Book Reviews *

Water, A Comprehensive Treatise. Volume 6. Recent Advances. Edited by F. Franks (University of Cambridge). Plenum Press Publishers, New York. 1979. xiv + 455 pp. $45.00.

The sixth volume of this comprehensive treatise concerning water is dedicated to the recent advances in the physics and chemistry of water and aqueous systems. Topics going from experimental results on organic reactions to theoretical mathematical models are included.

The first chapter summarizes the use of X-ray and neutron scattering by aqueous solutions of electrolytes. After describing the basic problems appearing in scattering radiation through a solution, the authors present the structural information that can be derived. As the authors say, it is now possible to answer in a definite way specific questions relating to the number of water molecules in the first coordination shell and the orientation of the molecule with respect to the ion–oxygen axis.

The second chapter is dedicated to water in protein crystals. Water is the major component of living tissue and crystalline proteins contain a large percentage of water. The structural information provided by X-ray and neutron diffractions can be used to test the predictions of any solvent–protein interaction model. The authors develop extensively the position and influence of water molecules in various proteins. The role of water on the conformation of the protein chain is discussed.

The third chapter summarizes the effort of theoretical ab initio calculations in the problem of molecular hydration. It is now possible to calculate polymers of water and solvated ions and molecules with either the supermolecule approach or the continuum or statistical approaches which are briefly described as they are more developed in other chapters.

Chapter 4 describes the influence of mixed aqueous solvent effects on kinetics and mechanisms of organic reactions. Water and highly aqueous mixed solvents display amazing solvent effects, which are especially important to understand, since biological processes take place in aqueous solution. Numerous examples of kinetic solvent effects are given. Results are discussed in terms of thermodynamic quantities.

Chapter 5 gives the point of view of modern physics on solvent structure and hydrophobic solutions. The relations between thermodynamic quantities and solvent–solute distribution functions are explored to provide a link between solvent structure and solution properties. The effect of solvent structure on long-range forces and short-range solute–solute interactions are discussed. An alternative model given by the mean-field theory that has been used in biological problems is described.

The last chapter is devoted to computer simulation of water and aqueous solutions. Due to the increasing computing facilities, this approach is nowadays highly used. When a Monte Carlo sampling of points in classical configuration space and an initial statement of the total intermolecular potential energy are used, it is possible to perform computer simulations of thermodynamic functions. The models that have been used for the water molecule are described. They are of two types: empirical models with constructed potential functions or ab initio quantum mechanical SCF calculations. Some results concerning pure water and aqueous solutions are presented. In the appendix, a Fortran program to perform a molecular dynamics simulation is provided.

This book is certainly very useful for anybody interested in the latest developments in the analysis of solutions.

O. Eisenstein, *The University of Michigan*

Gas Solubilities. Widespread Applications. By W. Gerrard (The Polytechnic of North London). Pergamon Press, Oxford. 1980. xxi + 497 pp. $67.50.

In his Preface, the author's first sentence states: "The solubility of gases in liquids has been a troublesome subject." Over the 178-year history of the subject, it must be acknowledged that the confusion of terms, units, and relationships (both theoretical and empirical) found in the literature present an almost insurmountable obstacle to anyone attempting to obtain information on a real solute–solvent system. Unfortunately, for the monumental amount of solubility data that the author has evaluated and reduced, this book adds to the confusion.

A most perplexing issue raised in his discussion Terms and Symbols preceding Chapter 1 is the author's attempt to refute the utility of the ideal solution and the applicability of Raoult's and Henry's laws. In Chapter 1, What is Henry's Law?, it is difficult to find the answer. The historical review provided in this chapter amply illustrates the confusion found in the literature. Instead of relating solubilities in terms of Henry's and Raoult's laws, all isothermal data are presented graphically in plots of the equilibrium partial pressure of a solute, p_A, vs. the mole fraction solubility, N_A, of solute gas. Isotherms over the experimental pressure range are drawn for each solvent (in many instances as relatively short line segments around 1 atm). These curves are compared to a so-called "reference line", or R-line (Raoult's line?), which passes through the origin and intersects the right vertical axis (at unit mole fraction) at the vapor pressure of the pure solute, p_A^0. For solutes above their critical point, p_A^0 is obtained by extrapolation. The three alternate methods describing how the extrapolation can be made are given in Chapter 2, Effect of Temperature on Gas Solubilities (p 49).

