.9
298.15	26.6	29.0	22.4	24.4
303.15	21.0	23.3	18.1	20.2
308.15	19.3	21.8	17.9	20.0
313.15	17.1	19.6	14.5	16.6

T/K	Gelatin/Wt % 10 Bunsen Coefficient	Gelatin/Wt % 10 Ostwald Coefficient
283.15	26.2	27.2
288.15	24.1	25.5
293.15	22.6	24.2
298.15	19.3	22.1
303.15	16.0	17.7
308.15	14.7	16.6
313.15	12.9	14.3

The enthalpy of solution of oxygen was calculated from the temperature coefficient of the Bunsen coefficient. It is 2780, 4200, 4160, and 4160 cal mol^{-1} in water, and 1, 5, and 10 wt % gelatin respectively.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The apparatus and procedure of Lannung were modified (1).

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. Source not given. Stated to be 99.98 - 99.99 per cent.

(2) Gelatin. No information.

(3) Water. No information.

ESTIMATED ERROR:

REFERENCES:

1. Lannung, A.
J. Am. Chem. Soc. 1930, *52*, 68.

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

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

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

ORIGINAL MEASUREMENTS:

Zander, R.

Z. Naturforsch., C: Biosci. 1976, *31C*, 339-52.

VARIABLES:

T/K = 310.15
P/kPa = 101.325

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

T/K	1,2,3-Propanetriol g 100 cm^{-3}	Bunsen Coefficient $10^4\alpha/cm^3cm^{-3}$ atm^{-1}	Constant[1] $k=(1/c)\ \ln\ (\alpha/\alpha_0)$
310.15	0	241	
	10	219 ± 4	
	20	197 ± 1	
	30	184 ± 3	
	126	42 ± 5[2]	
			-0.00938

[1] $k/g^{-1}100\ cm^3$

[2] Pure glycerine

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Classical Van Slyke method (1).

The apparatus sample volume and constant gas volume are carefully calibrated. The correction for unextracted gas is made, but the reabsorption correction is not necessary for oxygen.

Equilibration is undertaken in a thermostated tonometer. A 2 cm^3 sample is directly transferred to the Van Slyke apparatus for analysis.

The solubility of oxygen in water value is from the authors analysis of ten literature values (2).

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. Linde Co. Purity 99.9 per cent by volume.

(2) 1,2,3-Propanetriol. No information.

(3) Water. Distilled.

ESTIMATED ERROR:

$\delta T/K = 0.1$
$\delta\alpha/\alpha = 0.01$

REFERENCES:

1. Van Slyke, D. D.; Neill, J. M. *J. Biol. Chem.* 1924, *61*, 523.
2. Zander, R.; Euler, R. *Measurement of Oxygen*, Edited by Degn, H.; Balslev, I.; Brook, R. Elsevier, Amsterdam, 1976, p.271.

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]
(2) 1,2,3-Propanetricarboxylicacid, 2-hydroxy-, (Citric acid); $C_6H_8O_7$; [77-92-9]
(3) Water; H_2O; [7732-18-5]

ORIGINAL MEASUREMENTS:

Popovic, M.; Niebelschutz, H.; Reuss, M.

European. J. Appl. Microbiol. Biotechnol. 1979, *8*, 1-15.

VARIABLES:

Concentration
T/K = 298

PREPARED BY:

C.L. Young

EXPERIMENTAL VALUES:

T/K	Concentration /g dm^{-3}	Oxygen solubility, $S \times 10^3$ /mol dm^{-3}
298.15	25	1.242
	40	1.196
	50	1.183
	75.6	1.148
	100	1.137
	150	1.083
	200	0.983

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Stirred equilibrium cell. Volumetric apparatus in which known volume of gas was added to a known volume of liquid and the equilibrium pressure measured. Details in source and ref. (1).

SOURCE AND PURITY OF MATERIALS:

No details given.

ESTIMATED ERROR:

$\delta T/K = \pm 0.1$; $\delta S = \pm 2\%$
(estimated by compiler).

REFERENCES:

1. Krauss, W.; Gestrich, W. *Chem. Ing. Techn.* 1977, *6*, 35.

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]
(2) Gluconic acid; $C_6H_{12}C_7$; [133-42-6]
(3) Water; H_2O; [7732-18-5]

ORIGINAL MEASUREMENTS:

Popovic, M.; Niebelschutz, H.; Reuss, M.

European. J. Appl. Microbiol. Biotechnol. 1979, *8*, 1-15.

VARIABLES:

T/K = 298
Concentration

PREPARED BY:

C.L. Young

EXPERIMENTAL VALUES:

T/K	Concentration /g dm^3	Oxygen solubility, $S \times 10^3$ /mol dm^{-3}
298.15	10	1.251
	15	1.223
	20	1.213
	25	1.210
	35	1.218
	50	1.192
	100	1.121
	150	1.013
	200	0.991
	300	0.956
	400	0.889
	500	0.802

AUXILIARY INFORMATION

METHOD APPARATUS/PROCEDURE:

Stirred equilibrium cell. Volumetric apparatus in which known volume of gas was added to a known volume of liquid and the equilibrium pressure measured. Details in source and ref. (1).

SOURCE AND PURITY OF MATERIALS:

No details given

ESTIMATED ERROR:

$\delta T/K = \pm 0.1$; $\delta S = \pm 2\%$

(estimated by compiler)

REFERENCES:

1. Krauss, W.; Gestrich, W. *Chem. Ing. Techn.* 1977, *6*, 35.

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) d-Glucose; $C_6H_{12}O_6$; [50-99-7]

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

ORIGINAL MEASUREMENTS:

Müller, C.

Z. Physik. Chem. 1912, *81*, 483-503.

VARIABLES:

T/K = 293 - 295

P/kPa = 101.325

PREPARED BY:

R. Battino

EXPERIMENTAL VALUES:

T/K[a]	Weight Percentage d-Glucose	Ostwald Coeff.[b] 10^2L	Bunsen Coeff.[c] $10^2\alpha$
294.35	10.84	2.856	2.650
294.65	20.7	2.375	2.202
293.05	33.8	1.946	1.814
293.65	51.9	1.481	1.378
294.85	58.84	1.318	1.221

[a] Temperature reported to 0.1°C.

[b] Ostwald coefficient calculated by compiler.

[c] Bunsen coefficient.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Water is degassed by pumping under vacuum. The absorption vessel is about 600 cm^3 and is separately thermostatted from the buret gas measuring system. Both are connected by a copper capillary tube. Gas uptake is measured on gas burets. The absorption flask volume and all liquid volumes were calibrated with mercury. The original paper contains details and a drawing of the apparatus. Solubilities were also reported in aqueous solutions of sucrose, glycerol, and chloral hydrate.

SOURCE AND PURITY OF MATERIALS:

(1) From the heating of $KMnO_4$ and washed in concentrated KOH solution.

(2) d-Glucose - from Merck.

(3) No comment by author.

ESTIMATED ERROR:

$\delta\alpha/\alpha = \pm 0.01$, estimated by compiler.

REFERENCES:

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) D-Glucose, $C_6H_{12}O_6$; [50-99-7]

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

ORIGINAL MEASUREMENTS:

Zander, R.

Z. Naturforsch., C: Biosci. 1976, *31C*, 339-52.

VARIABLES:

$T/K = 310.15$
$P/kPa = 101.325$

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

T/K	Disaccharide g 100 cm^{-3}	Bunsen Coefficient $10^4\alpha/cm^3 cm^{-3}$ atm^{-1}	Constant[1] $k=(1/c) \ln (\alpha/\alpha_0)$
310.15	0	241	
	2	230 $\pm$ 1	
	10	205 $\pm$ 2	
	20	178 $\pm$ 3	
			-0.01562

[1] $k/g^{-1} 100$ cm^3

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Classical Van Slyke method (1).

The apparatus sample volume and constant gas volume are carefully calibrated. The correction for unextracted gas is made, but the reabsorption correction is not necessary for oxygen.

Equilibration is undertaken in a thermostated tonometer. A 2 cm^3 sample is directly transferred to the Van Slyke apparatus for analysis.

The solubility of oxygen in water value is from the authors analysis of ten literature values (2).

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. Linde Co. Purity 99.9 per cent by volume.

(2) D-Glucose. No information

(3) Water. Distilled.

ESTIMATED ERROR:

$\delta T/K = 0.1$
$\delta\alpha/\alpha = 0.01$

REFERENCES:

1. Van Slyke, D. D.; Neill, J. M. *J. Biol. Chem.* 1924, *61*, 523.

2. Zander, R.; Euler, R. *Measurement of Oxygen*, Edited by Degn, H.; Balslev, I.; Brook, R. Elsevier, Amsterdam, 1976, p.271.

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Sucrose; $C_{12}H_{22}O_{11}$; [57-50-1]

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

ORIGINAL MEASUREMENTS:

Müller, C.

Z. Physik. Chem. 1912, *81*, 493-503.

VARIABLES:

T/K = 289-290

P/kPa = 101.325

PREPARED BY:

R. Battino

EXPERIMENTAL VALUES:

T/K[a]	Weight Percentage Sucrose	Ostwald Coeff.[b] 10^2 L	Bunsen Coeff.[c] 10^2 α
289.15	12.1	3.082	2.911
288.75	24.38	2.502	2.367
289.75	28.44	2.241	2.113
288.75	42.96	1.672	1.582
289.35	49.25	1.428	1.348
290.35	50.	1.384	1.302

[a] Temperature reported to 0.1°C.

[b] Ostwald coefficient calculated by compiler.

[c] Bunsen coefficient.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Water is degassed by pumping under vacuum. The absorption vessel is about 600 cm^3 and is separately thermostatted from the buret gas measuring system. Both are connected by a copper capillary tube. Gas uptake is measured on the gas burets. The absorption flask volume and all liquid volumes were calibrated with mercury. The original paper contains details and a drawing of the apparatus. Solubilities were also reported in aqueous solutions of d-glucose, glycerol, and chloral hydrate.

SOURCE AND PURITY OF MATERIALS:

(1) From the heating of $KMnO_4$ and washed in concentrated KOH solution.

(2) Chemically pure from Merck in Darmstadt.

(3) No comment by author

ESTIMATED ERROR:

$\delta\alpha/\alpha = \pm 0.01$, estimated by compiler.

REFERENCES:

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Sucrose; $C_{12}H_{22}O_{11}$; [57-50-1]

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

ORIGINAL MEASUREMENTS:

MacArthur, C. G.

J. Phys. Chem. 1916, *20*, 495-502.

VARIABLES:

$T/K = 298.15$

O_2 $P/kPa = \sim 21.2$ (O_2 in air at one atm)

$c_3/mol\ dm^{-3} = 0 - 2$

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

T/K	Sucrose c_3/mol dm^{-3}	Solution density[1] ρ/g cm^{-3}	Solubility[2] cm^3 (STP) O_2 per dm^3
298.15	0.0	1.000	5.78
	0.125	1.015	5.40
	0.25	1.033	4.82
	0.5	1.068	4.39
	1	1.147	3.20
	2	1.336	1.84

[1] The author calculated the densities from data in the *International Critical Tables*. Use the density values with caution, some of them appear to be in error.

[2] The solubility in water is about 3 per cent smaller than the presently accepted value.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The solutions were thermostated in tall cylinder open to the air. They were shaken by hand several times a day for a period of four days.

A sample of 250 cm^3 was analyzed for oxygen by a modified Winkler method.

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. Air at one atm.

(2) Sucrose. No information.

(3) Water. No information.

ESTIMATED ERROR:

The solubility values may be in 5 to 10 per cent error. The salt concentrations above one mol dm^{-3} may be in error by 10 per cent.

REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Oxygen; O_2; [7782-44-7] (2) Sucrose; $C_{12}H_{22}O_{11}$; (3) Water; H_2O; [7732-18-5]	Hikita, H.; Asai, S.; Azuma, Y. *Can. J. Chem. Eng.* 1978, *56*, 371-4.
VARIABLES:	**PREPARED BY:**
T/K = 288-318 Concentration	R. Battino

EXPERIMENTAL VALUES:

t/°C	T^a/K	Sucrose wt %	Concn. kmol m^{-3}	ρ/kg m^{-3}	10^3C^*/kmol m^{-3}
25	298	0	0	997	1.26^b
25	298	12.0	0.367	1047	1.06
25	298	23.5	0.754	1097	0.883
25	298	33.5	1.12	1144	0.738
25	298	43.0	1.49	1188	0.626
25	298	54.0	1.97	1248	0.480
15	288	54.0	1.98	1253	0.563
35	308	54.0	1.95	1237	0.425
45	318	54.0	1.95	1232	0.381

[a] Calculated by compiler.

[b] For pure water. Corresponds to a mole fraction solubility at 101.325 kPa partial pressure of gas of 2.28×10^{-5}.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:	SOURCE AND PURITY OF MATERIALS:
Used the method of Markham and Kobe (1). A known volume of gas is brought into contact with a known quantity of gas-free solution, the latter attained by boiling under vacuum for about ten hours. Equilibrium is established by agitation and the volume of remaining gas measured.	No details given.
	ESTIMATED ERROR:
	$\delta C^*/C^* = \pm 0.01$, compiler's estimate
	REFERENCES:
	1. Markham, A. E.; Kobe, K. A. *J. Am. Chem. Soc.* 1941, *63*, 449.

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Disaccharides; $C_{12}H_{22}O_{11}$

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

ORIGINAL MEASUREMENTS:

Zander, R.

Z. Naturforsch., C: Biosci. 1976, 339-52.

VARIABLES:

T/K = 310.15
P/kPa = 101.325 (1 atm)

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

T/K	Disaccharide g 100 cm^{-3}	Bunsen Coefficient $10^4\alpha/cm^3cm^{-3}$ atm^{-1}	Constant[1] $k=(1/c)$ ln (α/α_0)
β-D-fructofuranosyl-α-D-glucopyranoside or sucrose; $C_{12}H_{22}O_{11}$; [57-50-1]			
310.15	0	241	
	2	234 ± 1	
	10	215 ± 3	
	20	189 ± 4	
			-0.01195
4-O-α-D-glucopyranosyl-D-glucose or maltose; $C_{12}H_{22}O_{11}$; [69-79-4]			
310.15	0	241	
	20	190 ± 1	
4-O-β-D-galactopyranosyl-D-glucose or lactose; $C_{12}H_{22}O_{11}$; [63-42-3].			
310.15	0	241	
	20	187 ± 3	

[1] $k/g^{-1}100$ cm^3

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Classical Van Slyke method (1).

The apparatus sample volume and constant gas volume are carefully calibrated. The correction for unextracted gas is made, but the reabsorption correction is not necessary for oxygen.

Equilibration is undertaken in a thermostated tonometer. A 2 cm^3 sample is directly transferred to the Van Slyke apparatus for analysis.

The solubility of oxygen in water value is from the authors analysis of ten literature values (2).

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. Linde Co. Purity 99.9 per cent by volume.

(2) Disaccharides. No information.

(3) Water. Distilled.

ESTIMATED ERROR:

$\delta T/K = 0.1$
$\delta\alpha/\alpha = 0.01$

REFERENCES:

1. Van Slyke, D. D.; Neill, J. M. *J. Biol. Chem.* 1924, *61*, 523.

2. Zander, R.; Euler, R. *Measurement of Oxygen*, Edited by Degn, H.; Balslev, I.; Brook, R. Elsevier, Amsterdam, 1976, p. 271.

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Fermentation medium

ORIGINAL MEASUREMENTS:

Liu, M.S.; Branion, R.M.R.; Duncan, D.W.

Biotechnol. Bioeng. 1973, *15*, 213-6.

VARIABLES:

T/K = 308
Concentration

PREPARED BY:

P. Battino

EXPERIMENTAL VALUES:

35°C; 308 K

Concentration	Solubility /mg liter^{-1}
4.5 K[a]	6.92
9 K	6.68
13.5 K	6.66
18 K	7.06

[a] Fermentation medium of Silverman and Lundgren (1) with 4.5 g liter^{-1} ferrous ion.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Saturation solubilities were derived from determining oxygen partial pressures with a polarographic oxygen electrode as a function of time with the electrode being in the stirred medium.

SOURCE AND PURITY OF MATERIALS:

No details given.

ESTIMATED ERROR:

±3% in solubility (estimated by compiler).

REFERENCES:

1. Silverman, M.P.; Lundgren, D.G. *J. Bacteriol.* 1959, *78*, 326.

COMPONENTS: (1) Oxygen; O_2; [7782-44-7] (2) Fermentation medium. (3) Methanol; CH_4O; [67-56-1]	ORIGINAL MEASUREMENTS: Popovic, M.; Niebelschutz, H.; Reuss, M. *European J. Appl. Microbiol. Biotechnol.* 1979, *8*, 1-15.
VARIABLES: T/K = 298 Concentration	PREPARED BY: C.L. Young

EXPERIMENTAL VALUES:

T/K	Concentration of methanol (volume%)	Oxygen solubility, x 10^3 /mol dm^{-3}
298.15	1	1.200
	2	1.175
	3	1.150

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Stirred equilibrium cell. Volumetric apparatus in which known volume of gas was added to a known volume of liquid and the equilibrium pressure measured. Details in source and ref. (1).

SOURCE AND PURITY OF MATERIALS:

(2) Medium contained 6.0 g dm^{-3} $(NH_4)_2SO_4$; 0.94 g dm^{-3} K_2HPO_4; 0.71 g dm^{-3} KH_2PO_4; 0.82 g dm^{-3} $MgSO_4.7H_2O$; 0.08 g dm^{-3} NaCl; 0.06 g dm^{-3} $CaCl_2.\ 2H_2O$: Remainder H_2O.

ESTIMATED ERROR:

$\delta T/K = \pm 0.1$; $\delta S = \pm 2\%$

(estimated by compiler)

REFERENCES:

1. Krauss, W.; Gestrich, W. *Chem. Ing. Techn.* 1977, *6*, 35.

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]
(2) Corn steep liquor.
(3) Water; H_2O; [7732-18-5]

ORIGINAL MEASUREMENTS:

Popovic, M.; Niebelschutz, H.; Reuss, M.

European. J. Appl. Microbiol. Biotechnol. 1979, *8*, 1-15.

VARIABLES:

Concentration
T/K = 298

PREPARED BY:

C.L. Young

EXPERIMENTAL VALUES:

T/K	Concentration /g dm^{-3}	Oxygen solubility, $S \times 10^3$ /mol dm^{-3}
298.15	10	1.205
	50	1.189
	100	1.154

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Stirred equilibrium cell. Volumetric apparatus in which known volume of gas was added to a known volume of liquid and the equilibrium pressure measured. Details in source and ref. (1).

SOURCE AND PURITY OF MATERIALS:

No details given.

