

## Book Reviews

**Physical Chemistry for the Life Sciences. Second Edition.** By Gordon M. Barrow. McGraw-Hill Book Company, New York. 1981. xi + 468 pp. \$23.95.

Within the past 15 years a number of physical chemistry texts have been published that are designed specifically for students of the biological sciences. These texts were written for one-semester courses and were not actually intended for use by chemistry majors who normally would take a 1-year course in traditional physical chemistry. The particular group for whom Gordon Barrow's book is directed is not made clear in the preface. While there is considerable duplication of the material found in a standard 1-year physical chemistry text (as one might expect), the application in this book of physical chemistry to problems of a biological nature is extensive, exhaustive, and evenly done. The extent and complexity of the mathematics used is comparable to that found in more traditional physical chemistry texts. Unfortunately, this may place the book at a level of mathematical sophistication beyond that acquired by the average biology student. The mathematics is presented in the form of segmented "notes" at the ends of Chapters 1-4, 6, and 8. These "notes" cover unit conversions, natural logarithms, differential and integral calculus, factorials, and certain expansion expressions. While the "notes" are clear and well written, they may not be adequate to prepare the student lacking formal training in calculus.

The book has a strong thermodynamics emphasis (as is the stated intent of the author). The first four chapters are involved with gas laws, kinetic theory of gases, energy, enthalpy, entropy, and free energy considerations. Chapters 5-7 deal with various aspects of equilibrium, including a lengthy discussion on substrate binding in Chapter 6. Chapter 8 is entirely devoted to an involved and thorough treatment of transport phenomena, including Fick's laws, Stokes' law, sedimentation, viscosity, and electrophoresis. While the presentation of this material is straightforward, the mathematics used would be challenging and may well prove to be intractable for most biology students. The remaining chapters (9-12) deal with kinetics (reaction rates and mechanisms), quantum mechanics and spectroscopy (with an unusually heavy theoretical emphasis for a book of this type), and crystalline structure (with an extensive section on the interpretation of diffraction patterns).

Nuclear chemistry and its applications are entirely left out of this book. The discussion of ORD and CD (Chapter 11) is much too brief and of little practical value.

There are 191 end-of-chapter problems; answers are provided for 148 of these. Approximately 40% of the questions are biologically or biochemically related. There are also 35 worked-out examples contained in the body of the text. For a book of this nature, the problems are too few (compare with the Williams/Mattice/Williams text that offers nearly 300 problems).

In summary, although the book is well written, up-to-date, thorough, and complete (with the exceptions noted) it appears suitable mainly for advanced students in the life sciences who already have a firm background in mathematics and some physics. For others, it may be quite useful as a "reference" book dealing in depth with the physical chemistry involved in the life sciences.

Robert Desiderato, North Texas State University

**Rearrangements of Ground and Excited States. Volume 3.** Edited by Paul de Mayo (University of Western Ontario). Academic Press, New York. 1980. xii + 607 pp. \$89.00.

The multitude of molecular rearrangements that occur in the excited state are explored in a collection of essays in this volume of the series, which, in turn, is part of another distinguished series of monographs titled "Organic Chemistry" under the general editorship of Harry H. Wasserman. The essays, written by a panel of photochemists each of whom has made major contributions in the area that he reviews, are exceptionally well organized and thorough, and some even include notes added in proof, bringing up to date the experimental results that are described or reporting on new experimental work done to clarify earlier observations that defied mechanistic interpretation.

The subjects reviewed are Chemical Generation of Excited States by N. J. Turro and V. Ramamurthy, Cis-Trans Isomerization of Olefins by J. Saltiel and J. L. Charlton, Photochemical Rearrangements in Trienes by W. G. Dauben, E. L. McClinnis, and D. M. Michno, The Di- $\pi$ -methane (Zimmerman) Rearrangement by H. E. Zimmerman, Photochemical Rearrangements of Enones by D. I. Schuster, Photochemical Rearrangements of Conjugated Cyclic Dienones by K. Schaffner and M.