It appears that this book ignores all that has been enumerated in solution thermodynamics over the past 100 years. At the same time that the validity of Henry's law is denied, most of the solubility isotherms are drawn on the R-line graphs with linear slopes corresponding to Henry's law. When the author states that the important solution parameter should be the slope of the isotherm and not the Henry's law constant, he ignores the fact that the slope is the Henry's law constant since the slope and the right-hand intercept are equivalent on a mole fraction abscissa. The derivation based on the Gibbs–Duhem relation that demonstrates that the solute obeys Henry's law as long as the solvent obeys Raoult's law is similarly ignored. Temperature dependence of the solubility is given in p_A vs. t (°C) plots without any suggestion that the van't Hoff relation, ln K vs. $1/T$ (K), can provide the enthalpy of solution as a simple quantitative parameter defining the temperature dependence. Little discussion is included on enthalpies or entropies of solution, with most of what is covered in reference to the work of Hildebrand in Chapter 10.

Activities are mentioned in only five places according to the index. The discussion in Chapter 17, section 9, on Lewis and Randall's Calculation of Activity is not referenced in the index. It seems that the author's purpose in employing the "reference line" is to compare various solvents for a given solute by comparing the difference between mole fraction solubilities and the R-line mole fraction at, typically, 1 atm in p_A. Although all plots are said to be quantitative, interpolation of values from the graphs cannot be made with any precision. Since the majority of plots are in the Henry's law region, quantitative results could have been given in tables of activity coefficients. For all solvents, the activity coefficient, defined as the ratio of the mole fraction of the solute (at 1 atm) to the Raoult's law value at that mole fraction, equals the product of p_A^0 and the R-line difference. Thus no new information is obtained by the author's method.

The intervening chapters cover R-line analysis of solubilities of various non-metal gaseous oxides, hydrides, and halogenides. Chapter 16 covers gas solubilities of biotechnological interest. Although the title of the book states Widespread Applications and the author maintains that it is intended for "all those having interest and requirements in the concepts and disciplines of chemistry," this reviewer feels that both claims are exaggerated. The writing style is very informal and abounds in the first person singular. Much of the critical reviews of papers are assertions instead of refutations. The book is reproduced directly from the typescript at a rather prohibitive price that makes it unlikely to have wide appeal to individuals.

Paul E. Field, *Virginia Polytechnic Institute and State University*

Synthetic Fuels. By R. F. Probstein (MIT) and R. E. Hicks (Water Purification Associates). McGraw-Hill Publishers, New York. 1982. xiv + 490 pp. $29.95.

This book is part of the McGraw-Hill chemical engineering series and is intended for graduate students and as an introductory reference guide for professionals. After a brief introduction to the general properties and resources associated with coal, oil shale, and tar sands, two chapters deal with some of the aspects of chemical, physical, and conversion fundamentals common to all synthetic fuel systems. Building on this background, individual chapters deal with coal gasification, gas upgrading, liquids and clean solids from coal, oil shale and tar sands, and biomass conversion. The concluding chapters cover environmental and economic aspects of synthetic fuel development.

The background and fundamentals are dealt with clearly and in sufficient detail to support the main section of the book without being ponderous. Each chapter includes a list of references that should cover those areas not dealt with in detail or assumed as general knowledge. The variables associated with each of the synfuel technologies are presented as introductions to their respective chapters, before moving on to the specifics of conversion techniques, product slates, thermal and material

*Unsigned book reviews are by the Book Review Editor.

balances, advantages and disadvantages of all the systems described, etc. The degree of detail associated with the very wide range of topics covered is enhanced by the inclusion of over 290 figures and tables throughout the text. All the data are presented in SI units and there is a very useful set of appendices of conversion factors, symbols, and acronyms. A suitably detailed index, along with the methodical presentation of subject material, make it very easy to find specific information.

An important feature in this rapidly changing subject area is that the book presents a very up-to-date picture of the very diverse areas of current synthetic fuel development. The authors have succeeded in drawing together the fundamental aspects of a broad range of topics to produce a volume well-suited for use as a text and as a reference, which will be of value to the wide range of people associated with synthetic fuels.

Robert F. Gerlach, *Exxon Research & Engineering Co.*

Chemiosmotic Proton Circuits in Biological Membranes: In Honor of Peter Mitchell. Edited by V. P. Skulachev and Peter Hinkle. Addison-Wesley Publishing Company, Inc., Advanced Book Program, Reading, Mass. 1981. xviii + 663 pp. $29.50.

This book is a compendium of current research papers and reviews on proton-transport reactions. The volume is dedicated to the Nobel-laureate founder of the field on the occasion of his 60th birthday. The excellent introductory article by V. P. Skulachev on the Proton Cycle provides an historical overview of membrane-linked energy transmission. Mitchell's "chemiosmotic hypothesis" and the concept of $\Delta\tilde{\mu}_{H^+}$ are well presented in their simplicity and generality. (Note is made of the not-enough-appreciated fact that this form of energy is suitable for transmission in the cell over long distances in the specific direction of final utilization.) The rest of the articles are divided into two groups—studies of processes related to $\Delta\tilde{\mu}_{H^+}$ generation and those related to $\Delta\tilde{\mu}_{H^+}$ consumption.