ESTIMATED ERROR:

$\delta T/K = \pm 0.1$; $\delta S = \pm 2\%$

(estimated by compiler)

REFERENCES:

1. Krauss, W.; Gestrich, W. *Chem. Ing. Techn.* 1977, *6*, 35.

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]
(2) Yeast extract.
(3) Water; H_2O; [7732-18-5]

ORIGINAL MEASUREMENTS:

Popovic, M.; Niebelschutz, H.; Reuss, M.

European. J. Appl. Microbiol. Biotechnol. 1979, *8*, 1-15.

VARIABLES:

T/K = 298
Concentration

PREPARED BY:

C.L. Young

EXPERIMENTAL VALUES:

T/K	Concentration /g dm^{-3}	Oxygen solubility, $S \times 10^3$ /mol dm^{-3}
298.15	5	1.255
	10	1.228

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Stirred equilibrium cell. Volumetric apparatus in which known volume of gas was added to a known volume of liquid and the equilibrium pressure measured. Details in source and ref. (1).

SOURCE AND PURITY OF MATERIALS:

No details given.

ESTIMATED ERROR:

$\delta T/K = \pm 0.1$; $\delta S = \pm 2\%$

(estimated by compiler)

REFERENCES:

1. Krauss, W.; Gestrich, W. *Chem. Ing. Techn.* 1977 , *6*, 35.

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]
(2) Molasses
(3) Water; H_2O; [7732-18-5]

ORIGINAL MEASUREMENTS:

Popovic, M.; Niebelschutz, H.; Reuss, M.

European. J. Appl. Microbiol, Biotechnol. 1979, *8*, 1-15.

VARIABLES:

Concentration
T/K = 298

PREPARED BY:

C.L. Young

EXPERIMENTAL VALUES:

T/K	Concentration /g dm^{-3}	Oxygen solubility, $S \times 10^3$ /mol dm^{-3}
298.15	5	1.243
	66	1.192
	80	1.752
	106	1.128
	150	1.112
	238	1.019
	278	0.840

AUXILIARY INFORMATION

METHOD APPARATUS/PROCEDURE:

Stirred equilibrium cell. Volumetric apparatus in which known volume of gas was added to a known volume of liquid and the equilibrium pressure measured. Details in source and ref. (1).

SOURCE AND PURITY OF MATERIALS:

No details given.

ESTIMATED ERROR:

$\delta T/K = \pm 0.1$; $\delta S = \pm 2\%$

(estimated by compiler)

REFERENCES:

1. Krauss, W.; Gestrich, W.
Chem. Ing. Techn. 1977, *6*, 35

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Oxygen; O_2; [7782-44-7] (2) Antifoam. (3) Water; H_2O; [7732-18-5]	Popovic, M.; Niebelschutz, H.; Reuss, M. *European, J. Appl. Microbiol. Biotechnol.* 1979, *8*, 1-15.
VARIABLES: Concentration T/K = 296	PREPARED BY: C.L. young

EXPERIMENTAL VALUES:

T/K	Concentration $\times 10^3$ vol/vol	Oxygen solubility, $S \times 10^3$ /mol dm^{-3}
295.75	0.01	1.320
	0.02	1.328
	0.05	1.329
	0.07	1.336
	0.10	1.344
	0.15	1.327
	0.20	1.300
	0.50	1.290
	0.80	1.286
	1.20	1.271
	1.50	1.240

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Stirred equilibrium cell. Volumetric apparatus in which known volume of gas was added to a known volume of liquid and the equilibrium pressure measured. Details in source and ref. (1).

SOURCE AND PURITY OF MATERIALS:

(2) Antifoam was Contraspum 210 supplied by Zoehiemmer and Schwarz, Lahnstein Rhein.

ESTIMATED ERROR:

$\delta T/K = \pm 0.1$; $\delta S = \pm 2\%$

(estimated by compiler)

REFERENCES:

1. Krauss, W.; Gestrich, W.

Chem. Ing. Techn. 1977, *6*, 35

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Xanthan

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

ORIGINAL MEASUREMENTS:

Popovic, M.; Niebelschutz, H.; Reuss, M.

European J. Appl. Microbiol. Biotechnol. 1979, *8*, 1-15.

VARIABLES:

$T/K = 298$
Concentration

PREPARED BY:

C.L. Young

EXPERIMENTAL VALUES:

T/K	Concentration /g dm^{-3}	Oxygen solubility, $S \times 10^3$ /mol dm^{-3}
298.15	1	1.250
	5	1.251

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Stirred equilibrium cell. Volumetric apparatus in which known volume of gas was added to a known volume of liquid and the equilibrium pressure measured. Details in source and ref. (1).

SOURCE AND PURITY OF MATERIALS:

No details given.

ESTIMATED ERROR:

$\delta T/K = \pm 0.1$; $\delta S = \pm 2\%$
(estimated by compiler)

REFERENCES:

1. Krauss, W.; Gestrich, W.

Chem. Ing. Techn. 1977, *6*, 35

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]
(2) Pullulan
(3) Water; H_2O; [7732-18-5]

ORIGINAL MEASUREMENTS:

Popovic. M.; Niebelschutz, H.; Reuss, M.

European. J. Appl. Microbiol. Biotechnol. 1979, *8*, 1-15.

VARIABLES:

Concentration
T/K = 298

PREPARED BY:

C.L. Young

EXPERIMENTAL VALUES:

T/K	Concentration /g dm^{-3}	Oxygen solubility, $S \times 10^3$ /mol dm^{-3}
298.15	1	1.266
	10	1.241
	20	1.240

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Stirred equilibrium cell. Volumetric apparatus in which known volume of gas was added to a known volume of liquid and the equilibrium pressure measured. Details in source and ref. (1).

SOURCE AND PURITY OF MATERIALS:

No details given.

ESTIMATED ERROR:

$\delta T/K = \pm 0.1$; $\delta S = \pm 2\%$

(estimated by compiler)

REFERENCES:

1. Krauss, W.; Gestrich, W. *Chem. Ing. Techn.* 1977, *6*, 35.

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]
(2) Sucrose; $C_{12}H_{22}O_{11}$; [57-50-1)
(3) Ethanol; C_2H_6O; [64-17-5]
(4) Water; H_2O; [7732-18-5]
(5) Various wines

ORIGINAL MEASUREMENTS:

Moditis, I.Z.

Izv. Vyssh. Uchebn. Zaved. Pisch. Tehnolog, 1976, (3), 193-41.

Chem. Abstr. 85; 175431g.

VARIABLES:

T/K = 298

PREPARED BY:

V. Katovic

EXPERIMENTAL VALUES:

	Alcohol %	Sucrose %	Solutility of oxygen[a] Obtained
Water	-	-	8.4
Alcohol solution	10	-	9.0
Alcohol solution	20	-	9.0
Sugar solution	-	5	7.9
	-	10	7.8
Wines			
Port wine	18	10	7.9
Muscatel	16	16	7.1
Madeira	19	4	8.4
"Heres"	20	3	8.3

[a] Solubility of oxygen at 25°C (298 K) in mgO_2 per liter of solution.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The amount of oxygen was determined using a gas chromatograph. Columns packed with silica gel and molecular sieves 13X were used.

SOURCE AND PURITY OF MATERIALS:

No details given.

ESTIMATED ERROR:

Error in solubility ca. ±2% (compiler's estimate).

REFERENCES:

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Sucrose; $C_{12}H_{22}O_{11}$; [57-50-1]

(3) Ethanol; C_2H_6O; [64-17-5]

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

(5) Various wines

ORIGINAL MEASUREMENTS:

Fal'kovich, Yu.E.; Dimenov. A.T.; Moditis, I.Z.; Strukova, V.E.

Izv. Vyssh. Uchebn. Zaved. Pisch. Tekhnolog., 1977, (7), 56-9.

Chem. Abstr.   , *87*, 66545j.

VARIABLES:

T/K = 288-308
Concentration

PREPARED BY:

R. Battino

EXPERIMENTAL VALUES:

Water solution	C_o^a 15°C	25°C	35°C
Ethanol/(%)			
0	10.2	8.4	7.2
10	11.6	9.0	7.8
15	11.4	8.9	7.5
20	11.6	9.0	8.0
40	10.4	10.4	10.0
70	21.0	21.2	21.2
Sucrose g/100 ml			
5	9.7	7.9	7.0
10	9.1	7.8	6.5
15	8.3	7.4	6.2
20	7.3	6.6	5.9
25	6.4	6.0	5.7
30	5.6	5.2	4.9
60	2.2	2.1	2.0

[a] Solubility of oxygen in mgO_2 per 1 liter of solution.

continued on following page

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The solutions were saturated with air for 30 minutes at constant temperature. The dissolved oxygen was determined by gas chromatography.

SOURCE AND PURITY OF MATERIALS:

(1) From air.

(2,3,4) No details given.

ESTIMATED ERROR:

REFERENCES:

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]
(2) Sucrose; $C_{12}H_{22}O_{11}$; [57-50-1]
(3) Ethanol; C_2H_6O; [64-17-5]
(4) Water; H_2O; [7732-18-5]
(5) Various wines

EVALUATOR:

Fal'kovich, Yu.E.; Pinenov, A.T.; Moditis, I.Z., Strukova, V.E.

Izv. Vyssh. Uchebn. Zaved. Pisch. Tekhnolog. 1977, (7), 56-9.

Chem. Abstr. , *87*, 66545j.

EXPERIMENTAL VALUES:

continued

Sucrose g/100 ml	C_o^a at different % of alcohol 0	10	15	20	40	70
0	8.4	9.0	8.9	9.0	10.4	21.2
1	-	9.0	8.9	9.0	10.4	21.2
2	-	8.9	-	8.9	10.2	21.0
3	-	8.7	8.9	8.8	-	-
4	-	8.6	-	8.7	10.0	20.2
5	8.0	-	8.6	8.6	-	-
8	-	8.4	-	8.4	-	-
10	7.8	-	-	8.0	-	-
12	-	8.0	-	7.8	-	-
15	7.4	-	-	-	-	-
16	-	7.6	-	7.1	-	-
18	-	-	6.9	6.9	-	-
20	6.6	6.8	-	-	-	-

[a] Solubility of oxygen in mgO_2 per liter of solution.

	Alcohol %	Sucrose g / 100ml	C_o^a 50°C	25°C
Type of wine:				
dry	10-11	-	12.8	8.9
"madeira" "heres"	16-19	3-4	12.2	8.4
port wine	17-19	7-10	11.7	7.9
dessert	16	16	10.2	6.8
must	-	15	9.4	7.4
must	-	20	8.2	6.5
Cognac:				
3*	40	1.5	10.5	10.2
4*	41	1.5	10.6	10.3
Wine Distillate	68	-	20.3	20.2

[a] Solubility of oxygen in mgO_2 per 1 liter of solution.

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Water solutions of alcohol and sugar

(3) Wines

ORIGINAL MEASUREMENTS:

Moditis, I.Z.; Strukova, V.E.; Fal'kovich, Yu.E.

Vinodel Vinograd. SSSR 1977, (4), 15-8.

Chem. Abstr. 1977, 87; 51587a.

VARIABLES:

T/K = 298
Concentration

PREPARED BY:

V. Katovic

EXPERIMENTAL VALUES:

Sugar/%	S^a
10% (vol) alcohol	
1	9.0
2	8.8
4	8.4
8	8.5
12	8.2
16	7.6
20	7.0
20% (vol) alcohol	
1	9.0
2	8.7
4	8.5
8	8.5
12	7.8
20	6.2

[a] Solubility of oxygen at 25°C (298 K) in mgO_2 per 1 liter of solution.

Wine	alcohol % (vol)	S^a
white table	10	9.0
red table	10	8.9
"Heres"	19	8.4
Madeira	19	8.3
Port wine white	19	8.0
Dessert white	16	8.0
Dessert red	16	7.0
Tokai "AZOS"	16	6.6

[a] Solubility of oxygen at 25°C (298 K) in mgO_2 per 1 liter of wine.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Not given.

SOURCE AND PURITY OF MATERIALS:

(1) From air.

(2,3) No details given.

ESTIMATED ERROR:

REFERENCES:

COMPONENTS: (1) Oxygen; O_2; [7782-44-7] (2) Hydrogen fluoride; HF; [7664-39-3]	ORIGINAL MEASUREMENTS: Rewick, R. T.; Tolberg, W. E.; *J. Chem. Eng. Data* 1970, *15*, 527-30.
VARIABLES: T/K = 273-293	PREPARED BY: C. L. Young

EXPERIMENTAL VALUES:

T/K	Total pressure P/kPa	Partial pressure P/kPa	Conc. of oxygen /mol kg^{-1}	Mole fraction of oxygen, x_{O_2} *
292.95	843.9	741.3	0.160	0.00320
272.94	726.6	678.6	0.153	0.00307

* calculated by compiler

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Static equilibrium cell made of Monel metal. Known amounts of oxygen added to known amount of hydrogen fluoride in cell. Quantity of gas absorbed calculated from equilibrium pressure and cell volume.

SOURCE AND PURITY OF MATERIALS:

(1) High purity sample obtained from General Dynamics Corp.

(2) Anhydrous sample obtained from Olin Corp. Conductivity 3×10^5 ohm^{-1} cm^{-1}.

ESTIMATED ERROR:

$\delta T/K = \pm 0.02$; $\delta x_{O_2} = \pm 2\%$ (estimated by compiler).

REFERENCES:

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Sulfur dioxide; SO_2;

ORIGINAL MEASUREMENTS:

Dornte, R.W.; Ferguson, C.V.

Ind. Eng. Chem. 1939, *31*, 112-3.

VARIABLES:

T/K = 213 - 253

PREPARED BY:

R. Battino

EXPERIMENTAL VALUES:

t/°C	T/K[a]	K[b]
-60	213.2	0.12
-60	213.2	0.59
-50	223.2	1.63
-50	223.2	2.14
-40	233.2	5.2
-40	233.2	4.05[c]
-30	243.2	10.2
-30	243.2	11.0
-20	253.2	25.2
-20	253.2	24.8
-20	253.2	30.1[c]

[a] Calculated by compiler.

[b] Kuenan coefficient, cm^3(STP) of gas dissolved in 1 g of solvent at 101.32 kPa partial pressure of gas.

[c] By the circulation method; all other points by the static method. Authors give $\log_{10} K = 9.710 - 9650/(4.58\ T/K)$ as a smoothing equation good to ±10%.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The apparatus consisted of a gas buret, a differential manometer, and two 10 cm^3 bulbs. The bulbs were in a dewar flask whose temperature was controlled manually by adding dry ice. Measurements could be taken while the gas was circulating or static. Gas uptake was read on the buret. Corrections were applied for the lines being at different temperatures.

SOURCE AND PURITY OF MATERIALS:

No details given.

ESTIMATED ERROR:

$\delta K/K = \pm 0.1$

$\delta T/K = \pm 0.5$

REFERENCES:

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Nitrogen oxide or dinitrogen tetraoxide; N_2O_4; [10544-72-6]

ORIGINAL MEASUREMENTS:

Chang, E. T.; Gokcen, N. A.

J. Phys. Chem. 1966, *70*, 2394-9.

VARIABLES:

$T/K = 262.02 - 303.16$
$P/kPa = 26.780 - 201.383$

PREPARED BY:

P. L. Long
H. L. Clever

EXPERIMENTAL VALUES:

The authors discuss the system further (1, 2), but present no additional solubility data.

The authors point out that their method of purification (double distillation) is not capable of removing trace amounts of N_2O_3 in the N_2O_4.

In the presence of trace amounts of N_2O_3 the reaction $\frac{1}{2}O_2(g) + N_2O_3 = N_2O_4$ takes place in the liquid N_2O_4. As a result the gas appears to obey Sievert's law, $K = x_O/P^{\frac{1}{2}}$, at low pressures of oxygen.

If oxygen is first bubbled through the N_2O_4, then the trace amounts of N_2O_3 are oxidized to N_2O_4, and the expected Henry's law behavior is observed at all pressures.

continued on following page

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The apparatus was of all glass construction. It consisted of three calibrated bulbs for the measurement of the gas, a container for the solvent, which was stirred by a glass enclosed magnet, and a manometer for measuring the pressure with a microslide cathetometer. The solvent container had a capacity for 100 g of solvent with a 5 cm^3 gas space above the liquid surface. The apparatus sections volumes were calibrated to $\pm 0.0002 - 3$ cm^3.

The solvent was degassed under vacuum in the previously weighed apparatus. The apparatus and the degassed liquid were weighed. The gas was introduced into the apparatus at a known P and T, the liquid stirred, and the pressure observed until there was no further change. Equilibrium was established within 10 m, and the pressure was followed for 40 m.

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. Source not given.

(2) Nitrogen oxide. Source not given. Research grade, 99.5 per cent min. purity. Doubly distilled, then bubbled with O_2 to remove last traces of N_2O_3. Density,

$$\rho/g\ cm^{-3} = 1.4916 - 0.00226\ t/{}^0C$$

ESTIMATED ERROR:

$\delta T/K = \pm 0.03$
$\delta P/mmHg = \pm 0.01$
$\delta x_1/x_1 = \pm 0.05$

REFERENCES:

1. Chang, E. T.; Gokcen, N. A.; Poston, T. M. *J. Spacecr. Rockets* 1969, *6*, 1177.

2. Gokcen, N. A.; Chang, E. T. *J. Chem. Ed.* 1977, *54*, 368.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Oxygen; O_2; [7782-44-7] (2) Nitrogen oxide or dinitrogen-tetraoxide; N_2O_4; [10544-72-6]	Chang, E. T.; Gokcen, N. A. *J. Phys. Chem.* 1966, *70*, 2394-9.

EXPERIMENTAL MEASUREMENTS: continued

T/K	P/atm	Henry's Constant $K \times 10^4$	Mol Fraction $x_1 \times 10^4$	Bunsen Coefficient α	Ostwald Coefficient L
262.02	0.6041	8.84	5.34		
	1.2017	8.80	10.58		
	1.3091	8.76	11.47		
	1.6119	8.83	14.23		
	1.9876	8.75	17.40		
	1.0		8.80	0.325	0.312
273.15	0.2643	9.19	2.43		
	0.6275	9.21	5.78		
	1.1241	9.16	10.30		
	1.7950	9.12	16.37		
	1.0		9.17	0.333	0.333
298.15	0.3728	10.09	3.76		
	0.4989	10.34	5.16		
	0.5745	10.39	5.97		
	0.9963	10.12	10.08		
	1.0809	9.90	10.70		
	1.0		10.16	0.355	0.388
303.16	0.4441	10.65	4.73		
	0.9189	10.31	9.47		
	1.0	10	10.48	0.364	0.404

The solubility values at 1.0 atm oxygen pressure were calculated by the compiler from the average Henry's constant.

The author's define the Henry's constant, $K/\text{atm}^{-1} = x_1/P_1$.

The mole fraction solubility at 1 atm oxygen pressure is numerically equal to the Henry's constant.

