dation, the Environmental Protection Agency, the Donors of the Petroleum Research Fund administered by the American Chemical Society, Union Carbide Corporation and Gulf Oil Chemicals Company. □

NOTATION

3c = total number of external degrees of freedom per molecule
$\triangle E_{vap}$ = energy of isothermal vaporization from the saturated liquid to the ideal gas
f = fugacity
H = Henry's constant for a gaseous solute in liquid ammonia
k = a proportionality constant (Figure 8)
k = Boltzmann's constant (Figure 13)
$\underline{K}$ = distribution coefficient for a solute between water and an organic liquid phase
l = a binary parameter characterizing deviation from the geometric-mean assumption
$\overline{M}_N$ = number-average molecular weight
N = number of polymer molecules
Nr = number of polymer segments (or monomers)
P = total pressure
Ps = saturation (vapor) pressure
P* = a characteristic molecular parameter having units of pressure
q = a molecular size parameter
R = gas constant
T = absolute temperature
T* = a characteristic molecular parameter having units of temperature
U = attractive energy of one mole of solute molecules at very high dilution in a liquid solvent
v = liquid molar volume (Figure 1)
v = volume per segment (Figure 13)
$\overline{v}$ = partial molar liquid volume
V = total volume (Figure 13)
V* = characteristic (hard-core) volume, per mole
w(M) = frequency of molecular weight M in molecular-weight distribution
v* = characteristic (hard-core) volume per segment
x = liquid-phase mole fraction
y = vapor-phase mole fraction
$\alpha^{\infty}_{B/H}$ = relative volatility of benzene infinitely dilute in hexane
δ = solubility parameter
ϕ = vapor-phase fugacity coefficient
γ_1 = activity coefficient (normalized such that $\gamma_1 \rightarrow 1$ as $x_1 \rightarrow 1$)
γ_i^* = activity coefficient (normalized such that $\gamma_i^* \rightarrow 1$ as $x_i \rightarrow 0$)

LITERATURE CITED

1. Funk, E. W. and J. M. Prausnitz, Ind. Eng. Chem. *62* 8 (1970).
2. Lynn, S., C. G. Alesandrini and A. D. Sherman, IEC Proc. Des. & Devel. *12* 217 (1973).
3. Alesandrini, C. G., S. Lynn and J. M. Prausnitz, IEC Proc. Des. & Devel. *11* 253 (1972).
4. Chueh, P. L. and J. M. Prausnitz, Ind. Eng. Chem. *60* 34 (1968).
5. Lee, C. S., J. P. O'Connell, C. D. Myrat and J. M. Prausnitz, Can. J. Chem. *48* 2993 (1970).
6. Lyckman, E. W., C. A. Eckert and J. M. Prausnitz, Chem. Eng. Sci. *20* 685 (1965).
7. Won, K. W. and J. M. Prausnitz, AIChE Journal *20* 1187 (1974).
8. King, C. J., J. P. Earhart, K. W. Won and J. M. Prausnitz, "Extraction of Chemical Pollutants from Industrial Wastewaters with Volatile Solvents", report submitted to the Environmental Protection Agency, Ada, Oklahoma (1975).
9. Bonner, D. C., D. P. Maloney and J. M. Prausnitz, IEC Proc. Des. & Devel. *13* 91 (1974). Erratum *13* 198 (1974).
10. Maloney, D. P. and J. M. Prausnitz, IEC Proc. Des. & Devel. *15* 216 (1976) and AIChE Journal *22* 74 (1976).

ChE books received

The History of Quantum Theory, Friedrich Hand, translated by Gordon Reece. Published by Barnes and Noble, New York, 260 pages. This book provides a survey of the history of quantum theory for students and those who may not have much knowledge of quantum theory.

Elementary General Thermodynamics, M. V. Sussman. Published by Addison-Wesley Publishing Co., Reading, MA, 444 pages. This book presents a broad introduction to thermodynamic thought and methodology, and applications to many branches of engineering and science.

Process Engineering with Economic Objective, G. L. Wells. Published by Halsted Press, div. of John Wiley & Sons, New York, 168 pages. This guide to process engineering with economic objective serves as an introduction and to integrate the fuller instruction available from specialist texts.

Professional Obsolescence, edited by S. S. Dubin. Published by Lexington Books, div. of D. C. Heath & Co., Lexington, MA, 121 pages. This book is a record of a symposium on combatting professional obsolescence held at Churchill College, Cambridge (1970) under auspices of the Scientific Affairs Office of NATO.