Demuth, Rearrangements of the Benzene Ring by D. Bryce-Smith and A. Gilbert, Rearrangements via Biradicals of Simple Carbonyl Compounds by P. J. Wagner, Photochemical Rearrangements Involving Three-Membered Rings by M. Nastasi and J. Streith, Photochemical Rearrangements of Five-Membered Ring Heterocycles by A. Padwa, and Photochemical Rearrangements of Coordination Compounds by Franco Scandola. Thus, the literature (through 1978, with a few references to publications in 1979) of many of the classical reactions of photochemistry is authoritatively reviewed here. Critical evaluations of different mechanistic interpretations of the experimental data are especially important and welcome features of the essays. Good diagrams and reaction schemes, as well as a subject index and a detailed table of contents, make browsing in this book attractive and fruitful. Even a brief excursion into its pages serves to remind one of the rapid increase in volume and in sophistication during the last 20 years of research in photochemistry.

Seyhan N. Ege, University of Michigan

**A Bibliography of *ab initio* Molecular Wave Functions. Supplement for 1978-1980.** By W. G. Richards, P. R. Scott, V. Sackwild, and S. A. Robins (Oxford University). Clarendon Press; Oxford University Press, New York. 1981. xxxix + 463 pp. \$78.00.

This is the third supplement to the bibliography of *ab initio* molecular wave functions. It covers the period 1978-1980. The organization of the book is similar to that of the previous one. The molecules are grouped according to their size: diatomic, triatomic, and then tetraatomic molecules. A large part of the book is devoted to polyatomic molecules and bimolecular systems. An entire section is devoted to the study of reactions. Bimolecular reactions and reactions occurring within a single entity are both considered. For each molecule of system, a brief annotation illuminates the content of the article. A table of contents at the beginning and an index at the end of the book provide an efficient way to find the requested system among the impressive number of articles quoted.

The book will certainly be a major tool of theoretical chemists and also other chemists interested in theoretical results. Although the necessity of storing the results on a computer file becomes more obvious every day, this book offers an alternative and pleasant approach to somebody who has no immediate access to a computer terminal.

O. Eisenstein, University of Michigan

**Basic Analytical Chemistry.** By L. Pataki and E. Zapp (Institute of Inorganic and Analytical Chemistry, Eötvös Loránd University). Pergamon Press, Oxford, England. 1980. xiii + 463 pp. \$38.00.

"Basic Analytical Chemistry" represents Volume 2 of the Pergamon Series in Analytical Chemistry. It has been translated from Hungarian by Gy. Jalsovszky.

The book is divided into six main chapters with each chapter subdivided into several sections.

Chapter 1 covers chemical equilibria in solution. The discussion in section 1 covers electrolyte dissociation, equilibrium constants, activity and activity coefficients, and ionic strength. Section 2 covers acid-base reactions, with a discussion of the different acid-base theories. Also covered is a good description of the pH dependence of solutions of strong and weak acids and bases and multibasic acids and multiacidic bases. Section 3 covers complex formation equilibria. Precipitation formation reactions are discussed in section 4. Redox reactions and partition equilibria are discussed in sections 5 and 6, respectively.

A feature not normally covered in any detail in modern texts on analytical chemistry is qualitative chemical analysis. The authors have included this topic in a quite coherent fashion in Chapter 2. Group reactions for cations and anions are discussed. Also included is a discussion of the most commonly used systems in qualitative analysis.

The classical quantitative chemical analysis approaches, such as gravimetry and titrimetry, are covered in Chapter 3. Instrumental methods of analysis are covered in Chapter 4. Most of the sections are fairly brief, but are well written and highlight the primary features of each technique.

Separation methods are covered in Chapter 5. The emphasis is on classical methods of separation with only a brief discussion of gas-liquid chromatography. The topic of high-pressure liquid chromatography has not been addressed.

Chapter 6 covers the analysis of organic compounds. Methods for elemental analysis and the analysis of functional groups have been included. Appendixes I, II, and III list  $K_a$  and  $pK_a$  values for some compounds in water, some standard redox potentials, and organic reagents

for the detection of anions and cations, respectively.