Smoothed Data: $\ln x_1 = -\ 5.7652 - 3.3415/(T/100\ K)$

T/K	Mol Fraction $x_1 \times 10^4$
258.15	8.59
263.15	8.80
268.15	9.01
273.15	9.22
278.15	9.43
283.15	9.63
288.15	9.83
293.15	10.03
298.15	10.22
303.15	10.41
308.15	10.60

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Nitrogen; N_2; [7727-37-9]

(3) Carbon dioxide; CO_2;
[124-38-9]

ORIGINAL MEASUREMENTS:

Zenner, G. H.; Dana, L. I.

Chem. Eng. Prog. Symp. Ser.
1963, 59, No. 44, 36-41.

VARIABLES:

$T/K = 218\text{-}273$
$P/MPa = 7\text{-}13$
Composition

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	$P/10^5 Pa$	Mole fractions in liquid			Mole fractions in gas		
		x_{O_2}	x_{N_2}	x_{CO_2}	y_{O_2}	y_{N_2}	y_{CO_2}
273.15	106.9	0.030	0.159	0.811	0.057	0.344	0.599
		0.0706	0.1224	0.8070	0.139	0.262	0.599
		0.1085	0.0888	0.8027	0.211	0.188	0.601
		0.1525	0.0515	0.7960	0.295	0.109	0.596
		0.286	0.1534	0.8180	0.0542	0.3353	0.6105
		0.557	0.1333	0.8110	0.1095	0.2865	0.6039
		0.1096	0.0801	0.8103	0.2217	0.1793	0.599
		0.1356	0.0669	0.7975	0.264	0.140	0.596
		0.1766	0.0308	0.7926	0.3383	0.0684	0.5933
232.85	124.4	0.0643	0.1770	0.7587	0.1806	0.5610	0.2584
		0.166	0.1100	0.724	0.4196	0.3190	0.2614
		0.2572	0.0523	0.6905	0.6017	0.1416	0.2567
		0.210	0.084	0.706	0.503	0.234	0.263
		0.1475	0.1215	0.731	0.3805	0.3575	0.2620
		0.1327	0.1307	0.7366	0.3396	0.4092	0.2512
		0.058	0.180	0.762	0.159	0.583	0.258
		0.024	0.206	0.770	0.071	0.671	0.258
		0.124	0.143	0.733	0.321	0.420	0.259
232.85	68.95	0.0913	0.0321	0.8766	0.5092	0.2414	0.2494
		0.0662	0.0506	0.8832	0.3858	0.3676	0.2466
		0.0477	0.0665	0.8858	0.277	0.473	0.250
		0.0349	0.0740	0.8911	0.2128	0.5407	0.2465

continued on following page

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Static bomb. Pressure measured with dead weight tester. Temperature measured with resistance thermometer. Samples of liquid and gas analysed by removing carbon dioxide from sample with potassium hydroxide solution. Oxygen was then removed with "ammoniacal copper" solution and remainder assumed to be nitrogen only.

SOURCE AND PURITY OF MATERIALS:

(1) and (2) No details given.

(3) Purified - no other details given.

ESTIMATED ERROR:

$\delta T/K = \pm 0.2$; $\delta P/MPa = \pm 0.05$;
δx_{O_2}, δx_{N_2}, δx_{CO_2}, δy_{O_2}, δy_{N_2}, δy_{CO_2}
$= \pm 0.002$ (estimated by compiler).

REFERENCES:

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Nitrogen; N_2; [7727-37-9]

(3) Carbon dioxide; CO_2;
[124-38-9]

ORIGINAL MEASUREMENTS:

Zenner, G. H.; Dana, L. I.

Chem. Eng. Prog. Symp. Ser. 1963, 59, No. 44, 36-41.

EXPERIMENTAL VALUES:

T/K	$P/10^5$Pa	Mole fractions in liquid			Mole fractions in gas		
		x_{O_2}	x_{N_2}	x_{CO_2}	y_{O_2}	y_{N_2}	y_{CO_2}
232.85	68.95	0.0686	0.0503	0.8811	0.396	0.354	0.250
		0.0516	0.0628	0.8856	0.292	0.454	0.254
		0.0610	0.0564	0.8826	0.3472	0.3936	0.2592
		0.0658	0.0540	0.8802	0.3746	0.3820	0.2434
		0.0787	0.0470	0.8743	0.4436	0.3093	0.2471
232.85	51.7	0.0620	0.0231	0.9149	0.4943	0.2299	0.2758
		0.0482	0.0336	0.9182	0.382	0.338	0.280
		0.0557	0.0277	0.9166	0.4479	0.2789	0.2732
		0.0376	0.0441	0.9183	0.2934	0.4256	0.2810
		0.0315	0.0435	0.9250	0.2463	0.4717	0.2820
		0.0269	0.0491	0.9240	0.2137	0.5035	0.2828
		0.0564	0.0300	0.9136	0.4363	0.2893	0.2744
		0.0604	0.0242	0.9154	0.4837	0.2373	0.2790
		0.0445	0.0325	0.9230	0.3714	0.3492	0.2794
		0.0565	0.0273	0.9162	0.4504	0.2731	0.2765
		0.0357	0.0427	0.9216	0.2880	0.4297	0.2823
		0.0404	0.0370	0.9226	0.3246	0.3978	0.2776
218.15	131.0	0.0507	0.1885	0.7608	0.1448	0.6560	0.1992
		0.158	0.121	0.721	0.422	0.388	0.190
		0.0874	0.1656	0.7470	0.2522	0.5620	0.1858
		0.1410	0.1365	0.7225	0.3875	0.4240	0.1885
		0.1797	0.1161	0.7042	0.455	0.348	0.197
		0.238	0.081	0.681	0.602	0.217	0.181
		0.314	0.042	0.644	0.681	0.107	0.212
		0.2182	0.0922	0.6896	0.5325	0.2682	0.1993
218.15	103.5	0.087	0.109	0.804	0.327	0.514	0.159
		0.125	0.084	0.791	0.455	0.388	0.157
		0.148	0.065	0.787	0.555	0.287	0.158
		0.0660	0.1217	0.8123	0.2427	0.600	0.1573
		0.100	0.098	0.802	0.473	0.369	0.158
		0.116	0.089	0.795	0.432	0.412	0.156
		0.136	0.076	0.788	0.499	0.3395	0.1615
218.15	68.95	0.0936	0.0347	0.8717	0.5681	0.2822	0.1497
		0.078	0.046	0.876	0.481	0.367	0.152
		0.062	0.058	0.880	0.385	0.462	0.153
		0.0610	0.0580	0.8810	0.3742	0.4677	0.1581
		0.0508	0.0646	0.8846	0.3142	0.5293	0.1565
		0.041	0.073	0.886	0.250	0.598	0.152
		0.029	0.079	0.892	0.166	0.673	0.161
		0.0219	0.0849	0.8932	0.1387	0.7051	0.1562
		0.0133	0.0912	0.8955	0.0858	0.7596	0.1546
		0.129	0.013	0.858	0.760	0.084	0.156

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Mineral oil, white

ORIGINAL MEASUREMENTS:

Kubie, L. S.

J. Biol. Chem. 1927, *72*, 545-8.

VARIABLES:

T/K = 297. 5
P/kPa = 101.325 (1 atm)

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

T/K	Bunsen Coefficient $\alpha/\mathrm{cm^3\ (STP)\ cm^{-3}\ atm^{-1}}$
297. 5	0.134 ± 0.004

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The apparatus was the constant volume Van Slyke and Neill type (1).

Saturation was attained by bubbling the gas through the oil for several hours.

A 1.990 ± 0.007 cm^3 volume of saturated solution was analyzed. The Van Slyke correction factor for unextracted and redissolved gas was 1.02.

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. Commercial cylinder.

(2) Mineral oil."Amalie" brand, L. Sonneborn Sons, Inc., NY. A medicinal white oil which meets US Pharmacopeia standards. Specific gravity 0.890 - 0.895 at 15 °C , viscosity 285 at 100 °F. Prepared by fractional distillation from a naphthene base, unsaturated hydrocarbons removed.

ESTIMATED ERROR:

$\delta T/K = 1$

REFERENCES:

1. Van Slyke, D. D.; Neill, J. M. *J. Biol. Chem.* 1924, *56*, 523.

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Oils.

ORIGINAL MEASUREMENTS:

Baldwin, R. R.; Daniel, S. G.;

J. Appl. Chem., 1952, *2* (Apr.), 161-5.

J. Inst. Petrol., London, 1953, *39*, 105-24.

VARIABLES:

T/K = 273.15 - 373.15

O_2 P/kPa = 101.325

PREPARED BY:

P. L. Long
H. L. Clever

EXPERIMENTAL VALUES:

T/K	Bunsen Coefficient α	Ostwald Coefficient L
Oil A1, viscosity 615 centistokes at 100°F, mean mol wt 670.		
293.15	0.124	0.133
Oil A2, viscosity 268 centistokes at 100°F, mean mol wt 610.		
273.15	0.135	0.135
293.15	0.126	0.135
333.15	0.119	0.145
373.15	0.118	0.161
Oil A3, viscosity 181 centistokes at 100°F, mean mol wt 570.		
293.15	0.129	0.139
Oil A4, viscosity 80.3 centistokes at 100°F, mean mol wt 530.		
293.15	0.137^1	0.147
Oil A5, viscosity 34.9 centistokes at 100°F, mean mol wt 400.		
273.15	0.150	0.150
293.15	0.1445	0.155
333.15	0.135	0.164
373.15	0.130	0.178
Oil B1, viscosity 260 centistokes at 100°F, mean mol wt 630.		
293.15	0.120	0.129

METHOD/APPARATUS/PROCEDURE:

The method consists of two operations: Saturation of the liquid with the gas under consideration; and determination of the amount of dissolved gas in the liquid saturated with the gas. All gases were passed through a liquid air trap to remove water and CO_2 vapors before passage through the liquid. All gases were passed through a long coil, thermostated, before the saturation process.

Oil or similar liquid is deaerated by passing it through a continuously evacuated vessel. Gas is then passed through the liquid to saturation. Liquid is then degassed, and transferred to a storage burette, disconnected from the degassing apparatus, thermostated, and saturated with the desired gas. Burette is now connected to another degassing apparatus, portions of the oil degassed and gas collected.

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. From commercial cylinders, and gas analysis on a Bone and Wheeler apparatus shows it to be at least 99.5% pure; no source given.

(2) Oils. The oils conform to DTD-472B specifications. Composition and physical properties of the oils are given in the appendix of the 1953 paper. The molecular weights were determined by freezing point depression in naphthalene to within ±5 percent.

REFERENCES:

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Four oils

ORIGINAL MEASUREMENTS:

Rodnight, R.

Biochem. J. 1954, 57, 661-3.

VARIABLES:

T/K = 311

PREPARED BY:

R. Battino

EXPERIMENTAL VALUES:

Oil	38°C (311K) α^a/cm^3(STP)cm^{-3} atm^{-1}	L^b
liquid paraffin[c]	0.098 (5)[d]	0.112
olive oil[e]	0.102 (6)[d]	0.116
silicone fluid[f]	0.251	0.286
	0.250	0.285
	0.210	0.239
silicone fluid[e]	0.304	0.346
	0.297	0.338

[a] Bunsen coefficient.

[b] Ostwald coefficient calculated by compiler.

[c] Specific gravity of 0.835.

[d] Number of duplicate determinations in parentheses.

[e] Characterized as B.P. (1948).

[f] Viscosity of 5cS.

[e] Viscosity of 1cS.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Oxygen was introduced into a chamber containing degassed oil. The rate of absorption was monitored on a manometer. Then a fresh charge of degassed oil was added and the pressure monitored again. From knowledge of the oil volumes and the change of pressure in both cases the Bunsen coefficient could be calculated. Details and a drawing are given in the paper.

SOURCE AND PURITY OF MATERIALS:

No details given.

ESTIMATED ERROR:

$\delta\alpha/\alpha = \pm 0.03$, compiler's estimate.

REFERENCES:

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Paraffin Oil and a 50:50 mixture of 1-decanol and 1-dodecanol

ORIGINAL MEASUREMENTS:

Luther, H.; Hiemenz, W.

Chem. Ingr.-Tech. 1957, *29*, 530-5.

VARIABLES:

T/K - 293

PREPARED BY:

R. Battino

EXPERIMENTAL VALUES:

t/°C	T^a/K	$10^4 x_1{}^b$	H^c
	Paraffin Oil		
20	293	27.8	364
	Alcohol Mixture[d]		
20	293	10.4	962

[a] Calculated by compiler.

[b] Mole fraction solubility at 101.325 kPa partial pressure of gas.

[c] Henry's law constant; P_1/atm = x_1 (H/atm).

[d] 50 mol % 1-decanol + 50 mol % 1-dodecanol.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Solubilities determined in an apparatus described in the paper by a combined pressure and volume measurement.

SOURCE AND PURITY OF MATERIALS:

(1) No details given.

(2) Paraffin oil - density of 0.8795g cm^{-3} and molecular weight of 405g mol^{-1}.

(2) Alcohol mixture is 50 mol % 1-decanol + 50 mol % 1-dodecanol.

ESTIMATED ERROR:

$\delta H/H = \pm 0.05$, compiler's estimate.

REFERENCES:

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Paraffin Oil.

ORIGINAL MEASUREMENTS:

Luther, H.; Rottger, H.

Elektrotech. Z. 1957, *A78*, 462-4.

VARIABLES:

T/K = 318

P/kPa = 27-103

PREPARED BY:

R. Battino

EXPERIMENTAL VALUES:

t/°C	T^a/K	P/mm Hg	$S/cm^3 g^{-1}$
45	318	200	0.038
45	318	400	0.079
45	318	600	0.117
45	318	770	0.151

[a] Calculated by compiler.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Solubilities determined by an apparatus described in the paper by a combined volume and pressure measurement.

SOURCE AND PURITY OF MATERIALS:

(1) No details given.

(2) Molecular weight of 357 g mol^{-1}, d_{20} = 0.8420 g cm^{-3}, n_D^{20} = 1.4597.

ESTIMATED ERROR:

$\delta S/S = \pm 0.05$, estimate by compiler.

REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Oxygen; O_2; [7782-44-7] (2) Polydimethylsiloxane oil	Cannon, P.; St. Pierre, L.E.; Miller, A.A. *J. Chem. Eng. Data* 1960, 5, 236.
VARIABLES:	PREPARED BY:
T/K = 303 P/kPa = 446 - 2169	R. Battino

EXPERIMENTAL VALUES:

t/°C	T/K^a	P/atm	P/kPa^a	$10^4 S^b$
30	303	4.40	446	7.7
		7.80	790	12.8
		12.02	1218	20.5
		16.31	1653	27.7
		21.41	2169	38.5

[a] Calculated by compiler.

[b] Solubility in g gas/g oil.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

A sample of about 10 g is placed in a sintered alumina bucket in an automatic gravimetric sorption balance. At different gas pressures the weight of dissolved gas is measured.

SOURCE AND PURITY OF MATERIALS:

(1) "Tank grade."

(2) 26,000 centistoke.

ESTIMATED ERROR:

$\delta S/S = \pm 0.02$, compliler's estimate

REFERENCES:

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Hydrocarbon fuels and oil

ORIGINAL MEASUREMENTS:

Logvinyuk, V. P.; Makarenkov, V. V.; Malyshev, V. V.; Panchenkov, G. M.

Khim. Tekhnol. Topl. Masel 1970, *15*, (No. 5), 27-9.
Chem. Technol. Fuels Oils (Eng. trans) 1970, *15*, 353-5.

VARIABLES:

T/K = 253.15 - 365.15
O_2 P/kPa = 101.325

PREPARED BY:

S. A. Johnson
H. L. Clever

EXPERIMENTAL VALUES:

T/K	Bunsen Coefficient α	Ostwald Coefficient L
Hydrocarbon fuel, T-1, density ρ_4^{20} = 0.816		
253.15	0.258	0.239
273.15	0.228	0.228
293.15	0.205	0.220
323.15	0.182	0.215
Hydrocarbon fuel, TS-1, density ρ_4^{20} = 0.775		
293.15	0.220	0.236
Hydrocarbon fuel, T-6, density ρ_4^{20} = 0.84		
253.15	0.198	0.184
273.15	0.190	0.190
293.15	0.198	0.212
323.15	0.190	0.225
365.15	0.152	0.203
Hydrogenated fuel, density ρ_4^{20} = 0.832		
293.15	0.198	0.212
Oil, MK-8, density ρ_4^{20} = 0.855		
293.15	0.152	0.163

The compiler calculated the Ostwald coefficients.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The apparatus and procedure were described in reference (1) which was not available to the compiler.

Mashinostroenie, see *Izv. Vyssh. Uchebn. Zaved., Mashinostr.*

SOURCE AND PURITY OF MATERIALS:

No information given.

ESTIMATED ERROR:

$\delta\alpha/\alpha = 0.06$ (authors)

REFERENCES:

1. Gogitidize, L. D.; Logvinyuk, V. P.; Makarenkov, V.V.; Panchenkov, G.M.; Malyshev, V.V.; Yakovlevskii, V.V. *Method of Evaluating the Operating Properties of Jet Fuels and Lubricating Materials (Russ.)*, *Mashinostroenie* 1966.

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Wax ester oils

ORIGINAL MEASUREMENTS:

Ke, P. J.; Ackman, R. G.

J. Am. Oil Chemists' Soc. 1973
80, 429-35.

VARIABLES:

T/K = 293.15 - 353.15
P/kPa = partial pressure of oxygen in air at 101.325 kPa

PREPARED BY:

P. L. Long
H. L. Clever

EXPERIMENTAL VALUES:

Temperature t/°C	T/K	Density ρ/g cm^{-3}	Bunsen Coefficient[1] α	Parts per Million[2] $\mu g\ g^{-1}$	cm^3 (STP) O_2 100 cm^{-3} of oil[2]
Sperm whale oil					
20	293.15	0.8775	0.109	37.0	2.27
40	313.15	0.8639	0.125	43.1	2.60
60	323.15	0.8514	0.117	40.9	2.46
80	353.15	0.8378	0.070	24.9	1.45
Barracudina oil					
20	293.15	0.8933	0.092	30.4	1.91
40	313.15	0.8812	0.095	32.1	1.98
60	323.15	0.8679	0.080	27.5	1.67
80	353.15	0.8553	0.058	20.2	1.21

[1] The Bunsen coefficients are for an oxygen partial pressure of 101.325 kPa (1 atm or 760 mmHg).

[2] The parts per million and the volume O_2 (STP) per 100 cm^3 oil are for the partial pressure of oxygen in air (ca. 0.21 atm or 160 mmHg).

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Polarographic exponential dilution method (1).

The oil was degassed by the method of Battino et al. (2).