This reviewer found the following papers particularly interesting and informative: Coupling Ratios of Proton Transport (P. C. Hinkle), The Cytochrome *b* Paradox (E. C. Slater), The Electron Path in Cytochrome Oxidase (Britton Chance), Biogenesis of the Mitochondrial Proton Translocating System (Gottfried Schatz), Proton Circuits in Chloroplasts (H. T. Witt), Bacteriorhodopsin Photocycle and Stoichiometry (Walther Stoeckenius, R. H. Lozier, and Roberto Bogomolni), Light Driven Sodium Pump (R. E. MacDonald), H^+ Transport in Stomach (G. Sachs), Concepts and Experiments in Bioenergetics (Efraim Racker), H^+-ATP Synthase (P. D. Boyer), Bacterial Symporters (I. C. West), ATP and H^+ Ion Transport (F. M. Harold and D. L. Heefner), and Proton Current and DNA Transport (L. Grinius). The last article of the volume (From Black-Box Bioenergetics to Molecular Mechanics: Vectorial Ligand-Conduction Mechanisms in Biochemistry) is by Peter Mitchell, the celebrity, whose contribution (according to the preface of the book) is in "the spirit of a reply to a toast". The first part of this article deals with the interesting but rather abstract topic of vectorial molecular mechanical theory of biochemical processes. In the second half a generalized mechanism for the phosphate-cation symport of cationmotive ATPases is presented and discussed.

Overall, the volume contains a well-balanced presentation (although I missed a discussion of the evolutionary aspects). The book will make excellent reading for those who are somewhat familiar with the "chemiosmotic hypothesis" and would like to review the current activity in the field. Naturally, it is the specialists in this particular research area who will benefit the most from this book. The extensive list of references at the end of each paper should be particularly useful to this group.

It appears assured now that references to $\Delta\tilde{\mu}_{H^+}$ will occur frequently in countless biochemistry papers and books for generations to come. Why the adherence then to this admittedly descriptive but very awkward symbolism? It is a typesetters' and typists' nightmare whose exactitude is constantly violated by all but the most perfectionist of users (even in the book reviewed!). Therefore, my birthday gift to Professor Mitchell is the suggestion of a new designation, entirely befitting our computer generation: $\Delta@ \equiv \Delta\tilde{\mu}_{H^+}$.

Eugene Hamori, *Tulane University*

Progress in Reaction Kinetics. Volume 10. Edited by K. R. Jennings and R. B. Cundall. Pergamon Press, Oxford. 1981. v + 404 pp. $82.50.

This volume, the continuation of an excellent series, contains three articles that may be loosely grouped under the heading "fast reactions".

Dynamics of Reactive Collisions, by Martin Levy, is an exhaustive review covering 252 pages and 1144 references through 1978. The coverage is limited to atom–molecule and molecule–molecule events, specifically excluding photodissociations and ion–molecule reactions. A 60-page introduction discusses experimental techniques (flash photolysis, discharge flow, chemical lasers, and a variety of beam methods) and theoretical work (potential surfaces and trajectory calculations as well simpler methods not using complete surfaces). The remainder is a thorough coverage of some 900 reactions, arranged according to the periodic table.

Reactive, Inelastic and Radiative Processes Involving Electronically Excited Atoms, by R. J. Donovan, is an illustrative rather than comprehensive view of the field. The author discusses the types of processes that can be involved in the removal of electronic excitation and some of the interesting and significant questions that are addressed in this area. The processes covered are the following: emission (spontaneous, stimulated, and collision induced); energy transfer (resonant and nonresonant electronic–electronic, energy pooling, electronic–translational and electronic–vibrational, rotational, and translational); ionization (collisional detachment, Penning and associative ionization, dissociative, and rearrangement); and chemical reaction (abstraction, insertion, and dissociative excitation). This paper will be useful to those wanting an overview, but less so to those looking for details of current research. It covers 46 pages with 101 references through 1978.

Luminescence Kinetics of Metal Complexes in Solution, by T. J. Kemp, is restricted, as the title implies, to a discussion of inorganic photochemistry. It is a survey of recent developments in the field and begins with a brief coverage of the theories of spectroscopy of inorganic species, nonradiative transitions, and electron-transfer processes of excited states. Rate equations are developed for some of these processes. A long section is devoted to Cr(III) chemistry, which is developed as a model for theoretical work as well as for its intrinsic interest. Platinum metal complexes are covered, and the article concludes with a discussion of porphyrins and some other organometallic complexes. The review covers 97 pages and has 256 references through 1978.