In attempting to condense what is normally covered in several volumes into one text of manageable size, the authors have, of necessity, been brief in most of the topics addressed. However, the discussions are highly cogent in their conciseness.

One aspect of the book that may be a limitation if it is to be used as an undergraduate text is the absence of problems at the ends of the chapters and the limited number of examples in the text itself. The text is very readable and would be a useful addition as a reference text to the libraries of practicing analytical chemists.

R. Ken Forcé, *University of Rhode Island*

**Oxygen and Life.** By the Royal Society of Chemistry, London. 1981. xii + 224 pp. £11.00.

This book is a collection of papers presented at the Second British Oxygen Company Priestly Conference in Birmingham, September 15–18, 1980. Numerous conferences on oxygen in living systems have been held during the last few years and a large number of such symposium volumes have appeared. This one is unusual in its broad scope and the general interest of many of the papers. The subject of many of the papers in this conference has not come up at many other symposia. The Priestly lecture on Mars, Biogenesis, and the Role of Oxygen, by G. A. Soffen, Director of Life Sciences, NASA, is particularly interesting for a general audience. R. J. P. Williams also has an outstanding introductory lecture entitled *Oxygen and Life: An Introduction*, which ties together in an understandable and clear way the role of metals and their redox potentials in mediating reactions of oxygen in nature. The paper by M. Calvin on The Photoactivation of O and the Evolution of O<sub>2</sub> would also be particularly interesting for the nonspecialist. The volume also covers topics as diverse as manganese porphyrins as sensitizers for photooxidation of water to oxygen, the exploitation of molecular oxygen by human neutrophils, the use of perfluoro chemicals as blood substitutes, and mechanisms of action of several oxygen transporters and oxygenases; it concludes with a wry toast to Joseph Priestly by C. Beale, Pro-Chancellor of the University of Birmingham. (It should be remembered that Priestly's stay in Birmingham was terminated by religious riots: Professor Calvin's lecture expresses his thanks to Birmingham for its contribution to American Science for sending Priestly to the United States!)

In all, this book is a symposium volume of much more than the usual general interest at a modest price, even for an offset volume in a soft binding.

Christopher S. Foote, *University of California, Los Angeles*

**Topics in Current Physics. Mössbauer Spectroscopy. Volume II.** Edited by U. Gonser (Universität der Saarlandes). Springer-Verlag, Berlin, Heidelberg, and New York. 1981. xii + 196 pp. \$29.80.

Subtitled "The Exotic Side of the Method", this work presents some of the unconventional uses of the Mössbauer effect. It is intended to broaden the perspective offered in the earlier volume "Topics in Applied Physics (Volume 5), Mössbauer Spectroscopy", which focused on the more familiar applications of the method. Following a brief introduction by U. Gonser to the Mössbauer effect, R. L. Mössbauer, F. Parak, and W. Hoppe describe their technique for solving the well-known phase problem in X-ray structure determination of large biological macromolecules. The method takes advantage of the interference of  $\gamma$  quanta scattered by atoms in a crystal of the macromolecule with that due to Mössbauer scattering from <sup>57</sup>Fe nuclei implanted in the structure. Initial results from single crystals of myoglobin are described along with some technical problems that have been recognized.

In Chapter 3, R. V. Pound reviews the use of the Mössbauer effect in studying the gravitational red shift. After an introduction to the red shift, a discussion of the specific details of experiments designed by the author to detect the phenomenon is presented. Pound describes the results obtained so far and suggests improved approaches for new experiments.

Trends in the Development of the Gamma Laser by V. I. Goldanskii, R. N. Kuzmin, and V. A. Namiot examines current efforts aimed at the title device making use of transitions between nuclear energy levels to produce stimulated  $\gamma$  emission. The theoretical basis for the proposed device is reviewed with emphasis on the Mössbauer effect with use of pulse-pumping or long-lived isomers. The authors conclude with a specific list of experimental tasks which they believe are needed to verify the

theory and lay the foundation for the technical development of the  $\gamma$  laser.