A 155-159 cm^3 sample of degassed oil was transferred to a glass vessel and weighed. The vessel was so constructed that the ratio $V_{\text{top air space}}/V_{\text{oil}}$ was between 0.0704 and 0.0981. A magnetic stirring bar (120 rpm) and a polarographic oxygen sensor were placed in the sample. Air was bubbled through the sample at 15 $cm^3\ m^{-1}$ for two hours. The air was stopped, and helium gas preheated to the sample temperature was introduced into the oil at a rate of 7-10 $cm^3\ m^{-1}$. The oxygen concentration was measured as a function of the volume of helium passed through the solution. A plot of log (O_2) *vs.* V_{helium} is linear. The slope is a function of the Ostwald coefficient. The Ostwald coefficient was converted to Bunsen coefficient.

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. Breathing grade compressed air.

(2) Sperm whale oil. Oil from sperm whale (Physeter catodon) blubber obtained from local commercial reduction plant in Nova Scotia. Barracundina oil. Oil from whole barracudina (Paralepis rissoi Krøyeri) was produced in pilot scale reduction plant at the Vancouver Lab of The Fisheries Research Board of Canada.

All oils were kept under nitrogen in cold storage at 3°C except when the experiment was in progress.

ESTIMATED ERROR:

Solubility values are the average of three determinations with relative standard deviation of 7% or less.

REFERENCES:

1. Aho, L.; Wahlroos, O. *J. Am. Oil Chem. Soc.* 1967, *44*, 65.
2. Battino, R.; Banzhof, M.; Bogan, M.; Wilhelm, E. *Anal. Chem.* 1971, *45*, 806.

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Petroleum

ORIGINAL MEASUREMENTS:

Gniewosz, S.; Walfisz, A.

Z. Phys. Chem. 1887, *1*, 70-2.

VARIABLES:

T/K = 283.15, 293.15

Pressure = "Atmospheric"

PREPARED BY:

M. E. Derrick

H. L. Clever

EXPERIMENTAL VALUES:

T/K	Bunsen Coefficient α	Ostwald Coefficient L
283.15	0.229	0.237
293.15	0.202	0.217

The Ostwald coefficients were calculated by the compiler.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The apparatus consisted of an absorption flask connected to a gas buret by a flexible lead capillary. The system was thermostated in a large water bath.

The volume of oxygen absorbed in a known volume of degassed petroleum was directly measured using the gas buret.

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. No information.

(2) Petroleum. Russian petroleum. Cleaned by boiling in a large copper flask.

ESTIMATED ERROR:

$\delta\alpha/\alpha = 0.05$ (compiler)

REFERENCES:

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Hydrocarbon fuels

ORIGINAL MEASUREMENTS:

Baldwin, R. R.; Daniel, S. G.

J. Appl. Chem. 1952, *2*, 161-5.

J. Inst. Petrol., London, 1953, *39*, 105-24.

VARIABLES:

T/K = 273.15 - 293.15

O_2 P/kPa = 101.325

PREPARED BY:

P. L. Long
H. L. Clever

EXPERIMENTAL VALUES:

T/K	Bunsen Coefficient α	Ostwald Coefficient L
100 octane fuel D		
293.15	0.344	0.369
Kerosene		
273.15	0.220	0.220
293.15	0.212	0.228

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

1. Degassing. The liquid was deaerated by passage through a continuousty evacuated vessel. The liquid was saturated with gas, then degassed again.

2. Saturation of liquid with gas. The gas was passed through a liquid air trap to remove water and carbon dioxide, then through a long coil thermostated at the temperature of the solubility measurement, and then bubbled through the liquid up to five hours.

3. Determination of the amount of gas liberated under vacuum from a known volume of the saturated liquid. The saturated liquid is placed in a vessel attached to a calibrated buret. The whole apparatus was initially evacuated. The gas released from the liquid was transferred to the calibrated buret by a Topler pump. Five operations and transfers recover all but a trace of the gas. The last trace (2 - 5 %) removed by boiling the liquid.

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. Commercial cylinder, sou source not given. 99.5 per cent pure by gas analysis on Bone and Wheeler apparatus.

(2) 100 Octane Fuel. Molecular weight estimated to be 100.
Kerosene. Mean molecular weight measured, obtained 165.

ESTIMATED ERROR:

$\delta P/P = 0.01$
$\delta\alpha/\alpha = 0.01$

REFERENCES:

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Liquid paraffin

ORIGINAL MEASUREMENTS:

Ruppel, D.

Can. J. Chem. 1971, *44*, 3762-4.

VARIABLES:

$T/K = 304 - 363$

$P/kPa = 39 - 111$

PREPARED BY:

R. Battino

EXPERIMENTAL VALUES:

P/Torr	P^a/kPa	β^b/cm^3(STP) cm^{-3} atm^{-1}	$10^{-5}K_H^c$
	35°C	(308.2 K)	
290	38.7	0.052	2.76
397	52.9	0.068	2.90
506	67.5	0.091	2.75
631	84.1	0.112	2.80
760	101.3	0.135	2.80
834	111.2	0.150	2.76

t/°C	T^a/K	β^b/cm^3(STP) cm^{-3} atm^{-1}	$10^{-5}K_H^c$
31	304.2	0.139	2.73
35	308.2	0.137	2.75
44	317.2	0.134	2.80
57	330.2	0.135	2.74
69	342.2	0.133	2.78
79	352.2	0.133	2.76
90	363.2	0.131	2.78

[a] Calculated by compiler.

[b] Bunsen coefficient.

[c] Henry's constant in Torr per mole fraction.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Method based on that in reference (1). The liquid was equilibrated with the gas; then transferred to a gas stripping cell; and then the extracted gas was analyzed by gas chromatography. The oxygen was determined on a 2 m molecular sieve type 5A of 40-60 mesh at 50°C.

SOURCE AND PURITY OF MATERIALS:

(1) No details given.

(2) LP, Anachemia AC7014. Average molecular weight of 390, viscosity and density, respectively, at 20°C of 126 cs and 0.871 g cm^{-3}. Refractive index of 1.4748 at 21.4°C.

ESTIMATED ERROR:

$\delta\beta/\beta = \pm 0.03$, compiler's estimate.

$\delta T/K = \pm 0.1$

REFERENCES:

1. Gubbins, K.E.; Carden, S.N.; Walker, R.D. *J. Gas Chromatogr.* 1965, *3*, 98.

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Paraffin wax

ORIGINAL MEASUREMENTS:

Ridenour, W. P.; Weatherford, W. D.; Capell, R. G.

Ind. Eng. Chem. 1954, *46*, 2376-81.

VARIABLES:

T/K = 345.35
P/kPa = 31.70 - 107.79

PREPARED BY:

A. L. Cramer
H. L. Clever

EXPERIMENTAL VALUES:

T/K	Pressure/ mmHg	Mol Fraction $X_1 \times 10^3$	Bunsen Coefficient α	Solubility Coefficient cm^3 O_2 (STP) g^{-1} wax
245.35	237.8	1.00	0.156	0.064
	402.9	1.70	0.158	0.109
	602.5	2.58	0.161	0.165
	808.5	3.47	0.161	0.222
	760.0	(3.28)	0.161	0.21

The mole fraction solubility at 760 mmHg was calculated by the compiler.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The apparatus was similar to the equilibrium adsorption apparatus described by Brunauer, Emmett, and Teller (1) for the measurement of the surface area of a solid catalyst.

A weighed amount of wax was placed in the apparatus. The gas and solvent were equilibrated for 20 to 60 minutes. The gas volume in the buret system was calculated from the ideal gas law.

The results of the absorption measurements were checked by a desorption measurement. The two measurements agreed very well.

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. Prepared from $KMnO_4$. Contained 97.8% O_2, 1.1% N_2, and 0.1% CO_2.

(2) Paraffin wax. Described as 122°F English melting point wax. Molecular weight 350, actual melt point 123.2°F (323.8 K), density 0.7716 g cm^{-3} at 293.3 K and 0.7662 g cm^{-3} at 298.0 K.

ESTIMATED ERROR:

$\delta T/K$ = 2.
$\delta P/mmHg$ = 0.2
$\delta \alpha/cm^3$ = 0.004 (low pressure)
-0.001 (high pres.)

REFERENCES:

1. Brunaur, S.; Emmett, P. H.; Teller, E. *J. Am. Chem. Soc.* 1938, *60*, 309.

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Petrowax A

ORIGINAL MEASUREMENTS:

Pidenour, W. P.; Weatherford, W. D.; Capell, R.G.

Ind. Eng. Chem. 1954, *46*, 2376-81.

VARIABLES:

T/K = 354.75
P/kPa = 38.60 - 104.92

PREPARED BY:

A. L. Cramer
H. L. Clever

EXPERIMENTAL VALUES:

T/K	Pressure/ mmHg	Mol Fraction $X_1 \times 10^3$	Bunsen Coefficient α	Solubility Coefficient cm^3 O_2 (STP) g^{-1} wax
354.75	289.5	1.27	0.081	0.038
	361.9	1.67	0.084	0.050
	480.0	2.37	0.090	0.071
	583.5	3.18	0.099	0.095
	787.0	4.43	0.103	0.133

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The apparatus was similar to the equilibrium adsorption apparatus described by Brunauer, Emmett, and Teller (1) for the measurement of the surface area of a solid catalyst.

A weighed amount of wax was placed in the apparatus. The gas and solvent were equilibrated for 20 to 60 minutes. The gas volume in the buret system was calculated from the ideal gas law.

The results of the absorption measurements were checked by a desorption measurement. The two measurements agreed very well.

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. Prepared from $KMnO_4$. Contained 97.8% O_2, 1.1% N_2, and 0.1% CO_2.

(2) Petrowax A. Molecular weight 750, melting point 159.6°F (352.8 K) density 0.8039 g cm^{-3} at 355.6 K and 0.7949 g cm^{-3} at 370.2 K.

ESTIMATED ERROR:

$\delta T/K$ = 2.
$\delta P/mmHg$ = 0.2
$\delta\alpha/cm^3$ = 0.004 (low pressure)
- 0.001 (high pres.)

REFERENCES:

1. Brunaur, S.; Emmett, P. H.; Teller, E. *J. Am. Chem. Soc.* 1938, *60*, 309.

COMPONENTS: (1) Oxygen; O_2; [7782-44-7] (2) Amsco 123-5	ORIGINAL MEASUREMENTS: Steinberg, M.; Manowitz, B. *Ind. Eng. Chem.* 1959, *51*, 47 - 51.
VARIABLES: T/K = 297.15 P/kPa = 101.325	PREPARED BY: H. L. Clever

EXPERIMENTAL VALUES:

T/K	Absorption Coefficient β
297.15	0.159

The authors define the Absorption coefficient as the volume of gas, corrected to 288.15 K and 101.325 kPa, absorbed under a total system pressure of 101.325 kPa per unit volume (at 288.15 K) of solvent.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Van Slyke Method.

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. Matheson Co.

(2) Amsco 123-5. American Mineral Spirits Co. No. 140. Paraffin 59.6 wt %, naphthene 27.3 wt %, and aromatics 13.2 wt %.

ESTIMATED ERROR:

$\delta\beta/\beta$ = 0.05 - 0.10 (authors)

REFERENCES:

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) L-1822, which is a mixture of mostly 10-carbon fluorocarbons, including cyclic, open chain, and branched molecules.

ORIGINAL MEASUREMENTS:

Sargent, J. W.; Seffl, R. J.

Fed. Proc. 1970, *29*, 1699 - 1703.

VARIABLES:

T/K = 298 - 310
Total P/kPa = 101.325

PREPARED BY:

A. L. Cramer
H. L. Clever

EXPERIMENTAL VALUES:

Temperature		Oxygen Solubility	
t/°C	T/K	g O_2 1000 g^{-1}	cm^3 O_2 100 cm^{-3}
25	298.15	0.285	41.5
37	310.15	0.271	40.7

The authors solubility, cm^3 O_2 100 cm^{-3}, appears to be the Ostwald coefficient times 100.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The equilibrium apparatus is a 50 cm^3 three neck flask equipped with a water condenser, a thermometer, and a gas dispersing tube extending below the fluid surface level. Between 25 and 35 cm^3 of solvent are placed in the flask. Gas is bubbled through the solvent for 2 - 3 h. An 80 microliter sample is slowly taken into a gas tight syringe. The sample is injected into a gas chromatograph. The results of three sampling and analyses are averaged.

The chromatograph is an F and M Model 720 equipped with a thermal conductivity detector at 320 °C, and a 6' by ¼" stainless steel column packed with 13X molecular sieve at room temperature. The apparatus is calibrated with pure gas samples.

Details of the procedure were furnished by R. D. Danielson of the 3 M Co.

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. Source not given. Commercial cylinder.

(2) L-1822. Minnesota Mining and Manufacturing Co. All H in an organic compound are replaced by F by Simons electrochemical process (1).

ESTIMATED ERROR:

$\delta T/K = 0.1$
$\delta c/c = 0.01$ (reproducibility)
$= 0.05$ (absolute)

REFERENCES:

1. Simons, J. H., Editor
Fluorine Chemistry
Academic Press, New York, 1950.

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Surfactants (see below)

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

ORIGINAL MEASUREMENTS:

Kousaka, K.; Kise, H.; Seno, M.

Yukagaku 1980, *29*, 177-80.

VARIABLES:

T/K = 298

Concentration

PREPARED BY:

R. Battino

EXPERIMENTAL VALUES:

25°C (298K)

Surfactant[a]	Relative concentration $(S/S_0)'$[b] of oxygen in surfactant at indicated concentration				
	0.2M[c]	0.4M	0.6M	0.8M	1.0M
Sodium acetate	0.871	0.798	0.787	0.747	0.716
Sodium propionate	0.897	0.860	0.797	0.765	0.708
Sodium butyrate	0.881	0.846	0.834	0.780	0.730
Sodium pentanoate	0.887	0.846	0.838	0.784	0.735
Sodium hexanoate	0.900	0.860	0.840	0.793	0.735
Sodium octanoate	0.916	0.936	0.983	0.990	-

[a] Sodium acetate;
Sodium propionate;
Sodium butyrate;
Sodium pentanoate;
Sodium hexanoate;
Sodium oxtanoate;

[b] Relative solubilities. S is in the solution and S_0 is in the pure solvent. Solubilities are on a weight basis.

[c] Concentrations are in units of mol dm^{-3}, i.e., molarity.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Solubilities determined by a gas chromatographic method which yielded ratios of solubilities in the aqueous surfactant solutions to that in pure water.

SOURCE AND PURITY OF MATERIALS:

No details given.

ESTIMATED ERROR:

$\delta(S/S_0)'/(S/S_0)' = \pm 0.03$, compiler's estimate

REFERENCES:

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Various solvents (see table below.)

ORIGINAL MEASUREMENTS:

Sinn, E.; Mattes, K.; Naumann, E.

Wiss. Z. Friedrich-Schiller-Univ.
Jena, Math.-Naturwiss. Reihe
1967, *16*, 523-9.

VARIABLES:

T/K = 293

PREPARED BY:

R. Battino

EXPERIMENTAL VALUES:

Solvent	L^a	ℓ^b
20°C (293 K)		
n-pentane; C_5H_{12}; [109-66-0]	0.507	0.212
n-hexane; C_6H_{14}; [110-54-3]	0.495	0.386
n-heptane; C_7H_{16}; [142-82-5]	0.390	0.346
n-octane; C_8H_{18}; [111-65-9]	0.348	0.320
n-nonane; C_9H_{20}; [111-84-2]	0.331	0.307
dichloromethane; CH_2Cl_2; [3474-12-2]	0.257	0.130
trichloromethane; $CHCl_3$; [67-66-3]	0.278	0.204
tetrachloromethane; CCl_4; [56-23-5]	0.331	0.271
1,2-dichloroethane; $C_2H_4Cl_2$; [1300-21-6]	0.178	0.153
trichloroethylene; C_2HCl_3; [79-01-6]	0.292	0.252
tetrachloroethylene; C_2Cl_4; [127-18-4]	0.264	0.241
1,1,2-trifluoro-1,2,2-trichloroethane; $C_2Cl_3F_3$; [76-13-1]	0.602	0.359
methanol; CH_4O; [67-56-1]	0.231	0.188
ethanol; C_2H_6O; [64-17-5]	0.195	0.171

continued on following page

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The various solvents were saturated with oxygen and the amount of dissolved oxygen was determined electrochemically using a Clark electrode. Details and drawings are given in the original paper.

SOURCE AND PURITY OF MATERIALS:

No details given.

ESTIMATED ERROR:

$\delta L/L = \pm 0.05$, compiler's estimate.

REFERENCES:

COMPONENTS:	EVALUATOR:
(1) Oxygen; O_2; [7782-44-7] (2) Various solvents (see table below.)	Sinn, E.; Matthes, K.; Naumann, E. *Wiss. Z. Friedrich-Schiller-Univ. Jena, Math.-Naturwiss. Reihe* 1967, *16*, 523-9.

CRITICAL EVALUATION: continued

Solvent	L^a	ℓ^b
1-propanol; C_3H_8O; [540-67-0]	0.206	0.188
1-butanol; $C_4H_{10}O$; [71-36-3]	0.199	0.185
1-pentanol; $C_5H_{12}O$; [71-41-0]	0.203	0.189
1-heptanol; $C_7H_{16}O$; [111-70-6]	0.185	0.172
1-octanol; $C_8H_{18}O$; [111-87-5]	0.183	0.170
1-nonanol; $C_9H_{20}O$; [143-08-8]	0.173	0.161
1-decanol; $C_{10}H_{22}O$; [112-30-1]	0.161	0.150
ethylene glycol; $C_2H_6O_2$; [107-21-1]	0.031	0.029
2,4,6-trimethoxy-1,3,5-trioxane(paraldehyde); $C_{12}H_{12}O_3$; [123-63-7]	0.206	0.190
acetone; C_3H_6O; [67-64-1]	0.313	0.221
methylethyl ketone; C_4H_8O; [78-93-3]	0.314	0.263
diethyl ketone; $C_5H_{10}O$; [96-22-0]	0.293	0.268
methylpropyl ketone; $C_5H_{10}O$; [107-87-9]	0.290	0.266
formic acid (85%); CH_2O_2; [64-18-6]	0.062	0.055
acetic acid; $C_2H_4O_2$; [64-19-7]	0.195	0.179
propionic acid; $C_3H_6O_2$; [79-09-4]	0.277	0.257
n-propylamine; C_3H_9N; [107-10-8]	0.242	0.159
n-butylamine; $C_4H_{11}N$; [109-73-9]	0.272	0.216
methyl formate; $C_2H_4O_2$; [107-31-3]	0.303	0.106
ethyl formate; $C_3H_6O_2$; [109-94-4]	0.355	0.247
n-octyl formate; $C_9H_{18}O_2$; [112-32-3]	0.240	0.223
methyl acetate; $C_3H_6O_2$; [79-20-9]	0.276	0.200
ethyl acetate; $C_4H_8O_2$; [141-78-6]	0.314	0.265
n-propyl acetate; $C_5H_{10}O_2$; [109-60-4]	0.318	0.286
n-butyl acetate; $C_6H_{12}O_2$; [123-86-4]	0.302	0.277
diethyl ether; $C_4H_{10}O$; [60-29-7]	0.485	0.191
ethane,1,1-oxybis[2-ethoxy]-(diethylene glycol diethyl ether); $C_8H_{18}O_3$; [112-36-7]	0.205	0.191
butane,1,1'-[oxybis(2,1-ethanediyloxy)bis-(diethylene glycol di-n-butyl ether)]; $C_{12}H_{26}O_3$; [112-73-2]	0.204	0.190
1,4-dioxane; $C_4H_8O_2$; [123-91-1]	0.172	0.155
dibenzyl ether; $C_{14}H_{14}O$; [103-50-4]	0.086	0.080
benzene; C_6H_6; [71-43-2]	0.249	0.209
toluene; C_7H_8; [108-88-3]	0.221	0.195
p-xylene; C_8H_{10}; [106-42-3]	0.258	0.235
ethyl benzene; C_8H_{10}; [100-41-4]	0.219	0.199
chlorobenzene; C_6H_5Cl; [108-90-7]	0.214	0.197
bromobenzene; C_6H_5Br; [108-86-1]	0.143	0.132
iodobenzene; C_6H_5I; [591-50-4]	0.110	0.103

continued on following page

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Various solvents (see table below.