Clifford W. Hand, *University of Alabama*

Bioactive Organosilicon Compounds. Topics in Current Chemistry. Volume 84. By R. Tacke and U. Wannagat (Institute für Anorganische Chemie der Technischen Universität, Braunschweig) and M. G. Voronkov (Institute of Organic Chemistry, Siberian Division of the USSR Academy of Sciences, Irkutsk). Springer-Verlag, Berlin. 1979. iv + 144 pp. $48.40.

This volume, yet another useful addition to this fine series, reviews the new, growing field of bio-organosilicon chemistry. The two chapters describe the preparation and biological properties of many organosilicon compounds of wide structural diversity with an emphasis on silatranes. It is recommended reading for chemists in the fields of organosilicon and medicinal chemistry and is enjoyable perusing for those outside those fields.

Tacke and Wannagat give an excellent overview of the synthesis and properties of bioactive organosilicon compounds. After a brief discussion of the effects of the substitution of a silicon atom in organic compounds on the physical and chemical properties of the compounds, the authors describe three types of bioactive organosilicon compounds, namely: (a) silyl derivatives of bioactive organic compounds (N-, O-, and C-silylated drugs); (b) bioactive silicon compounds without organic analogues (e.g., silatranes, organosiloxanes, dialkylsilanediols, and alkylsilanetriols); and (c) "sila-pharmaca", i.e., compounds in which a silicon atom replaces a carbon atom in known biologically active agents. This last section is by far the most extensive and informative, providing data on more than 100 sila analogues of known active compounds with widely varying properties (e.g., muscle relaxant, insecticidal, anticholinesterase, antiseptic, antihistaminic, etc.). This chapter is very easy reading and provides useful information for both those directly engaging in medicinal research and those with only an ancillary interest.

In the second chapter, Voronkov summarizes the quite extensive work of his group on the biological properties of silatranes. Areas reviewed are the various effects of a large number of silatranes, e.g., toxicity, effects on blood, endocrine function, and enzyme activity, on plants, fowl, insects, and parasites. He also describes in detail the intriguing use of certain silatranes, e.g., 1-chloromethylsilatrane and 1-ethoxysilatrane, for the treatment of wounds and burns, for intensification of hair growth (treatment of alopecia), and as immunostimulants and antitumor agents. The presentation is quite detailed with a large amount of testing data.

As an addendum, the author index for Volumes 26–84 is included.

Michael E. Jung, *University of California, Los Angeles*

Metal Ions in Biological Systems. Volume 12. Properties of Copper. Edited by Helmut Sigel. Marcel Dekker, Inc., New York. 1981. XX + 384 pp. $57.50.

In recent years, interest in the biological chemistry of copper has expanded dramatically, which makes the introduction of this book timely. Volume 12 of this well-established series is devoted to presenting the fundamental properties of copper necessary to obtain an understanding of the biological systems that employ copper. Also included in this volume are discussions of several biological processes involving small copper complexes, such as the chemistry of copper transport. Reviews

of current research on copper-containing metalloproteins are reserved for the following volume of this series, Volume 13.

This book is divided into seven chapters of which the first two provide a detailed review of the properties of copper, including discussion of the coordination chemistry of the common oxidation states and their accompanying spectral properties. Chapter Two also contains a description of several cases in which copper(II) has been used as a probe to elucidate a particular metalloprotein active-site structure. A useful addition in this chapter is a compilation of the procedures used to prepare the apo (metal removed) and copper-substituted proteins.

Chapter Three provides a rather extensive review of the chemistry of copper(III). Included here is an account of a number of relatively long-lived copper(III)–peptide complexes. This is followed by some speculation concerning the participation of copper(III) in biological processes.

A summary of the current work that has been reported on low molecular weight complexes of copper that serve as models for metalloprotein systems is given in Chapter Four. In the next section, the possibility of in vivo oxidation of hemoglobin by copper(II) complexes is proposed based on a number of laboratory studies.

Chapter Six presents an interesting discussion of the transport of copper in mammals. In addition, two diseases are discussed that result from copper deficiency (Menke's disease) and copper overload (Wilson's disease) along with the up-to-date level of understanding of their mechanisms.

In the final chapter, the role of copper in alleviating the inflammation associated with rheumatoid arthritis is considered. The authors point out the association of the use of copper complexes in arthritis treatment with folklore and then go on to present the data substantiating the ability of copper complexes to reduce inflammation.

This well-written edition with its abundance of references is a must for workers in the fields of copper chemistry and bioinorganic chemistry. Further, it would be recommended for students and others with a general interest in inorganic chemistry, biochemistry, and metabolic chemistry.