Physical Properties of Inorganic Compounds—SI Units, A. L. Horvath. Published by Crane, Russak & Co., New York, 466 pages. In this book the essential physical properties of thirty one elements, and compounds which are needed by design engineers are presented in graphical and tabular form.

Statistics for Technology, Christopher Chatfield. 1975 reprint of Halsted Press, div. of John

Continued on page 75.

Sol Weller did his undergraduate work at Wayne and obtained his Ph.D., from the University of Chicago in 1941, under the Nobel Prize winner in physics, James Franck. After serving the N.D.R.C. and the Manhattan Project during W.W. II, he conducted research at the Bureau of Mines. He was head of fundamental research at Houdry Process Corp., then he joined the Aeronautic Division of Ford (later Philco-Ford). He came to SUNY/Buffalo in 1965 as professor of chemical engineering. He has contentedly pursued research in kinetics and catalysis in Buffalo since then, except for pleasant interludes as visiting professor at Berkeley, U.N. technical expert in Haifa, and Fulbright lecturer in Madrid.

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the following expression for the rate constant:

$$k = 9.55 \times 10^5 \exp(-14{,}200/RT) \qquad (2)$$

This is also consistent with the 25° value of Laidler and Chen.

We have found it convenient to use a solution that is initially 1M in both acetamide and sodium hydroxide, prepared by mixing equal volumes of the corresponding 2M solutions. The batch reaction is conducted in a multineck flask, immersed in a thermostatted water bath, and equipped with a variable speed stirer; 0.1 N HCl and NaOH are used for the determination of unreacted NaOH in 2 ml. aliquots, removed periodically by pipette. Some feeling for the frequency of sampling can be obtained by observing that the half-time for reaction at 50°C., for an initial concentration of 1M for both reactants, is about 1.2 hr. Since the reactants are present in equimolar ratio, the rate constant is evaluated by any standard rectifying plot: e.g., $1/C_{NaOH}$ vs. t. Figure 1 shows such a plot for a run conducted at 47.5°C by a student group. The slope corresponds to a value of $k = 1.10 \times 10^{-2} l$ mole^{-1} min^{-1}, or $1.83 \times 10^{-4} l.$ mole^{-1} sec^{-1}.

Some of the important sources of error are:

• Preparation of the stock solution of acetamide by weighing directly from the bottle. Acetamide is hygroscopic. If concentration is to be determined by weight, the material should be vacuum-dried first (m.p. = 82°C). Alternately, the concentration may be determined by allowing the alkaline hydrolysis with a known excess of NaOH to proceed to completion, with subsequent titration of residual alkali.

• Non-reproducible technique in the use of a 2 ml. pipette. (Practice with this might be educational for the chemical engineering student who lacks prior exposure to an analytical chemistry laboratory.)

•Failure to equilibrate the two initial solutions at reaction temperature before mixing.

One caution: NH_3 is slowly produced in the reaction. The laboratory should be adequately ventilated, therefore, especially when the reaction is run at temperatures above 50°.

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REFERENCES

1. Eisen, E. O., Minisession on Teaching of Undergraduate Reaction Kinetics, AIChE Meeting, Washington, D.C., December 4, 1974.
2. Willems, M. and Bruylants, A., *Bull. Soc. Chim.* Belg. *60*, 191 (1951).
3. Laidler, K. J. and Chen, D., *Trans. Far. Soc. 54*, 1026 (1958).

BOOKS RECEIVED

Continued from page 68.

Wiley & Sons, New York, 359 pages. The purpose of this book is to acquaint the reader with the increasing number of applications of statistics in engineering and the applied sciences.

Patterns of Problem Solving, Moshe F. Rubinstein. Published by Prentice-Hall, Inc., Englewood Cliffs, NJ, 544 pages. The material in this book was developed while teaching a compus wide interdisciplinary course, "Patterns of Problem Solving." The book attempts to provide the reader with tools and concept which are most productive in problem solving and are least likely to be eroded with the passage of time.

Thermoplastics - Properties and Design, Edited by R. M. Ogorkiewicz. Published by Wiley-Interscience, New York, 248 pages. This book sets out to provide an understanding of the principles underlying the properties of plastics, and also of the design problems associated with plastics in a way that will appeal to designers and engineers. □