EVALUATOR:

Sinn, E.; Matthes, K.; Naumann, E.

Wiss. Z. Friedrich-Schiller-Univ. Jena, Math.-Naturwiss. Reihe 1967, *16*, 523-9.

CRITICAL EVALUATION:

continued

Solvent	L^a	ℓ^b
nitrobenzene; $C_6H_5NO_2$; [98-95-3]	0.113	0.106
aniline; C_6H_7N; [62-53-3]	0.070	0.065

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[a] Ostwald coefficient. All measurements at 20°C (293K).

[b] Solubility coefficient defined as $\ell = L \, \frac{273}{T/K} \, \frac{760 - P/\text{mm Hg}}{760}$.
The term P/mm Hg is the saturation vapor pressure of the solvent at 293K. Vapor pressures are given in the original paper as well as temperature dependent data as graphs for tetrachloromethane, methanol, methylpropyl ketone, and water.

OXYGEN SOLUBILITIES ABOVE 200 kPa (2 BAR)

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

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

ORIGINAL MEASUREMENTS:

Zoss, L. M.

Ph.D. thesis, 1952
Purdue University

VARIABLES: T/K= 273.15 - 604.8

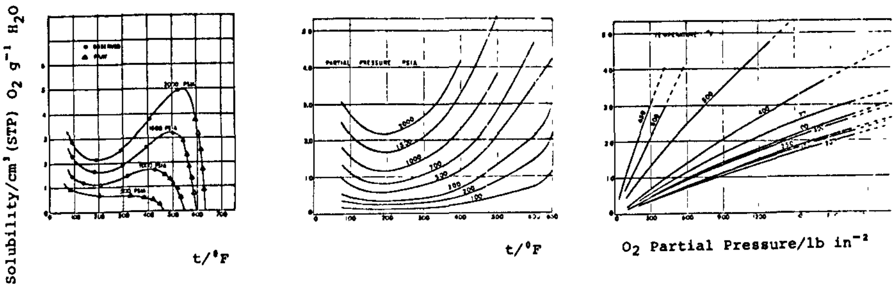
Total P/kPa= 3450 - 13,790

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

Later work by O. G. McKee, Jr, Ph. D. thesis, 1953, Purdue University shows that the 273.15 K (32 F) solubility values of Zoss are more than an order of magnitude to high. The solubility values at the higher temperatures appear to be reliable.



The figure above was constructed by Zoss, Suciu, and Sibbitt (1, 2).

The solubility values are from their own work, and from Pray, H. A.; Schweichert, C. E.; Minnich, B. H. Battelle Memorial Institute Report BMI-T-25, May 1950; *Ind. Eng. Chem.* 1952, *44*, 1146 - 1151.

continued on following page

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The apparatus (1, 2) consists of a high pressure vessel with integral vapor and liquid sample chambers, heaters, temperature controls, auxillary pumps, and analytical equipment.

The sequence of operations was: (a) the pressure vessel was evacuated, (b) charged with a known volume of water (about 175 cm^{-3}), (c) brought to a selected temperature level, (d) charged with gas (under conditiors of constant total pressure, constant temperature, and continual agitation) until phase equilibrium was reached, (e) fastened is a vertical position until the vapor and liquid phases separated.

The vapor and liquid phase sample chambers were isolated. The vapor was analysed through a drying train and wet test meter. The liquid phase was analysed at room temperature and pressure in a buret system.

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. Commercial source. Stated to be 99.9^+ per cent pure.

(2) Water. Distilled water, boiled three hours and cooled. Tested for pH and for oxygen content (polarography).

ESTIMATED ERROR:

$\delta t/^0F = 0.5$
$\delta P/lb\ in = 3$
$\delta S/S = 0.03$

REFERENCES:

1. Zoss, L. M.; Suciu, S.; Sibbitt, W. L. *Trans. ASME* 1954, *76*, 69 - 71.
2. Zoss, L.M.;Suciu, S.;Sibbitt,W.L. Paper No. 53-S30, American Society of Mechanical Engineers Meeting, Columbus, OH, Apr 1953.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Oxygen; O_2; [7782-44-7] (2) Water; H_2O; [7732-18-5]	Zoss, L. M. Ph.D. Thesis, 1952 Purdue University

EXPERIMENTAL VALUES: continued

Temperature		Pressure		Vapor Composition	
					mol Fraction
t/°F	T/K	p/lb in^{-2}	S/cm^3 (STP) g^{-1}	c_{H_2O}/mol dm^{-3}	x_{H_2O}
32	273.15	500	2.90		
		(34.0 atm,	1.29		
		3450 kPa)	2.55		
80	299.8		0.95[1]		
200	366.5		0.72[1]		
328	437.6		0.65[1]		
382	467.6		0.57[1]		
417	487.0		0.50[1]		
445	502.6		0.30[1]		
32	273.15	1000	11.43		
		(68.0 atm,	6.85		
		6895 kPa)	2.92		
93	307.0		1.49	0.0145	0.137
138	332.0		1.21		
181	355.9			0.0139	0.133
202	367.6		1.13		
206	369.8				0.203
313	429.3			0.139	0.594
316	430.9		1.46		
421	489.3			0.687	0.882
422	489.8		1.70		
467	514.8		1.50[1]		
486	525.4		1.30[1]		
503	534.8		1.15[1]		
518	543.15		0.94[1]		
532	550.9		0.54[1]		
32	273.15	1500	57.7		
		(102.1 atm,	50.8		
90	305.4	10,340 kPa)	2.30	0.0556	0.273
184	357.6		1.68		
189	360.4			0.0440	0.248
292	417.6			0.117	0.427
295	419.3		1.90		
390	472.0			0.323	0.731
392	473.15		2.62		
503	534.8		3.20	1.037	0.917
545	558.15		2.90[1]		
556	564.3		2.30[1]		
567	570.4		1.85[1]		
577	575.9		1.32[1]		
587	581.5		0.73[1]		
32	273.15	2000	134.		
		(136.1 atm,	111.		
		13,790 kPa)	108.		
88	304.3		2.89	0.0367	0.155
185	358.15			0.0166	0.090
187	359.3		2.19		
285	413.7			0.0980	0.338
287	414.8		2.54		
406	480.9		3.82		
413	484.8			0.550	0.719
523	545.9		4.96		
526	547.6			1.830	0.910
596	586.5		3.75[1]		
605	591.5		3.20[1]		
613	595.9		2.50[1]		
621	600.4		1.70[1]		
629	604.8		0.90[1]		

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

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

ORIGINAL MEASUREMENTS:

Pray, H. A.; Schweichert, C. E.; Minnich, B. H.

Ind. Eng. Chem. 1952, *44*, 1147-51.

VARIABLES:

$T/K = 436\text{-}617$
$P/\text{bar} = 7\text{-}28$

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	P/bar	10^3 Mole fraction of oxygen in water, x_{O_2}
435.9	6.89	0.11
	13.8	0.22
	20.7	0.33
477.6	6.89	0.13
	10.3	0.20
533.1	6.89	0.46
	13.8	0.65
	20.7	0.96
	27.6	1.22
588.7	6.89	0.45
	13.8	1.01
	20.7	1.56
616.5	7.17	0.87
	12.1	1.32
	14.1	1.63
	19.3	2.11
	19.9	1.83
	21.3	2.13

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Rocking equilibrium cell of 3 l capacity. Pressure measured with dead weight gauge and temperature measured using chromel-alumel thermocouple. Cell contents equilibrated and liquid sample removed. The amount of dissolved gas estimated volumetrically.

SOURCE AND PURITY OF MATERIALS:

No details given.

ESTIMATED ERROR:

$\delta T/K = \pm 1$; $\delta P/\text{bar} = \pm 1$;

$\delta x_{O_2} \simeq 1\text{-}5\%$ (estimated by compiler).

REFERENCES:

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

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

ORIGINAL MEASUREMENTS:

Pray, H.A.; Stephan, E.F.

U. S. Atomic Energy Commission 1953, *BMI-840.*

VARIABLES:

T/K = 373 - 436

P/MPa = 1.34 - 9.93

PREPARED BY:

R. Battino

EXPERIMENTAL VALUES:

P_{O_2}/psia	P_{O_2}/MPa	S^b	$10^4x_1{}^{a,c}$
212°F (373K)			
332	2.29	0.380	3.06
355	2.45	0.435	3.50
374	2.58	0.465	3.74
453	3.12	0.550	4.42
489	3.37	0.570	4.59
500	3.45	0.650	5.23
526	3.63	0.665	5.35
671	4.63	0.870	7.00
808	5.57	0.995	8.00
887	6.11	1.130	9.09
933	6.43	1.180	9.49
1292	8.91	1.600	12.87
1335	9.20	1.600	12.87
1410	9.72	1.820	14.64

P_{O_2}/psia	$P^a_{O_2}$/MPa	S^b	$10^4x_1{}^{a,c}$
275°F (408K)			
510	3.52	0.655	5.04
525	3.62	0.645	4.97
555	3.83	0.685	5.28
590	4.07	0.73	5.62
1090	7.51	1.42	10.94
1145	7.89	1.45	11.17
1173	8.09	1.51	11.63
1180	8.13	1.60	12.32
1195	8.24	1.60	12.32
1215	8.38	1.55	11.94
325°F (436K)			
195	1.34	0.303	2.44
195	1.34	0.306	2.46
195	1.34	0.314	2.53
530	3.65	0.830	6.68
560	3.86	0.880	7.08
600	4.14	0.905	7.28
950	6.55	1.41	11.34
950	6.55	1.42	11.42
960	6.62	1.51	12.15

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AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

A sample of saturated solution is withdrawn from a stainless steel pressurized and thermostatted autoclave and analyzed for the dissolved gas content. Details and a drawing are given in the paper.

SOURCE AND PURITY OF MATERIALS:

No details given.

ESTIMATED ERROR:

$\delta S/S = \pm 0.03$, compiler's estimate.

REFERENCES:

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

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

ORIGINAL MEASUREMENTS:

Pray, H.A.; Stephan, E.F.

U. S. Atomic Energy Commission 1953, BMI-840.

continued

P_{O_2}/psia	$P_{O_2}^{a}$/MPa	S^{b}	$10^4x_1^{a,c}$
1410	9.72	2.12	17.06
1440	9.93	2.28	18.34

[a] Calculated by compiler.

[b] Solubility in units of ml O_2(STP)/g of water.

[c] Mole fraction solubility at partial pressure of oxygen indicated. Henry's constants are: 373K, 6897(±240)MPa/mole fraction; 408K, 6995 (±232)MPa/mole fraction; 436K, 5537(±158)MPa/mole fraction (all calculated by compiler).

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

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

ORIGINAL MEASUREMENTS:

McKee, O. L. Jr.

Ph.D. thesis, 1953
Purdue University

VARIABLES:

T/K= 273.15
Total P/kPa= 3450 - 20,680

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

Temperature t/°F	T/K	Total Pressure P/lb in^{-2}	Oxygen Solubility S/cm^3(STP) g^{-1}
32	273.15	500	1.38
			1.48
			1.56
			1.60
		1000	2.74
			2.80
		1500	3.93
			3.92
		2000	5.01
			4.93
		3000	6.34
			6.39

The author calculated the maximum error to range from 3.5 per cent at a solubility of 1.5 to 1.5 per cent for a solubility of 6.3.

The work was carried out in the Department of Mechanical Engineering under the direction of W. L. Sibbitt.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The apparatus of Zoss (1) with modifications to improve the temperature control at 32 °F, and to improve the sampling of the liquid phase sample.

Total Pressure:

P/lb in^{-2}	P/atm	P/kPa
500	34.0	3450
1000	68.0	6895
1500	102.1	10340
2000	136.1	13790
3000	204.1	20680

SOURCE AND PURITY OF MATERIALS:

(1) Oxygen. No information given.

(2) Water. Distilled water, boiled for three hours before use.

ESTIMATED ERROR:

See comment under table above.

REFERENCES:

1. Zoss, L. M.
Ph. D. thesis, 1952
Purdue University

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

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

ORIGINAL MEASUREMENTS:

Stephan, E. L.; Hatfield, N. S.; Peoples, R. S.; Pray, H. A. H.

Battelle Memorial Institute Report BMI-1067, 1956.

VARIABLES:

T/K = 373-561
P/bar = 14-200

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	$P^{\dagger}$/bar	Mole fraction of oxygen in liquid, x_{O_2}	T/K	$P^{\dagger}$/bar	Mole fraction of oxygen in liquid, x_{O_2}
373.15	19.7	0.000301	408.15	14.1	0.000233
	22.9	0.000306		14.8	0.000265
	24.5	0.000350		35.2	0.000527
	25.8	0.000374		36.2	0.000519
	31.2	0.000442		38.3	0.000551
	33.7	0.000458		40.0	0.000587
	34.5	0.000523		75.2	0.00114
	36.3	0.000535		77.6	0.00125
	36.9	0.000547		78.9	0.00116
	46.3	0.000699		80.9	0.00121
	55.7	0.000800		81.4	0.00129
	61.2	0.000908		100.6	0.00157
	64.3	0.000948		103.0	0.00161
	89.1	0.00129		105.1	0.00161
	92.0	0.00129		120.2	0.00176
	97.6	0.00130		122.3	0.00178
	117.6	0.00167		123.7	0.00178
	121.7	0.00165		133.0	0.00189
	147.2	0.00197		138.2	0.00197
	149.3	0.00199		144.4	0.00201
	156.9	0.00200		145.1	0.00204
	161.0	0.00201		147.1	0.00213
	192.0	0.00221		148.5	0.00205
	201.7	0.00231			

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AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Gas and liquid equilibrated for 18 hours. Pressure measured with Bourdon gauge and temperature measured with thermocouple. Composition of liquid estimated by volumetric method. Details in source. Partial pressure estimated by subtracting vapor pressure from total pressure.

SOURCE AND PURITY OF MATERIALS:

No details given.

ESTIMATED ERROR:

$\delta T/K = \pm 0.6$; $\delta P/\text{bar} = \pm 0.3$;

$\delta x_{O_2} = \pm 0.00002$ (estimated by compiler)

REFERENCES:

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

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

ORIGINAL MEASUREMENTS:

Stephan, E. L.; Hatfield, N. S.; Peoples, R. S.; Pray, H. A. H.

Battelle Memorial Institute Report *BMI-1067*, 1956.

EXPERIMENTAL VALUES: continued

T/K	$p^\dagger$/bar	Mole fraction of oxygen in liquid, x_{O_2}	T/K	$p^\dagger$/bar	Mole fraction of oxygen in liquid, x_{O_2}
408.15	152.0	0.00213	477.59	58.8	0.00135
	155.4	0.00217		80.9	0.00193
	158.2	0.00218		85.7	0.00216
	162.0	0.00225		128.1	0.00319
	172.6	0.00233		133.3	0.00336
	193.3	0.00246		138.8	0.00341
	196.8	0.00250		158.1	0.00353
	199.6	0.00255		167.7	0.00399
435.93	13.4	0.000244		176.0	0.00413
	13.4	0.000246		187.6	0.00424
	13.4	0.000252	533.15	37.9	0.00159
	36.5	0.000667		39.9	0.00169
	38.6	0.000707		39.9	0.00165
	41.4	0.000727		41.3	0.00165
	65.5	0.00113		42.7	0.00165
	65.5	0.00114		58.5	0.00252
	66.2	0.00121		60.6	0.00263
	97.2	0.00170		70.3	0.00319
	99.3	0.00183		74.4	0.00317
	132.7	0.00233		77.2	0.00329
	138.2	0.00230		77.8	0.00329
	156.1	0.00250		79.9	0.00325
	163.0	0.00263		88.0	0.00369
	171.3	0.00270		92.3	0.00390
	179.5	0.00271		128.2	0.00536
	192.0	0.00294		132.3	0.00578
	198.8	0.00293		136.4	0.00568
477.59	17.4	0.000490		137.8	0.00584
	18.8	0.000498	560.93	31.4	0.00181
	19.5	0.000514		33.4	0.00195
	35.4	0.000892		63.1	0.00385
	36.7	0.000924		66.5	0.00395
	37.4	0.000988		98.9	0.00612
	56.7	0.00133		100.3	0.00619
	58.1	0.00129			

$p^\dagger$ - partial pressure of oxygen

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

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

ORIGINAL MEASUREMENTS:

Broden, A.; Simonson, R.

Svensk Papperstidning 1978, *81*, 541-4.
Chem. Abstr. 1979, *90*, 1427084.

VARIABLES:

T/K = 323-423

P/MPa = 1-5

PREPARED BY:

R. Battino

EXPERIMENTAL VALUES:

Data at the right in Figure 3 from the original paper. The following equation fits the data with a standard deviation of ±0.45 mmol dm^{-3}. The solubility, $[O_2]$, is expressed as mmol dm^{-3} where the solvent volume is at the pressure and temperature of the measurement.

$$[O_2] = 5.351 - 1.252 \times 10^{-2}(T/K) - 79.54(P/MPa) + 2.135 \times 10^{-4}(P/MPa)(T/K)^2 + 2.125 \times 10^{4}(P/MPa)/(T/K)$$

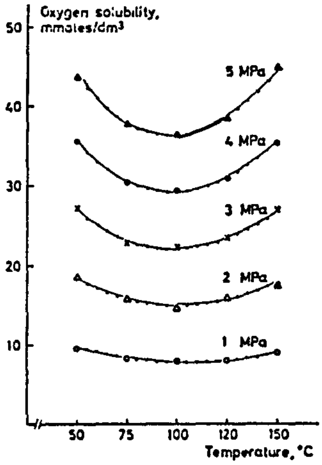


Fig. 3. Oxygen solubility at different pressure levels versus temperature. The dotted lines included are those corresponding to eq. [1].