Richard S. Himmelwright, *Polaroid Corporation*

Advances in Natural Products Chemistry. Extraction and Isolation of Biologically Active Compounds. Edited by L. Natori, N. Ikekawa, and M. Suzuki. John Wiley & Sons, Inc., New York: Kodansha, Tokyo. 1981. xii + 598 pp. $89.95.

One of the most important developments in natural products chemistry during the last 20 years has come from the understanding that bioactive natural products frequently are present in very small quantities in the tissues from which they are extracted and also that they often occur in the natural environment as molecular species that are labile to the conditions utilized in their extraction and isolation. Thus there has arisen a need for a handbook exemplifying the techniques available at the present time for the isolation of the fundamental bioactive natural compounds, i.e., the "true" natural products. This book readily fulfills this educational purpose by exemplifying, with the aid of chapters by a distinguished list of Japanese co-contributors, accurate and thoughtful descriptions of the techniques utilized in the isolation of a number of biologically active natural compounds. The coverage might appear at first glance to be extremely broad; in fact, the book serves as a compendium of techniques available to the natural products chemist for the isolation of biologically active substances, especially those polar and difficultly isolable materials whose isolation and structure determination form such an important part of modern natural products chemistry.

All natural product chemists will be indebted to the authors for such clear and particular descriptions of the procedures they have utilized for the procurement of these fascinating molecules. University and institutional libraries will require a copy, and those individual chemists engaged in this kind of work will find the book essential to their personal bookshelves.

Philip W. Le Quesne, *Northeastern University*

Inorganic Reaction Mechanisms. Volume 7. Edited by A. G. Sykes. The Royal Society of Chemistry, London. 1981. 442 pp. $200.25.

This volume, the seventh in the series begun in 1971, continues the tradition of giving to the practicing chemist a summary of the published kinetic information in the inorganic area during the past several months, in this case between January 1978 and June 1979. The editor and writers have limited the material to that for which there is numerical kinetic information, but have covered all areas of inorganic reaction kinetics, from electron transfer to bioinorganic to organometallic. The organization differs only slightly from previous volumes, but differs in what I perceive as a positive step toward providing a more useful tool. The sections under redox reactions have been divided into reactions between two metal ion complexes, between a metal ion complex and a nonmetallic reagent (including a separate chapter on reactions with organic substrates), and between two nonmetallic reagents. There is also a section not previously present on pulse radiolysis. The chapters on substitution reactions of metal ions cover their area strictly on the basis of coordination geometry, although the topic of octahedral substitution is divided into subtopics of aquation, base hydrolysis, formation reactions, and isomerizations; in addition several related sections on topics such as solvent exchange and solvent effects appear. Main-group elements and various reactions of organometallic elements are the subjects of several separate chapters. The editor has apparently realized the difficulties inherent in any such arbitrary choice of topics and has provided for a reasonable amount of cross-referencing to help the reader find additional discussion on a given topic.

A reader of this material is, on the one hand, overwhelmed by the enormous amount of information that is presented in a small space and, on the other hand, worries about the validity of many of the arguments that read "... an associative mechanism is favored", for the essentials of the arguments that couple those voluminous facts to the conclusions are of necessity missing. It was with gratification then that I sensed an increase (in this volume compared to previous ones) of the instances in which the reporters had taken the liberty to give their impressions of those missing arguments. This is especially true in Chapters 1, 2, 5, and 13 (even to the extent of "... but on the flimsiest of evidence"). This service by the reporters helps the reader assess the significance of a given piece of work.

I found this volume useful and up to the standards that this series has achieved. Only the price and the slowness of the writing and printing process—the material is already from 2.5 to 4 years old—temper that opinion.

R. G. Linck, *Smith College*

Developments in Polymer Degradation. Volume 3. Edited by N. Grassie (The University, Glasgow). Applied Science Publishers, Ltd., London. 1981. x + 321 pp. £30.

This volume is the third in a series of similar title, appearing about every 3 years, each edited very competently by Professor Grassie. The subject has some challenging academic aspects, and these volumes orient even the novice to various select chemical and physical methods applied to in-depth analysis of case examples of different polymer types. However, the greatest significance of the subject is the substantial economic import for polymers produced in such enormous volumes when information is won concerning the stabilization of such valuable materials. Some of the highlights a scientist will garner from reading the nine chapters follow.