Chapter 5, Nuclear Resonance Experiments with Synchrotron Sources by R. L. Cohen, explores the use of synchrotron radiation to carry out Mössbauer effect and other nuclear resonance experiments. The unique characteristics of such radiation are examined in the context of the requirements of the method. Consideration is given to both disadvantages, such as the relatively large bandwidth, and advantages, such as the possible use of the radiation to observe the Mössbauer effect in nuclei such as <sup>19</sup>F and <sup>40</sup>K which have no available radioactive parent species for sources.

Resonance Y-Ray Polarimetry by U. Gonser and H. Fischer is a fairly detailed account of the origin and effects of polarization of Mössbauer  $\gamma$  radiation. The design and operation of Mössbauer polarimeters is described, including illustrative spectra and results from amorphous metal ribbons.

Iron-Ion Implantation Studied by Conversion Electron Mössbauer Spectroscopy by B. D. Sawicka and J. A. Sawicki presents the application of a specialized Mössbauer technique for investigation of surfaces modified by <sup>57</sup>Fe ion bombardment. After a review of iron-ion implantation, the authors report on their use of conversion electron Mössbauer in the study of the iron environment in bombarded surfaces of various metals, semiconductors, and insulators. The reader will encounter grammar and syntax lapses in this chapter.

R. S. Preston and U. Gonser in Chapter 8, Selected 'Exotic' Applications, offer glimpses of "odd and strange examples", a few of which are redundant with earlier chapters. Included are applications involving tests of relativity, detection and measurement of small motions of macroscopic objects, modulation of  $\gamma$ -ray quanta, atmospheric aerosols, archaeology, art, medicine, and biology. The remarkable ingenuity shown in some of the cited examples such as the use of Mössbauer spectroscopy to study the breathing and related motions of the abdomens of ants demonstrates the outstanding versatility and potential of the method.

The final chapter, The Discovery of the Magnetic Hyperfine Interaction in the Mössbauer Effect, by S. S. Hanna contains interesting reminiscences of the early investigations by the author and co-workers at Argonne National Laboratory of magnetic hyperfine splitting in Mössbauer spectra.

"Mössbauer Spectroscopy" should serve as a useful review and reference source for researchers and students of the physical aspects of Mössbauer spectra. It should be especially valuable to those seeking to apply the technique to problems in other disciplines.

R. A. Geanangel, *The University of Houston*

**Monohydric Alcohols. ACS Symposium Series. No. 159.** Edited by Edward J. Wickson (Exxon Chemical Co.), American Chemical Society, Washington, D.C. 1981. 222 pp. \$31.00.

This ACS Symposium Series volume is based on the Division of Industrial and Engineering Chemistry Program at the 179th ACS Meeting in Houston, March 1980. The 13 chapters in this volume deal with various aspects of the preparation and end uses of monohydric alcohols. The stated objective of this symposium was not to cover all alcohols but rather to cover representative lower and higher alcohols with special attention paid to new developments and applications.

The basic industrially significant alcohol reactions such as dehydration, esterification, reductive amination, and oxidation are covered in the first chapter. The next few chapters cover methanol, its manufacture from syn-gas or wood (a status report on the Brazilian methanol project), and its present and projected utilities. The production of ethanol by synthetic and fermentation methods is then discussed, with a chapter devoted to the economics and politics involved with gasohol. The preparative chemistry of higher alcohols is examined in chapters on Oxo and Ziegler processes and a chapter on the rhodium Oxo process to prepare 1-butanol and 2-ethylhexanol. The uses of such alcohols are then examined in chapters on surfactants from long-chain primary and secondary alcohols, automotive lubricants from diesters, and ester plasticizers for PVC. The volume ends with a chapter on alcohol use in the flavor and fragrance industry.

This is a specialized and timely book which will find a place on library shelves, but will penetrate the personal library of only those involved in alcohol production.

P. E. Garrou, *Dow Chemical—New England Laboratory*