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

An autoclave was filled with 2 dm^3 of water. Bubbling oxygen through it served to degas the water and saturate it at the same. At equilibrium, 0.426 cm^3 samples were analyzed for oxygen via a gas chromatograph.

SOURCE AND PURITY OF MATERIALS:

No details given.

ESTIMATED ERROR:

$\delta P = \pm 0.005$ Ma
$\delta T/K = \pm 0.3$
$\delta[O_2]/[O_2] = \pm 0.01$, compiler's estimate

REFERENCES:

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Chlorine; Cl_2; [7782-50-5]

ORIGINAL MEASUREMENTS:

Krieve, W.F.; Mason, D.M.

J. Phys. Chem. 1956, *60*, 374.

VARIABLES:

T/K = 298

P/kPa = 529 - 1215

PREPARED BY:

R. Battino; C.L. Young

EXPERIMENTAL VALUES:

t/°C	T/K	Mol %	10^2x_1	P_{O_2}/atm	P_{O_2}/kPa
25	298	0.785	0.785	5.22	529
25	298	0.936	0.936	6.67	676
25	298	1.31	1.31	9.13	925
25	298	1.49	1.49	10.53	1067
25	298	1.65	1.65	11.99	1215

T/K, x_1, and P_{O_2}/kPa calculated by compiler. x_1 is the mole fraction solubility at the given partial pressure of gas. The data conforms to Raoult's Law with an average deviation of 3.3%.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Measurements were carried out using 175 cm^3 stainless steel bombs and calibrated stainless steel bourdon tube gages. A known weight of gas from one bomb is admitted to another containing a known amount of liquid. After equilibrium is established the pressure in the second bomb is determined and the solubility calculated from the pressure and weight measurements.

SOURCE AND PURITY OF MATERIALS:

(1) Matheson Co., Inc.

(2) Commercial chlorine purified by fractional distillation to remove air and carbon dioxide.

ESTIMATED ERROR:

$\delta P/P = \pm 0.005$ (authors).

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

$\delta T = \pm 0.1$ K

REFERENCES:

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Nitrous oxide; N_2O;
[10024-97-3]

ORIGINAL MEASUREMENTS:

Zeininger, H.

Chemie-Ing.-Tech. 1972, *44*, 607-12.

VARIABLES:

T/K = 213-293

P/MPa = 0.6-8.2

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	$P/10^5$Pa	Mole fraction of oxygen in liquid, x_{O_2}	Mole fraction of oxygen in gas, y_{O_2}
213.15	6.1	0.004	0.196
	8.9	0.009	0.444
	14.7	0.031	0.648
	21.5	0.048	0.779
	31.7	0.086	0.835
	35.6	0.081	0.861
	42.0	0.123	0.871
	47.3	0.143	0.873
	50.7	0.169	0.879
	59.0	0.194	0.886
	70.4	0.251	0.898
	83.7	0.410	0.883
	87.3	0.526	0.879
	91.3	0.589	0.920
233.15	16.9	0.016	0.371
	22.9	0.036	0.514
	38.2	0.057	0.665
	44.6	0.068	0.689
	49.9	0.125	0.751
	50.8	0.157	0.743
233.15	53.3	0.139	0.756
	58.1	0.110	0.744
	65.5	0.168	0.764
	71.1	0.197	0.805
	72.1	0.205	0.771
	82.9	0.267	0.830
	89.9	0.678	0.787
253.15	21.7	0.012	0.166
	27.2	0.023	0.306
	31.6	0.039	0.393
	34.2	0.032	0.432
	37.7	0.057	0.478
	45.3	0.086	0.527
	47.9	0.081	0.536
	56.9	0.116	0.588
	60.7	0.126	0.607
	64.8	0.146	0.625
	74.4	0.265	0.663
	82.3	0.418	0.666

(cont.)

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Static equilibrium cell stirred with a steel ball. Samples of gas and liquid phases removed and analysed by mass spectrometry. Care was taken to avoid large changes in pressure during sampling by taking small samples. Details in source.

SOURCE AND PURITY OF MATERIALS:

Nitrous oxide was "pure" as determined by gas chromatography.

ESTIMATED ERROR:

$\delta T/K = \pm 0.3$; $\delta P/10^5 Pa = \pm 0.2$;
$\delta x_{O_2} = \pm 0.01$; $\delta y_{O_2} = \pm 0.012$
(errors in composition greater near critical region).

REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Oxygen; O_2; [7782-44-7] (2) Nitrous oxide; N_2O; [10024-97-3]	Zeininger, H. *Chem. -Ing.-Tech.* 1972, *44*, 607-12.

EXPERIMENTAL VALUES:

T/K	$P/10^5$Pa	Mole fraction of oxygen in liquid, x_{O_2}	Mole fraction of oxygen in gas, y_{O_2}	T/K	$P/10^5$Pa	Mole fraction of oxygen in liquid, x_{O_2}	Mole fraction of oxygen in gas, y_{O_2}
273.15	35.5	0.006	0.060	273.15	70.1	-	0.441
	41.0	0.017	-		70.4	0.13	-
	44.6	-	0.225		79.0	-	0.450
	47.1	0.023	0.201		79.6	0.205	0.477
	49.1	0.045	-		81.1	0.203	0.450
	54.7	0.052	0.370	293.15	67.1	0.10	0.155
	59.0	0.091	0.390		71.1	0.059	0.177
	59.3	0.079	0.408		78.0	0.092	0.20
	65.4	0.095	-				

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Carbon dioxide; CO_2; [124-38-9]

ORIGINAL MEASUREMENTS:

Zenner, G. H.; Dana, L. I.

Chem. Eng. Prog. Symp. Ser. 1963, 59, No. 44, 36-41.

VARIABLES:

T/K =234-273
P/MPa = 6-15

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	P/MPa	Mole fraction of oxygen in liquid, x_{O_2}	Mole fraction of oxygen in vapor, y_{O_2}	T/K	P/MPa	Mole fraction of oxygen in liquid, x_{O_2}	Mole fraction of oxygen in vapor, y_{O_2}
273.15	6.03	0.0801	0.302	232.85	14.87	-	0.544
	6.10	0.063	0.302		14.30	0.497	0.617
	6.02	0.0603	0.298		5.92	0.113	0.774
	5.32	0.0432	0.254		7.28	-	0.770
	6.97	0.0843	0.353		4.92	-	0.749
	8.49	0.1293	0.407		3.79	-	0.716
	9.42	0.160	0.4205		2.66	-	0.553
	10.41	0.1985	0.422		3.85	-	0.671
	11.11	0.237	0.399	218.15	2.19	0.033	0.704
232.85	13.87	0.402	0.763		3.94	0.072	0.812
	12.39	0.331	-		5.91	0.119	0.847
	12.53	0.340	0.720		7.88	0.174	0.853
	11.15	0.276	0.753		9.72	0.234	0.851
	9.46	0.217	0.768		11.82	0.312	0.822
	7.77	0.1645	0.770		13.01	0.382	0.789
	13.49	0.403	0.707		14.02	0.468	0.736
	14.77	0.531	-				

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Static bomb. Pressure measured with dead weight tester. Temperature measured with resistance thermometer. Samples of liquid and gas analysed by removing carbon dioxide from sample with potassium hydroxide solution. Oxygen determined volumetrically.

SOURCE AND PURITY OF MATERIALS:

(1) No details given.

(2) Purified - no other details given.

ESTIMATED ERROR:

$\delta T/K = \pm 0.2$; $\delta P/MPa = \pm 0.05$;

δx_{O_2}, δy_{O_2} = ±0.002 (estimated by compiler).

REFERENCES:

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Carbon dioxide; CO_2; [124-38-9]

ORIGINAL MEASUREMENTS:

Kaminishi, G.; Toriumi, T.

Kogyo Kagaku Zaashi 1966, *69*, 175-8.

VARIABLES:

T/K = 233-298

P/MPa = 4-13

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	P/MPa	Mole fraction of oxygen in liquid, x_{O_2}	Mole fraction of oxygen in gas, y_{O_2}
298.15	7.42	0.030	0.081
	7.87	0.042	0.088
	8.05	0.049	0.088
	8.22	0.055	-
288.15	6.45	-	0.132
	7.42	0.062	0.196
	8.05	0.079	-
	8.84	0.102	0.228
	9.22	0.117	0.236
273.15	5.07	0.036	0.220
	7.42	0.096	0.371
	9.63	0.166	0.411
	10.57	0.206	0.408
	10.85	-	0.405
	11.01	-	0.404
	11.18	-	0.397
253.15	3.70	0.036	0.383
	5.27	0.072	0.516
	10.18	0.218	0.612
	12.74	0.371	0.564
233.15	5.27	0.092	0.722
	10.18	0.242	0.757

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Static equilibrium cell with agitator. Pressure measured with Bourdon gauge. After equilibrium established sample removed and analysed by volumetric and gravimetric technique. Carbon dioxide absorbed in potassium hydroxide solution.

SOURCE AND PURITY OF MATERIALS:

Better than 99.5 mole per cent.

ESTIMATED ERROR:

$\delta T/K = \pm 0.05$; $\delta P/MPa = \pm 0.01$;

δx_{O_2}, δy_{O_2} = ±0.003 (estimated by compiler)

REFERENCES:

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Carbon dioxide; CO_2; [124-38-9]

ORIGINAL MEASUREMENTS:

Fredenslund, A.; Sather, G. A.
J. Chem. Eng. Data 1970, *15*, 17-22.

VARIABLES:

T/K = 223-283
P/bar = 10-132

PREPARED BY:

C. L. Young

EXPERIMENTAL VALUES:

T/K	*P*/bar	Mole fraction of oxygen in liquid, x_{O_2}	Mole fraction of oxygen in vapor, y_{O_2}	T/K	*P*/bar	Mole fraction of oxygen in liquid, x_{O_2}	Mole fraction of oxygen in vapor, y_{O_2}
223.15	10.1	0.008	0.312	233.15	121.6	0.334	0.780
	20.3	0.025	0.617		131.7	0.393	0.762
	30.4	0.049	0.712	243.15	20.3	0.010	0.275
	40.5	0.071	0.761		30.4	0.031	0.463
	50.7	0.096	0.789		40.5	0.052	0.551
	60.8	0.117	0.809		50.7	0.080	0.609
	70.9	0.150	0.814		60.8	0.104	0.644
	81.1	0.189	0.818		70.9	0.140	0.671
	91.2	0.220	0.820		81.1	0.162	0.693
	101.3	0.267	0.819		91.2	0.191	0.689
	111.5	0.293	0.797		101.3	0.236	0.694
	121.6	0.334	0.780		111.5	0.266	0.682
	131.7	0.394	0.762		121.6	0.306	0.671
233.15	10.1	-	0.118	253.15	20.3	0.006	0.061
	20.3	0.021	0.419		30.4	0.030	0.302
	30.4	0.041	0.589		40.5	0.042	0.400
	40.5	0.064	0.651		50.7	0.062	0.500
	50.7	0.087	0.695		60.8	0.092	0.540
	60.8	0.120	0.723		70.9	0.125	0.560
	70.9	0.141	0.741		81.1	0.141	0.574
	81.1	0.167	0.757		91.2	0.170	0.601
	91.2	0.205	0.766		101.3	0.220	0.599
	101.3	0.248	0.767		111.5	0.255	0.601
	111.5	0.274	0.760		121.6	0.300	0.570

(cont.)

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

High pressure recirculating vapor flow apparatus. Temperature measured with quartz thermometer; pressure measured with Bourdon gauge. Samples analysed by gas chromatography.

SOURCE AND PURITY OF MATERIALS:

No details given.

ESTIMATED ERROR:

δT/K = ±0.02; δP/bar = ±0.5%; δx_{O_2}, δy_{O_2} = ±0.02 (estimated by compiler).

REFERENCES:

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Carbon dioxide; CO_2;
[124-38-9]

ORIGINAL MEASUREMENTS:

Fredenslund, A.; Sather, G. A.
J. Chem. Eng. Data 1970, *15*, 17-22.

EXPERIMENTAL VALUES:

		Mole fraction of oxygen				Mole fraction of oxygen	
T/K	P/bar	in liquid, x_{O_2}	in vapor, y_{O_2}	T/K	P/bar	in liquid, x_{O_2}	in vapor, y_{O_2}
263.15	30.4	0.009	0.096	273.15	60.8	0.062	0.298
	40.5	0.035	0.263		70.9	0.090	0.336
	50.7	0.056	0.346		81.1	0.126	0.372
	60.8	0.079	0.417		91.2	0.147	0.398
	70.9	0.110	0.463		101.3	0.185	0.401
	81.1	0.134	0.493		111.5	0.247	0.362
	91.2	0.162	0.495	283.15	50.7	0.028	0.115
	101.3	0.195	0.500		60.8	0.040	0.161
	111.5	0.243	0.498		70.9	0.071	0.218
	121.6	0.299	0.446		81.1	0.087	0.263
273.15	40.5	0.010	0.099		91.2	0.115	0.294
	50.7	0.042	0.214		101.3	0.187	0.263

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Oxygen; O_2; [7782-44-7] (2) Carbon dioxide; CO_2; [124-38-9]	Fredenslund, A.; Mollerup, J.; Persson, O. *J. Chem. Eng. Data* 1972, *17*, 440-3.
VARIABLES:	PREPARED BY:
T/K = 224 P/bar = 9-142	C. L. Young

EXPERIMENTAL VALUES:

T/K	P/bar	Mole fraction of oxygen in liquid, x_{O_2}	Mole fraction of oxygen in gas, y_{O_2}
223.75	9.31	0.0040	0.2222
	14.08	0.0122	0.4461
	25.94	0.0306	0.6453
	34.2	0.0426	0.7101
	50.5	0.0756	0.7771
	77.5	0.1433	0.8137
	87.1	0.1808	-
	118.6	0.3056	0.7970
	127.3	0.3413	0.7808
	137.8	0.3929	0.7113
	142.4	0.4462	0.6240

AUXILIARY INFORMATION

METHOD /APPARATUS/PROCEDURE:

Equilibrium established by re-circulating vapor by pump outside thermostat. Temperature measured with platinum resistance thermometer. Pressure measured with dead weight gauge. Samples of liquid and vapor analysed by gas chromatography. Details in source.

SOURCE AND PURITY OF MATERIALS:

No details given.

ESTIMATED ERROR:

$\delta T/K = \pm 0.01$; $\delta P/\text{bar} = \pm 0.1$;

$\delta x_{O_2} = \delta y_{O_2} \approx \pm 2.5\%$.

REFERENCES:

OZONE SOLUBILITIES

COMPONENTS:	EVALUATOR:
(1) Ozone; O_3; [10028-15-6] (2) Water; H_2O; [7732-18-5] (3) Buffer + H_2SO_4 or NaOH	John A. Roth Department of Chemical Engineering Vanderbilt University Nashville, Tennessee 37235 April 1981

CRITICAL EVALUATION:

Gases which react upon diffusing into the liquid phase present unique problems in establishing gas-liquid solubilities. Since ozone decomposes irreversibly in water, the overall mechanism in aqueous systems can be presented as

$$2O_3(g) \overset{1}{\rightleftarrows} 2O_3(\ell) \xrightarrow{2} 3O_2$$

The gas-liquid equilibrium involves step 1. Classical solubility measurements involving the equilibration of a fixed volume of gas with a measured mass of solvent cannot be used when step 2 is significant relative to the ozone transfer from the gas phase. Historically, investigators have generated ozone by passing an air or oxygen stream between electrodes across which an electrical discharge is generated. The exiting gas stream, typically 2 to 4% ozone by weight, is bubbled continuously through water. A steady state concentration is achieved as time increases. This approaches the ozone solubility only when the kinetic rate for step 2 is very slow compared to the gas to liquid mass transfer step. For the ozone water system, this occurs only in the low temperature and low pH regions. At higher relative reaction rates (step 2) however, the observed steady state concentration is not the thermodynamic equilibrium (i.e., solubility) concentration.

An experimental approach has been developed by Sullivan (1) and Roth and Sullivan (2) to determine the solubility of ozone in aqueous systems in which significant decomposition occurs. The experiment consists of sparging a high quality ozone demand-free water with an air-ozone or oxygen-ozone gas stream. The system is sampled during the unsteady state ozone uptake period until a steady state ozone concentration is achieved. The ozone stream is then stopped and the unsteady state batch decomposition is determined by taking concentration time measurements during decomposition. An unsteady state mass balance on ozone in the completely mixed system which describes the ozone uptake portion of the experiment is:

$$\begin{pmatrix}\text{rate of ozone trans-}\\ \text{ferred into the liquid}\end{pmatrix} = \begin{pmatrix}\text{rate of disappearance}\\ \text{by chemical reactor}\end{pmatrix} + \begin{pmatrix}\text{rate of ozone}\\ \text{accumulation in}\\ \text{the reactor}\end{pmatrix} \tag{1}$$

$$k_L a(C_i - C)\, V = (-r_{O_3})V + V\,\frac{dC}{dt} \tag{2}$$

where a = interfacial area, cm^2
C = concentration of the ozone in the bulk liquid, g mol^{-1}
C_i = concentration of the ozone at the interface, g mol^{-1}
r_{O_3} = rate of ozone decomposition, mol l^{-1} min^{-1}
k_L = liquid film mass transfer coefficient, cm^2 min^{-1}
t = time, min.
V = bulk liquid volume, l

The ozone decomposition can be represented adequately over the range of experimental data (Sullivan and Roth (3)) as first order. The interfacial ozone concentration is assumed to be liquid film controlling valid for high Henry's law constants (see, for example, Sherwood et al. (4)). The interfacial concentration, C_i, is then equal to C^*, the equilibrium solubility concentration.