The first chapter (W. W. Wright) compares the thermal and thermooxidative breakdown of polyimides. Most studies of the mechanism have concentrated on analysis of volatile degradation products that could number in the hundreds from a single sample. Even when the study is limited to a single polyimide, it is still apparent that the knowledge arising from the use of a variety of thermoanalytical techniques is an absolute necessity if a clear insight is to be obtained into the mechanisms involved. So too, from kinetic studies of chemical depolymerizations of thermolyzed polymer, the startling conclusion develops that as much as 50% of polymer units have undergone structural modification during the initial pyrolysis period of 2–3% sample weight loss. In the second chapter (D. W. Brazier) the newer and faster techniques of differential calorimetry (i.e. constant temperature, variable time) and differential scanning calorimetry (i.e., constant heating rate, variable temperature) are explored in the study of sulfur vulcanization and service aging of unsaturated elastomers. Objectives are quickly producing reliable process parameter profiles and gaining insight about the properties determining distribution of chemical linkages and nonbound compounds in the vulcanizates. The third chapter (N. C. Billingham, D. C. Bott, A. S. Manke) describes the use of the same calorimetric methods to investigate oxidation and stabilization of polymers, especially in terms of polypropylene in the presence of ten phenolic antioxidants. Limitations on the significance of the methods and details of a home-constructed DTA apparatus are also given.

The rather low stability of PVC to the influence of heat and light still raises difficulties with its use because of discoloration, HCl loss, and need for stabilization against its corrosiveness. Chapter 4 (D. Braun) discusses efforts to establish the chemical nature of structural aberrations in PVC that could serve as the defect origins influencing thermal stability. The mechanisms of oxidative and nonoxidative degradation are briefly recounted. The following chapter (W. H. Starnes, Jr.) describes efforts where ^{13}C NMR and chemical reduction with organotin compounds are used to identify tertiary halogens as structural defects responsible for the nonoxidative thermal degradation of PVC. The influences on fire retardance and smoke suppression by oxides of antimony and molybdenum, respectively, are briefly contrasted and rationalized. These last subjects are much more expansively reviewed in the ninth chapter of the book (C.

F. Cullis), which also describes the use of aluminum oxide, metal-containing borates, phosphates, chlorides, sulfates, carbonates, and bicarbonates, and various complexes.

The chemiluminescence accompanying thermal or photochemical oxidation can provide a sensitive new probe of the initial rates and activation energies of such free-radical reactions in solid polymers (G. A. George). This promising technique involves perturbing the steady state by changing the gas above the polymer, briefly irradiating the material, and observing the chemiluminescence as the nonstationary system relaxes toward a steady state. The method is dependent on the amplification of low intensities, and an apparatus for efficient photon counting of the oxyluminescence is described. The next chapter (G. Geuskens) relates the fairly well understood photooxidation of polystyrene. The generation of phenyl ketones as photosensitizers during polymer processing at 160 °C and the net effect on polymer tensile strength are covered. The free-radical abstraction and the chain scission chemistry involved are described, as well as the efficiencies of phenolic antioxidants and hindered amine light stabilizers. Wood and wood products are also subject to photochemical discoloration and degradation due to free-radical reactions of photooxidation, chain scission, dehydrogenation, dehydroxylation, and dehydroxymethylation. The eighth chapter (D. N.-S. Hon) describes ESR studies of the chemistry and mechanisms of the degradations, which appear to originate chiefly in the lignin content of wood but which also extend, via generated photosensitizers, to the cellulosic and hemicellulosic fibers.

This valuable book is written by specialists for specialists about rather special studies. However, it would serve the interests of a novice by the examples of problem solving approaches and the acute use of instrumentation. Presentation of the contents of each chapter is lucidly presented, well supported by graphs, figures, and tables, and very conveniently structured with an opening summary and a closing section of conclusions. This series serves a valuable function of centralizing information through expert reviews of new developments in an active field.

Frank Millich, *University of Missouri—Kansas City*

Applications of Glass Capillary Gas Chromatography. Edited by Walter G. Jennings (University of California). Marcel Dekker Inc. Publishers, New York. 1981. viii + 629 pp. $69.50.

The power of open tubular columns to perform complex separations makes this technique one of the most powerful tools available to the chromatographer. Thus chromatographers seek to understand how to make maximum use of and maintain an up-to-date knowledge of open tubular column technology.

"Applications of Glass Capillary Gas Chromatography" is an excellent source text for the information gas chromatographers find essential for use of open-tubular columns. It provides a detailed analysis of the theoretical development, methodology, and application of open-tubular columns. Included in this volume are methods for coating columns, equipment designs and modifications, and important applications detailing sample preparation and injection, columns, detectors, and qualitative/quantitative analysis techniques. This text also serves as a valuable reference library, citing over 1750 literature papers on open tubular columns.

Betty Moyers, *Hercules Inc.*

Annual Reports on the Progress of Chemistry. Section B. Organic Chemistry (1980). Volume 77. The Royal Society of Chemistry, London, 1981. xvii + 386 pp. $94.00.

The present volume in this series contains update reviews in 14 areas of general interest covering primarily the 1980 literature. The extent of Section B of the 1980 Reports has reverted to a more manageable 362 pages of text compared with 485 pages in the 1979 Reports. The first chapter contains a convenient table that shows the contents of Annual Reports for the past 6 years.

As in the previous volumes of the series, the authors have opted for completeness of coverage rather than critical discussion. Each chapter summarizes in a clear and concise manner a massive body of information that continues to be a valuable service to chemists.

Bahman Nasseri, *University of Michigan*

Treatise On Analytical Chemistry. 2nd Edition. Part I. Theory and Practice. Volume 7. Section H. Optical Methods of Analysis. Edited by P. J. Elving (University of Michigan), E. J. Meehan (University of Minnesota), and I. M. Kolthoff (University of Minnesota). Wiley-Interscience, New York. 1981. xxviii + 816 pp. $65.00.

Here is yet another volume of the consistently well done and definitive reference on Analytical Chemistry. Section H is part of the updated replacement for what was Section D-3 (Volumes 5 and 6) of the first edition.

The first three chapters by E. J. Meehan on Optical Methods. Emission and Absorption of Radiant Energy, Fundamentals of Spectrophotometry, and Spectroscopic Apparatus and Measurement have been revised to include current terminology and principles of new technology, for example, concave holographic gratings. These three chapters form a good fundamental basis for the remaining five chapters that cover specific methods in analytical spectrophotometry. All include new sections and references to recent developments in their respective areas.

Two chapters in this volume are concerned with molecular spectroscopy. Luminescence Spectrometry, by W. R. Seitz, has been expanded to cover the newly developing area of phosphorimetry as well as fluorimetry. This well-balanced coverage includes sections on structure–luminescence relationships and current applications such as fluorescence based detectors in chromatography. The 205-page short-course chapter, Infrared Spectroscopy, by A. L. Smith is commendable. One particularly good section is on spectrum interpretation.

The chapters on atomic methods have been expanded to three. A new chapter, Atomic Absorption Spectroscopy, by J. W. Robinson, now accompanies Flame Emission Spectrometry, by A. Syty, and Emission Spectroscopy, by R. D. Sacks. For their respective methods they cover theory, instrumentation, and practical problems such as interferences. Because they are closely related there is some redundancy, for example, in atomization processes and flame descriptions, and perhaps through closer coordination this could have been prevented, leaving room for a more detailed treatment of newly developed techniques such as inductively coupled plasma emission spectrometry or atomic fluorescence spectrometry.

In summary, this volume is a must for every library used professionally by chemists (as is the entire series). It is a good refresher course for practicing chemists and a detailed introduction for graduate level students and should prove a useful reference to advanced instrumental analysis instructors.

Bruce D. Pollard, *Marquette University*

Foreign Compound Metabolism in Mammals. Volume 6. By D. E. Hathway (I.C.I. Ltd.). The Royal Society of Chemistry, London. 1981. XVI + 390 pp. $138.00.

This volume belongs to the series "Specialist Periodical Reports" and provides a review of the literature published during 1978 and 1979 in the area of metabolism of foreign compounds. There are 14 chapters, giving an in-depth coverage of this field. The chapter authors should be credited with undertaking a formidable task of keeping abreast with a rapidly expanding research area. The increasing awareness of the importance of factors influencing drug absorption and bioavailability is reflected in the chapter on Drug Kinetics. There are reviews discussing the enzymic mechanisms of oxidation, reduction and hydrolysis, and the enzyme mechanism involving conjugation reactions in the metabolism of the wide variety of chemical compounds. An interesting chapter is devoted to drug metabolism and species, strain, and sex differences. Mechanisms of various chemical carcinogens are reviewed. A welcome inclusion in this section is the recent work on the carcinogenesis caused by metals. Metabolism of drugs acting on the central nervous system covers the literature on many new drugs in the areas of opiates, antidepressants, and tranquilizers. Reviews are available on cardiovascular drugs and recent developments in the field of biotransformation of sympathomimetic agents and bronchodilators. A chapter on anti-infective agents reviews the literature on antiparasitics, antibacterials, antivirals, antimycotic agents, and antitubercular drugs. There is a review on the current status of research on steroid hormone antagonists with emphasis on their specific effects on the target organs of hormone action. Update information is collected on the metabolism of food additives and components in the human diet. There are chapters discussing the metabolisms of agricultural and industrial chemicals. Cancer chemotherapy presents a unique challenge to researchers, and recent developments in this field have been covered in a chapter. The volume is a well-documented review of the latest researches on the metabolism of foreign compounds. The book is not for everyone, but it is extremely helpful to researchers working in medicinal chemistry, endocrinology, biochemical pharmacology, cancer chemotherapy, crop protection, and industrial chemicals.