Recognizing also that the accumulation term, dC/dt, is zero at stady state,

$$C^* = (1 + k/k_L a)\, C_{ss} \tag{3}$$

continued on following page

COMPONENTS:	EVALUATOR:
(1) Ozone; O_3; [10028-15-6] (2) Water; H_2O; [7732-18-5] (3) Buffer + H_2SO_4 or NaOH	John A. Roth Department of Chemical Engineering Vanderbilt University Nashville, Tennessee 37235 April 1981

CRITICAL EVALUATION:

continued

where C_{ss} is the steady state ozone concentration. Substituting $C_i = C^*$ and eq. 3 in eq. 2, integrating and rearranging, the following equation is obtained

$$C = C_{ss}\,[1 - \exp-(k_La + k)t] \qquad (4)$$

The rate constant, k, is determined from the ozone decomposition data. The value of k_La, specific for each experimental apparatus, is determined from the ozone uptake data using eq. 4 and the decomposition rate data. It is assumed further that the gaseous solution is ideal and Henry's law,

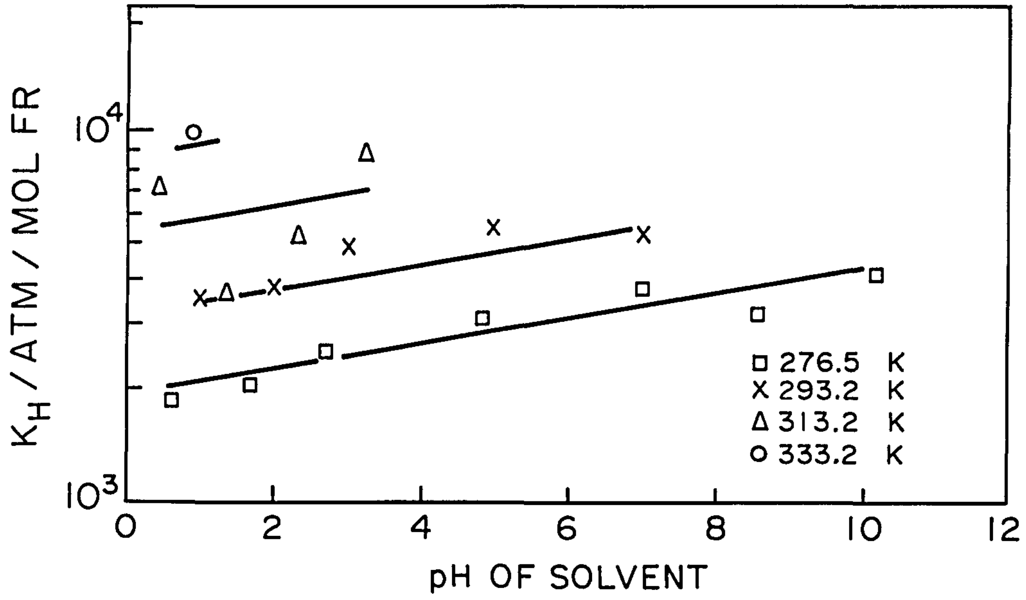
$$P(g) = K_Hx \qquad (5)$$

is valid for the nondisassociating step. The analysis of the gas phase oxone concentration provides the corresponding gas phase partial pressure for eq. 5 and K_H can be determined.

Roth and Sullivan (2) have determined the solubility of ozone in a buffered water system. Either H_2SO_4 or NaOH was used to adjust the pH to the desired value. The Henry's law constants are shown in Figure 1. These are fit by the equation,

$$K_H = 3.84 \times 10^7\,[OH^-][\exp(-2428/(T/K))] \qquad (6)$$

where $[OH^-]$ = hydroxide concentration, mole l^{-1}, and with an index of determination of 0.84 and standard error of estimate of 0.20. This equation is plotted in Figure 1 for comparison with the experimental data. These data are more consistent at the lower temperatures. At higher temperatures and pH's accurate measurements are much more difficult, and accordingly are less reliable.



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COMPONENTS:

(1) Ozone; O_3; [10028-15-6]

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

(3) Buffer + H_2SO_4 or NaOH

EVALUATOR:

John A. Roth
Department of Chemical Engineering
Vanderbilt University
Nashville, Tennessee 37235

April 1981

CRITICAL EVALUATION:

continued

Li (5) recognized the problem of determining the solubility of ozone in water. He estimated the solubility from his measurements in a buffered aqueous system, but did not fully account for the simultaneous decomposition. Sullivan (1) recalculated Li's data taking into account the domcomposition. These values, converted to Henry's law constants, are given in Table 1 and compared with Sullivan's results predicted by equation (6).

TABLE 1. Comparison of the Recalculated Henry's Law Constants of Li and Sullivan, 298 K

pH	Li (5) K_H (range) atm/mole fr.	Li (5) K_H (mean) atm/mole fr.	Sullivan (1) K_H atm/mole fr.
220	6747-8442	7582	4296
410	7172-7251	7212	5007
615	7440-8274	7857	5906
710	7603-8644	8123	6376

Li's values are 29 to 44% higher than those of Sullivan, disregarding the 2.20 pH data of Li, which appear to be inconsistent. Li's data varied up to 25% at the same experimental conditions. The differences between the Sullivan and the Li data are, however, not fully resolved.

Some of the early reported solubility data for the ozone-water system were obtained by Carius (6). Schone (7) demonstrated that when an ozone-oxygen stream was passed through distilled water, a true equilibrium was not reached. Although the concentration of the dissolved ozone remained constant, the ozone in the gas decomposed to oxygen. Schone accordingly corrected Carius' results. Ingles (8) in 1903 correctly recognized that the measured ozone concentration in water was an "apparent solubility", depending on the gas flow rate. He performed experiments confirming Schone's results and concluded that it is impossible to study the molecular state of dissolved ozone using traditional solubility measurement techniques.

Mailfert (9) in 1894 obtained apparent solubilities for ozone in water from 273 to 333 K and in dilute H_2SO_4 solutions over a range of 303 to 333 K. He presented his results as Ostwald coefficients. These water and low pH values were found to have small deviations at 293 to 298 K and substantial deviations for 303 to 330 K. The values obtained in distilled water were converted to Henry's law constants, reported in the International Critical Tables (10) and commonly reproduced in standard handbooks, disregarding the work of Ingles (8).

Luther-Leipsig (11) determined the apparent solubility at 273 K and 293 K. Rothmund (12) studied the solubility in H_2SO_4 solution and 273 K in which the ozone was quite stable. He found the Ostwald coefficient, L, to be constant over a gas concentration of 20 to 100 mg/l, verifying Henry's law under these conditions. He operated under conditions for which the decomposition rate of ozone was negligible compared to the mass transfer rate. Fischer and Tropsch (13) presented a single Ostwald's coefficient at 291 K.

Kawamura (14) studied both a pure water system for which he determined Ostwald coefficients from 323 K to 333 K and in sulfuric acid solutions ranging from 0.11 N to 7.57 N at 293 K. He found decreasing values of L with increasing acid normality.

continued on following page

COMPONENTS:	EVALUATOR:
(1) Ozone; O_3; [10028-15-6] (2) Water; H_2O; [7732-18-5] (c) Buffer + H_2SO_4 or NaOH	John A. Roth Department of Chemical Engineering Vanderbilt University Nashville, Tennessee 37235 April 1981

CRITICAL EVALUATION:

continued

Briner and Perrottet (14) determined the Bunsen absorption coefficient, α, in water at 276.6 K and 292 K. They also reported α in solutions containing 35 mg NaCl/ℓ (3.5% dissolved solids) at 236.6 K and 242.0 K. A significant reduction in the dissolved ozone concentration was observed.

Meddows-Taylor (16) references two Ostwald coefficients at 276 K and 293 K.

Hoather (17) noted that the saturation of water with ozone gas was impossible because of the simultaneous occurrence of self-decomposition. He also concluded that reasonably accurate determinations could be made when the mass transfer rate was much greater than the reaction rate. Using conditions where the half-life was about ten mintues, he reported the solubility at 288 K to 312.2 K.

Stumm (19) reported the apparent solubility of ozone in water. Contrary to other investigators, he found the solubility independent of pH up to 8.5. His work was performed over a temperature range of 278 K to 298 K for solutions with an ionic strength of 0.05.

Kirk and Othmer (20) reported Bunsen absorption coefficients from 273 K to 333 K. The original source of these data is not indicated.

The data of these investigators were converted to Henry's law constants, and are given in Table 2. The apparent Henry's law constants for the pure water determinations are shown in Figure 1. Sullivan converted the steady state concentrations to apparent Henry's law constants for comparison with the literature values. These were found to be a function of pH and temperature. Lines are shown in Figure 2 for pH 2 and 7. Values reported in Table 2 fall almost entirely between these two lines. These values are not recommended for use for the following reasons.

1. Solubilities were obtained by static techniques neglecting the effect of reaction or by bubbling a continuous oxygen stream through water. These latter experiments are dependent on the mass transfer characteristics, which differ for different experimental apparati and are affected by the reaction.

2. Even when extreme care is taken to prepare high purity-ozone demand free water (see Sullivan (1)), the pH will drop during ozonation. Most previous investigators did not monitor the pH during their experiments. Sullivan (1) chose to buffer his experiments thereby maintaining constant pH, but adding dissolved solids.

3. Analysis of the unstable ozone species in water is difficult and is usually based on the reaction of free ozone with the reagents used in analysis. Sullivan et al. (20) review the state of the art in ozone analysis. Some investigators clearly used analyses which gave total oxidants rather than ozone specific results. Although better precision can be obtained using spectrometric methods of analysis, these methods are still based on calibrations using iodometric methods.

4. Ozone-water chemistry is not well established. A number of mechanisms have been postulated (Peleg (21) and Sullivan (1)) but existing kinetic data are not sufficient to distinguish between the hypothesized kinetic mechanisms.

continued on following page

COMPONENTS:	EVALUATOR:
(1) Ozone; O_3; [10028-15-6] (2) Water; H_2O; [7732-18-5] (3) Buffer + H_2SO_4 or NaOH	John A. Roth Department of Chemical Engineering Vanderbilt University Nashville, Tennessee 37235 April 1981.

CRITICAL EVALUATION:

continued

TABLE 2. Apparent Solubility of Ozone in Aqueous Solution (Not Recommended for Use)

Investigator	T/K	Bunsen Coefficient, α	Ostwald Coefficient, L	K_H/ (atm/mole frac)
SCHÖNE (1873)	291.4	0.366		3400
MAILFERT (1894)	273.2		0.641	1940
	279.2		0.562	2260
	285.0		0.500	2600
	286.2		0.482	2710
	288.2		0.456	2880
	292.2		0.381	3500
	300.2		0.270	5070
	305.2		0.195	7130
	313.2		0.112	12750
	320.2		0.077	18960
	328.2		0.031	48260
	333.2		0.000	∞
MAILFERT[2] (1894) all values in weak H_2SO_4 soln.	303.2		0.240	5760
	306.2		0.224	6230
	315.9		0.174	8280
	322.2		0.156	9410
	330.2		0.096	15680
LUTHER (1905)	273.2		0.44	2830
	293.2		0.23	5810
ROTHMUND (1912)	273.2		0.487	2560
FISCHER AND TROPSCH (1917)	291.2		0.460	2890
KAWAMURA (1932)	278.2		0.44	2880
	283.2		0.38	3400
	293.2		0.29	4610
	303.2		0.20	6910
	313.2		0.15	9520
	323.2		0.11	13390
	333.2		0.08	18980
KAWAMURA[2] (1932)				
7.57N H_2SO_4	293.2		0.18	7420
2.02N H_2SO_4	293.2		0.23	5810
1.01N H_2SO_4	293.2		0.25	5350
0.18N H_2SO_4	293.2		0.28	4770
0.11N H_2SO_4	293.2		0.28	4770
BRINER AND PERROTTET (1939)	276.7	0.480		2590
	293.0	0.323		3860
BRINER AND PERROTTET[2] (1939) 35 g/ℓ NaCL	276.7	0.24		5190
	293.0	0.17		7320
MEDDOWS-TAYLOR (1948)	276.2		0.49	2570
	293.2		0.34	3930
HOATHER (1948)	288.2		0.173	7590

continued on following page

COMPONENTS:	EVALUATOR:
(1) Ozone; O_3; [10028-15-6] (2) Water; H_2O; [7732-18-5] (3) Buffer + H_2SO_4 or NaOH	John A. Roth Department of Chemical Engineering Vanderbilt University Nashville, Tennessee 37235 April 1981

CRITICAL EVALUATION:

continued

Investigator	T/K	Bunsen Coefficient, α	Ostwald Coefficient, L	K_H/ (atm/mole frac)
RAWSON (1953)	282.8		0.39	3300
	287.7		0.29	4520
	293.5		0.21	6370
	298.7		0.17	8010
	303.8		0.14	9890
	308.3		0.12	11710
	312.2		0.07	20330
STUMM (1958)	278.2		0.45	2820
	283.2		0.41	3150
	288.2		0.37	3550
	293.2		0.34	3930
	298.2		0.30	4530
KIRK, OTHMER (1967)	273.2	0.49		2530
	278.2	0.44		2820
	283.2	0.375		3330
	293.2	0.285		4370
	303.2	0.2		6210
	313.2	0.145		8550
	323.2	0.105		11770
	333.2	0.080		15600

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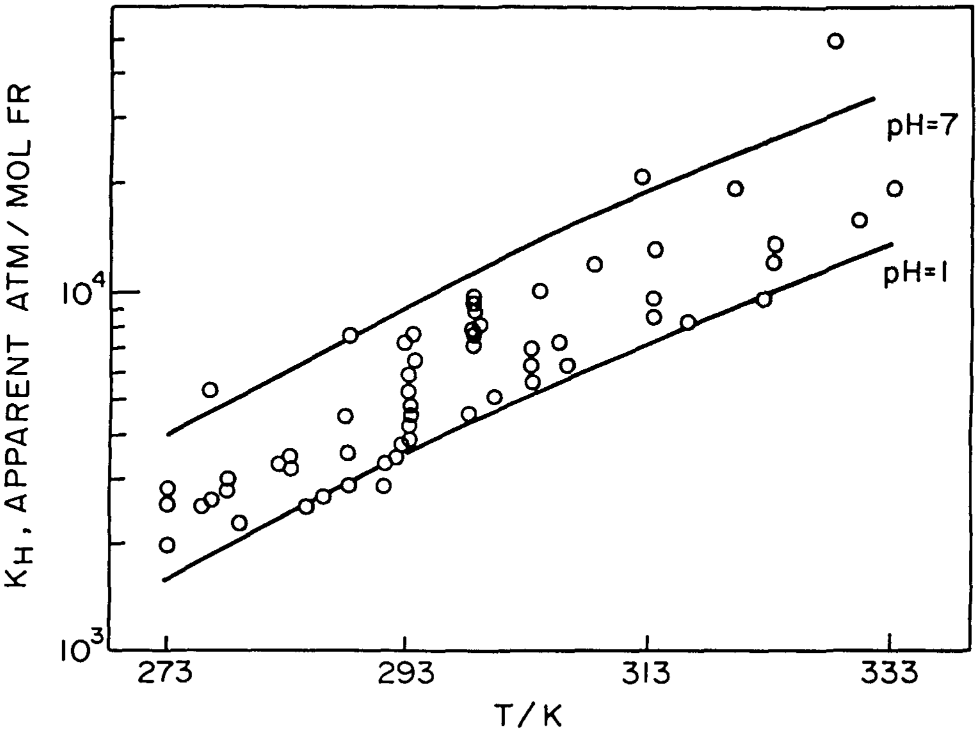
[1] Henry's Law constants calculated by Sullivan (1).

[2] Not shown on Figure 2.



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COMPONENTS:	EVALUATOR:
(1) Ozone; O_3; [10028-15-6] (2) Water; H_2O; [7732-18-5] (3) Buffer + H_2SO_4 or NaOH	John A. Roth Department of Chemical Engineering Vanderbilt University Nashville, Tennessee 37235 April 1981

CRITICAL EVALUATION: continued

Because of the above problems, none of these data are recommended for use.

Ozone-water solubility data are of lesser quality than those obtained on stable gas-liquid systems. The reactivity of the ozone, a very strong oxidizer, results in experimental problems as discussed above. The only data available which considers the problems of the simultaneous decomposition reaction are those of Roth and Sullivan (2) and Li (as recalculated by Sullivan (1)). While these values are empirically correlated with the Henry's law constant as a function of pH, careful investigations of ionic strength, dissolved solids, and perhaps the specific ionic species are still needed. The entire question of ozone aqueous chemistry also needs further clarification. Accordingly, the Roth and Sullivan data are recommended recognizing the limitations and assumptions of these data.

References

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3. Sullivan, D. E.; Roth, J. A. *AIChE Symp. Ser.* 1980, *76*, 142-9.
4. Sherwood, T. K.; Pigford, R. L.; Wilke, C. R. *Mass Transfer, McGraw-Hill; New York*, 1975, pp. 178-82.
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21. Sullivan, D. E.; Hall, L. C.; D'Ambrosi, J.; Roth, J. A. *Ozone Science Eng.*, 1980, *2*, 189-93.
22. Peleg, M. *Water Res.* 1976, 361-6.

COMPONENTS:

(1) Ozone; O_3; [10028-15-6]

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

ORIGINAL MEASUREMENTS:

Matrozov, V.E.; Kashtanov, S.A.; Stepanov, A.M.; Tregubov, B.A.

Zh. Prikl. Khim. (Leningrad) 1975, *48* (*8*), 1838-41.

VARIABLES:

T/K = 294 - 333

PREPARED BY:

R. Battino

EXPERIMENTAL VALUES:

T^a/K	$10^5/(T/K)^b$	$\log_{10}H^{b,c}$	$10^{-4}H^a$
333.3	300	5.45	28.2
322.6	310	5.33	21.4
312.5	320	5.20	15.8
303.0	330	5.08	12.0
294.1	340	4.90	7.94
298.5^d		4.98^a	9.46^d

[a] Calculated by compiler.

[b] Values read from graph.

[c] H is the Henry's constant in units of atm cm^3 mol^{-3}.

[d] Average value of H reported in paper over a small pressure range.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The ozone concentrations in the liquid and gas phases were determined with the aid of neutral 1% KI solution with phosphate buffer (1). Constancy of ozone concentration at the saturation column exit was determined spectrophotometrically at 254 nm. Special precautions were taken to minimize errors due to ozone decomposition in the liquid and gas phases.

SOURCE AND PURITY OF MATERIALS:

(1) From a LGO-15 ozonizer 3.

(2) Distilled.

ESTIMATED ERROR:

$\delta H/H = \pm 0.03$, compiler's estimate.

$\delta T/K = \pm 0.1$

REFERENCES:

1. Dietz, R.N.; Pruzansky, J.; Smith, J.D. *Anal. Chem.* 1973, *45*, 402.

COMPONENTS:

(1) Ozone; O_3; [10028-15-6]

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

ORIGINAL MEASUREMENTS:

Sullivan, D.E.

Ph.D. thesis, Vanderbilt University, 1979.

Roth, J.A.; Sullivan, D.E.

Ind. Eng. Chem. Fundamentals (in press for May 1981).

VARIABLES:

T/K = 277-333
pH

PREPARED BY:

R. Battino

EXPERIMENTAL VALUES:

t/°C	T^a/K	pH	$10^{-5}H^b$/ (atm/mol fraction)
3.50	276.65	0.65	1.829
3.50	276.65	1.70	2.025
3.50	276.65	2.75	2.502
3.50	276.65	4.85	3.070
3.50	276.65	7.00	3.771
3.50	276.65	8.60	3.195
3.50	276.65	10.20	4.186
20.00	293.15	1.00	3.524
20.00	293.15	2.00	3.755
20.00	293.15	3.00	4.795
20.00	293.15	5.00	5.497
20.00	293.15	7.00	5.304
40.00	313.15	0.45	7.145
40.00	313.15	1.40	3.590
40.00	313.15	2.35	5.112
40.00	313.15	3.30	8.834
60.00	333.15	0.95	9.671

[a] Calculated by compiler

[b] Henry coefficient in units of atm/mol fraction.

[c] The authors presented the following smoothing equation:

continued on following page

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

A modified iodimetric technique in which arsenious acid, a primary standard, was substituted for sodium thiosulfate. This permitted the analytical procedure to be performed in a neutral medium. The authors also studied the kinetics of the self-decomposition of ozone and corrected their results to true equilibrium solubilities. The pH was maintained with a phosphate buffer using H_2SO_4 or NaOH to attain the desired pH. Details are given in the thesis (1).

SOURCE AND PURITY OF MATERIALS:

(1) Medical grade oxygen was used in a Grace model LG-2-L1 ozone generator.
(2) Deionized, then distilled from an alkaline permangate solution. This was "ozone demand-free" water.

ESTIMATED ERROR:

$\delta T/K = \pm 0.1$
$\delta H/H = \pm 0.1$, compiler's estimate.

REFERENCES:

1. Sullivan, D.E. Ph.D. thesis, Vanderbilt University, 1979.

COMPONENTS:	EVALUATOR:
(1) Ozone; O_3; [10028-15-6] (2) Water; H_2O; [7732-18-5]	Sullivan, D.E. *Ph.D. thesis, Vanderbilt University,* 1979. Roth, J.A.; Sullivan, D.E. *Ind. Eng. Chem. Fundamentals (in press for May 1981).*

CRITICAL EVALUATION:

continued

$$H = 3.842 \times 10^{7}\, e^{-2.428 \times 10^{3}/(T/K)}\, [OH^{-}]^{0.035}.$$

This fits the data with an average deviation of about ±10 per cent. $[OH^-]$ denotes a molar concentration.

COMPONENTS:

(1) Ozone; O_3; [10028-15-6]

(2) Trichloromethane (Chloroform); $CHCl_3$; [67-66-3]

ORIGINAL MEASUREMENTS:

Boer, H.; Sixma, F.L.J.

Rec. Trav. Chim. 1951, *70*, 997-1004.

VARIABLES:

T/K = 234 - 248

PREPARED BY:

R. Battino

EXPERIMENTAL VALUES:

t/°C	T^a/K	L^b
-25.0	248.2	6.5^c
-25.0	248.2	7.0^c
-25.0	248.2	6.5
-28.0	245.2	6.8^c
-28.0	245.2	6.8^c
-28.0	245.2	6.8^c
-30.5	242.7	7.8
-30.5	242.7	8.0
-30.5	242.7	8.1
-30.5	242.7	8.0
-31.2	242.0	8.3^c
-31.2	242.0	8.2^c
-31.2	242.0	7.8^c
-35.2	238.0	9.5^c
-35.2	238.0	9.5^c
-39.2	234.0	10.9
-39.2	234.0	11.7

[a] Calculated by compiler.

[b] Ostwald coefficient.

[c] Solubilities determined by titration. Other solubilities determined from measured concentration of ozone in entrance and exit streams.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The ozone was generated electrolytically to give a mixture of oxygen and ozone that was 12% ozone by weight. In the indirect method the solubility was determined from the composition of the oxygen/ozone mixture entering and leaving the saturated solution. In the direct method an aliquot of the saturated solution is taken, weighed, neutral potassium iodide solution added, acidified with sulfuric acid, and the iodine formed titrated with sodium thiosulphate.

SOURCE AND PURITY OF MATERIALS:

(1) Generated electrolytically.

(2) No details given.

ESTIMATED ERROR:

$\delta T/K = \pm 0.04$

$\delta L/L = \pm 0.04$, compiler's estimate

REFERENCES:

COMPONENTS:

(1) Ozone; O_3; [10028-15-6]

(2) Trichlorofluoromethane;
CCl_3F; [75-69-4]

ORIGINAL MEASUREMENTS:

Mahieux, F.

Bull. Soc. Chim. France 1961, 2275 - 2276.

VARIABLES:

T/K: 293.15
p_1/kPa: 16.2 - 60.8
(0.16 - 0.60 atm)

PREPARED BY:

H. L. Clever

EXPERIMENTAL VALUES:

T/K	Ozone Pressure p_1/atm	Mol Fraction $x_1 \times 10^3$	Absorption Coefficient β/cm^3(STP)cm^{-3}	Henry's Constant[1] K'
293.15	0.16	2.5	0.60	3.7
	0.22	2.6	0.64	2.9
	0.40	6.5	1.58	3.9
	0.45	7.1	1.72	3.8
	0.55	7.4	1.8	3.3
	0.56	7.8	1.9	3.4
	0.59	7.8	1.91	3.2
	0.60	6.9	1.68	2.8
	[1.0	14.1	3.4	3.4 ± 0.5][2]

[1] Henry's constant, K'/cm^3(STP) cm^{-3} atm^{-1} = (β/cm^3(STP)cm^{-3})/(p_1/atm

Note that in this formulation of Henry's constant,that the constant is the Bunsen coefficient.

[2] Values calculated by the author at one atm ozone pressure.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Solubility equilibrium is attained between the ozone and the trichlorofluoromethane in a special cell. The total pressure is measured. The ozone saturated liquid phase is removed, and the ozone is absorbed in a potassium iodide solution. The liberated iodine is titrated by standard methods. The gas phase is also analyzed for ozone by absorption in potassium iodide and titration of the iodine released.

SOURCE AND PURITY OF MATERIALS:

(1) Ozone. No information.

(2) Trichlorofluoromethane. No information.

ESTIMATED ERROR:

$\delta K'/K' = \pm 0.15$

REFERENCES:

COMPONENTS:

(1) Ozone; O_3; [10028-15-6]

(2) Tetrachloromethane; CCl_4; [56-23-5]

ORIGINAL MEASUREMENTS:

Briner, E.; Perrottet, E.

Helv. Chim. Acta, 1939, *22*, 585-7.

VARIABLES:

T/K = 261-273

PREPARED BY:

V. Katovic

EXPERIMENTAL VALUES:

Ozone Concn.[a] %	$\alpha^{b,c}$	$\alpha^{b,d}$
8.2	2.8	
8.6	3.1	
9.0		4.5
9.4		4.9
10.0	2.5	
10.1	2.7	4.4

[a] Percentage in the gas phase.

[b] Bunsen coefficient in cm^3(STP) cm^{-3} atm^{-1}.

[c] At 0°C (273K).

[d] At -12°C (261K).

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Solubility of ozone was determined by an apparatus described in reference (1). The amount of ozone in the CCl_4 and the gas phase was determined by an iodometric technique.

SOURCE AND PURITY OF MATERIALS:

No details given.

ESTIMATED ERROR:

REFERENCES:

1. Briner, E.; Perrottet, E. Helv. Chim. Acta 1939, 22, 397-404.

COMPONENTS:

(1) Ozone; O_3; [10028-15-6]

(2) Tetrachloromethane; CCl_4; [56-23-5]

(3) Nitric acid, HNO_3; [7697-37-2]

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

ORIGINAL MEASUREMENTS:

Stolyarenko, T.E.; Stolyarenko, G.S.

Izv. Vyssh. Uchebn. Zaved. Khim. Khim. Tekhn. 1976, (19) 1613-4.

VARIABLES:

T/K = 263-303
Concentration

PREPARED BY:

V. Katovic

EXPERIMENTAL VALUES:

CCl_4 solution saturated with	t/°C	10^2c^a	α^b	$10^5/(T/K)$	$\log_{10}\alpha^b$
-	-10.0	7.0848	5.760	380.23	0.7604
	0.0	5.1783	4.210	366.30	0.6243
	18.0	3.4071	2.770	343.64	0.4425
	30.0	2.5769	2.095	330.03	0.3212
H_2O	-10.0	6.7404	5.480	380.23	0.7388
	0.0	6.3591	5.170	366.30	0.7135
	18.0	4.5387	3.690	343.64	0.5670
	30.0	2.5510	2.074	330.03	0.4040
HNO_3	-8.0	6.7486	4.860	377.36	0.6866
39.7376%	0.0	6.0960	4.390	366.30	0.6425
	19.5	4.1380	2.980	341.88	0.4742
	30.0	3.1105	2.240	330.03	0.3502
60.2341%	-9.5	7.3140	5.300	379.50	0.6920
	0.0	5.9423	4.306	366.30	0.6343
	19.5	4.0434	2.930	341.88	0.4669
	30.0	2.9946	2.170	330.03	0.3365
68.5889%	-8.0	6.7896	4.920	377.36	0.6920
	0.0	6.2376	4.520	366.30	0.6551
	18.4	4.3194	3.130	343.64	0.4955
	30.0	3.1188	2.260	330.03	0.3541
85.8646%	-12.0	8.8064	5.630	383.14	0.7505
	0.0	7.3048	4.670	366.30	0.6693
	18.0	5.2557	3.360	343.64	0.5262
	30.0	3.8949	2.490	330.03	0.3962

continued on following page

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Ozone in gas and liquid phases was determined by a spectrophotometric method.

SOURCE AND PURITY OF MATERIALS:

(1) 0.2 - 5% O_3 in oxygen produced by an ozone generator.

ESTIMATED ERROR:

REFERENCES:

COMPONENTS:	EVALUATOR:
(1) Ozone; O_3; [10028-15-6] (2) Tetrachloromethane; CCl_4; [56-23-5] (3) Nitric acid; HNO_3; [7697-37-2] (4) Water, H_2O; [7732-18-5]	Stolyarenko, T.E.; Stolyarenko, G.S. *Izv. Vyssh. Uchebn. Zaved. Khim. Khim. Tekhn.* 1976, (19), 1613-4

EXPERIMENTAL VALUES: continued

CCL_4 solution saturated with	t/°C	10^2c^a	α^b	$10^5/(T/K)$	$Log_{10}\alpha^b$
100.00%	-10.0	10.3863	6.640	380.23	0.8222
	-1.0	9.7340	6.223	367.65	0.7940
	18.0	6.3413	4.054	343.64	0.6079
	30.0	5.1931	3.320	330.03	0.5211

[a] Concentration of ozone in liquid phase in moles per liter.

[b] Solubility coefficient (unidentified).

COMPONENTS:

(1) Ozone; O_3; [10028-15-6]

(2) Six halocarbons (freons) - see below

ORIGINAL MEASUREMENTS:

Chretien, A.; Servigne, M.; Mahieux, F.

Bull. Soc. Chim. France 1960, 49-54.

VARIABLES:

T/K = 163-250

PREPARED BY:

V. Katovic

EXPERIMENTAL VALUES:

t/°C	T^a/K	CCl_3F (Freon-11)	CCl_2F_2 (Freon-12)	$CClF_3$ (Freon-13)	$CHClF_2$ (Freon-22)	CCl_2FCClF_2 (Freon-113)	$CClF_2$-$CClF_2$ (Freon-114)
		α^b/cm^3(STP) cm^{-3} atm^{-1}					
-110	163	1610	2090	2180	3490		
- 90	179	132	136				
- 63	210	25.4					35
- 23	250	6.6				9.4	

[a] Calculated by compiler.

[b] Bunsen coefficient calculated by the authors for 100 per cent ozone at 1 atm (101.325 kPa) partial pressure of ozone.

[c] Methane, trichlorofluoro (Freon-11); CCl_3F; [75-69-4].
Methane, dichlorodifluoro (Freon-12); CCl_2F_2; [1495-28-9].
Methane, chlorotrifluoro (Freon-13); $CClF_3$; [75-72-9].
Methane, chlorodifluoro (Freon-22); $CHClF_2$; [75-45-6].
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon-113); CCl_2FCClF_2; [76-13-1].
1,2-Dichloro-1,1,2,2-tetrafluoroethane (Freon-114); $CClF_2CClF_2$; [76-14-2].

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Solubility of ozone was determined by an apparatus described in the paper. The amount of ozone in the gas phase and in the liquid phase were determined by an iodometric method.

SOURCE AND PURITY OF MATERIALS:

(1) No details given.

(2) Freons (99%) were distilled through a column containing silica gel, molecular sieves 5A and P_4O_{10}.

ESTIMATED ERROR:

$\delta\alpha/\alpha$ = ±0.04, authors' estimate
$\delta T/K$ = ±1, authors' estimate

REFERENCES:

COMPONENTS:

(1) Ozone; O_3; [10028-15-6]

(2) Sulfuric acid; H_2SO_4; [7764-93-9]

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

ORIGINAL MEASUREMENTS:

Merkulova, V.P.; Lovchikov, V.S.; Ivanovskii, M.D.

Zh. Prikl. Khim. 1972, *45*, 1608-9.

VARIABLES:

T/K = 293-333
O_3 in O_2/% (vol) = 6.3-9.7

PREPARED BY:

V. Katovic

EXPERIMENTAL VALUES:

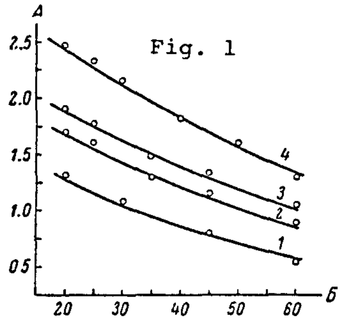

Fig. 1

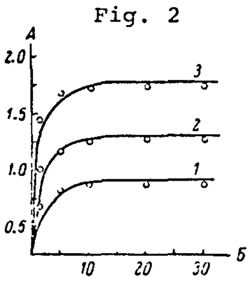

Fig. 2

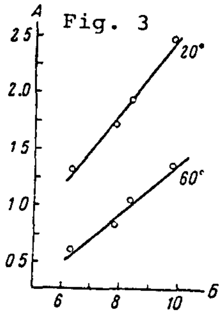

Fig. 3

Figure 1. Dependence of solubility of ozone on temperature at introduction of oxygen in the ozone generator at 25 liters per hour and on the concentration of ozone in the O_2/O_3 mixture. Sulfuric acid concentration of 10g/ℓ. A-axis is the solubility of ozone x 10^6 in mol/cm^3. B-axis is temperature in °C. The four lines are for volume per cent of O_3 in the O_2/O_3 mixture: 1-6.3; 2-7.8· 3-8.3; 4-9.7.

Figure 2. The solubility of ozone in H_2SO_4 solution of 10g/ℓ at different temperatures and at different concentrations of ozone in the O_2/O_3 mixture. A-axis is the solubility of ozone x 10^6 in mol/cm^3. B-axis is time in minutes. The three lines are for temperature in °C and for volume per cent of O_3 in the O_2/O_3

continued on following page

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

An O_3/O_2 mixture was bubbled through sulfuric acid solution. Ozone in gas and liquid phases was determined by an iodometric method.

SOURCE AND PURITY OF MATERIALS;

(1) From O_3 generator.

(2,3) No details given.

ESTIMATED ERROR:

REFERENCES:

COMPONENTS:	EVALUATOR:
(1) Ozone; O_3; [10028-15-6] (2) Sulfuric acid; H_2SO_4; [7664-93-9] (3) Water; H_2O; [7732-18-5]	Merkulova, V.P.; Lovchikov, V.S.; Ivanovskii, M.D. *Zh. Prikl. Khim.* 1972, *45*, 1608-9.

EXPERIMENTAL VALUES: continued

mixture: 1-60°C, 7.8%; 2-20°C, 6.3%; 3-20°C, 7.8%.

Figure 3. The dependence of ozone solubility in H_2SO_4 solution (10g/*l*) on the concentration of ozone in the O_2/O_3 mixture. A-axis is the solubility of ozone x 10^6 in mol/cm^3. B-axis is the volume per cent of O_3 in the O_2/O_3 mixture.

COMPONENTS:

(1) Ozone; O_3; [10028-15-6]

(2) Various solvents (see below)

ORIGINAL MEASUREMENTS:

Aleksandrou, Yu.A.; Tarunin, B.I.; Perepletchikov, M.L.

Zh. Obshch. Khim. 1976, *46*, 3-5.

VARIABLES:

T/K = 298

PREPARED BY:

R. Battino

EXPERIMENTAL VALUES:

Solvent[a]	L[b]
25°C (298K)	
Tetrachloromethane; CCl_4; [56-23-5]	1.96
Acetic acid; $C_2H_4O_2$; [64-19-7]	1.83
Acetic anhydride; $C_4H_6O_3$; [108-24-7]	1.89
1,1,2,2-Tetrachloroethane; $C_2H_2Cl_4$; [25322-20-7]	1.77
Trifluoroacetic acid; $C_2HO_2F_3$; [76-05-1]	2.3
Trichloromethane; $CHCl_3$; [67-66-3]	2.12
Methyl acetate; $C_3H_6O_2$; [79-20-9]	1.63
1,2-Dichloroethane; $C_2H_4Cl_2$; [1300-21-6]	1.95
1,1,2-Trifluoro-1,2,2-trichloroethane; $C_2Cl_3F_3$; [76-13-1]	2.06
CCl_4+$CHCl_2CHCl_2$ (14%)	2.01
CCl_4+$CHCl_2CHCl_2$ (33%)	1.99
CCl_4+$CHCl_2CHCl_2$ (55%)	2.08
CH_3COOH+C_2H_5COOH (62%)	1.93
Propionic acid; $C_3H_6O_2$; [79-09-4]	1.95

continued on following page

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The oxygen/ozone mixture was bubbled through the solvent being investigated. The ozone content was determined spectrophotometrically at 254nm in a flow cell. Extinction coefficients are given in the original paper. Henry's law was found to hold in all cases.

SOURCE AND PURITY OF MATERIALS:

(1) Prepared in a laboratory ozonizer from carefully dried oxygen.

(2) Solvents were "chemically pure" grade and purified further by distillation.

ESTIMATED ERROR:

$\delta L/L = \pm 0.03$, compiler's estimate.

REFERENCES:

COMPONENTS:

(1) Ozone; O_3; [10028-15-6]

(2) Various solvents (see below)

EVALUATOR:

Aleksandrou, Yu.A.; Tarunin, B.I.; Perepletchikov, M.L.

Zh. Obshch. Khim. 1976, *46*, 3-5.

CRITICAL EVALUATION: continued

Solvent	L^b
$H_2O+C_2H_5COOH$ (95%)	1.56
$H_2O+C_2H_5COOH$ (90%)	1.28
$H_2O+C_2H_5COOH$ (80%)	0.89
$H_2O+C_2H_5COOH$ (60%)	0.56
$H_2O+C_2H_5COOH$ (50%)	0.32
$H_2O+C_2H_5COOH$ (30%)	0.24
Water; H_2O; [7732-18-5]	0.20

[a] Composition probably in mol per cent.

[b] Ostwald coefficient. Ratio of concentration of ozone in solution to its concentration in the gas phase.

SYSTEM INDEX

Underlined page numbers refer to evaluation text and those not underlined to compiled tables. All compounds are listed as in Chemical Abstracts. For example, toluene is listed as benzene, methyl- and dimethylsulfoxide is listed as methane, sulfinylbis-. For the sake of brevity the oxygen is assumed to be the dissolving gas and is not explicitly stated as a component. On the other hand when ozone is the dissolving gas, it is explicitly stated as a component.

REGISTRY NUMBER INDEX

Underlined page numbers refer to evaluation text and those not underlined to compiled tables.

AUTHOR INDEX