Bibudhendra Sarkar, *University of Toronto*

Inorganic Reaction Chemistry. Volume 2. Reactions of the Elements and Their Compounds. Part A. Alkali Metals to Nitrogen; Part B. Osmium to Zirconium. By D. T. Burns (The Queen's University of Belfast), A. Townshend (University of Hull), and A. H. Carter (North Staffordshire Polytechnic). Ellis Horwood Ltd., Chichester, West Sussex, England. 1981. Part A: 300 pp. $79.95. Part B: 280 pp. $87.95.

Part A of this two-part work consists of 34 chapters devoted to concise descriptions of general chemical properties of the elements and some of the more important reactions of their better known ions and compounds. Each of the following elements or groups of closely related elements is

allotted a separate chapter: alkali metals, Al, Sb, As, Ba, Be, Bi, B, Br, Cd, Ca, C, Cl, Cr, Co, Cu, F, Ga, Ge, Au, H, In, I, Ir, Fe, Pb, Mg, Mn, Hg, Mo, Ni, Nb, and Ta, and N. References to selected original papers and reviews are included in each chapter to provide access to more detailed information concerning some of the reactions. The authors are careful to point out that their choice of reactions to include had to be limited and that the absence of any mention of a reaction should not be implied to mean that the reaction is unimportant or does not occur.

Part B includes separate chapters on each of the following elements or groups of elements: Os; O; Pd; P; Pt; Re and Tc; Rh; Ru; Sc, Y, and lanthanides; Se; Si, Ag, Sr; S; Te; Tl; Th; Sn; Ti; W; U; V; Xe; Zn; Zr and Hf; and the heavy radioactive elements. Structures of the organic reagents cited in both Part A and Part B, lists of references to general analytical and inorganic literature, and solubility products for many inorganic salts and hydroxides are compiled in three appendixes. An index is included that covers both Part A (pages 1–300) and Part B (pages 301–580).

A considerable amount of useful information has been collected and efficiently organized. Chemists and others concerned with detection, monitoring, manipulation or control of inorganic species in the laboratory, commerce, industry, or our environment would be well advised to avail themselves of this two-part volume as the first step in finding answers to their chemical queries. In many cases they may need to look no further. If, however, reactions for quantitative determinations are sought, one must search elsewhere, because none of the reaction descriptions include mention of their suitability for quantitative analysis.

Considering the short shrift commonly allotted to descriptive inorganic chemistry in most undergraduate chemical curricula of late, this work could very well serve a growing number of latter-day scientists.

This work provdes a convenient source of practical, authoritative information to assist those in search of reactions to identify, control, or modify inorganic species.

Alfred A. Schilt, *Northern Illinois University*

Biological Magnetic Resonance. Volume 3. Edited by Lawrence J. Berliner and Jacques Reuben. Plenum Press, New York. 1982. 268 pp. $35.00.

This volume contains five detailed and interesting reviews on the following topics: Multiple Irradiation ^1H NMR Experiments with Hemoproteins (R. M. Keller and K. Wüthrich), Vanadyl(IV) EPR Spin Probes: Inorganic and Biochemical Aspects (N. D. Chasteen), ESR Studies of Calcium- and Proton-Induced Phase Separations in Phosphatidylserine–Phosphatidylcholine Mixed Membranes (S. Ohnishi and S. Tokutomi), EPR Crystallography of Metalloproteins and Spin-Labelled Enzymes (J. C. W. Chien and L. C. Dickinson), and Electron Spin Echo Spectroscopy and the Study of Metalloproteins (W. B. Mims and J. Peisach). While some of the reviews tend to be of narrower scope than those of previous volumes, all are of generally high quality.

The first review provides a valuable survey of proton NMR investigations of hemoproteins and centers its discussion on the various techniques (transient NOE's, double irradiation difference spectra, truncated NOE's, two-dimensional NMR) that have been used for spectral assignment. The review provides a well-organized survey of the extensive literature of this field. The second review describes the inorganic chemistry, ESR spectroscopy, and biochemical uses of vanadyl(IV) oxycations. VO^{2+} coordinates via oxo linkages to many proteins and has been used as a spin-label probe of cationic binding sites. Further, VO^{2+} has been used to study a broad range of biologically relevant areas involving biomineralization, biogeochemistry, and the biological role of trace vanadium.

Of special current interest is the article Electron Spin Echo Spectroscopy (Mims and Peisach) that reviews experimental aspects of pulsed ESR and provides a useful assessment of the advantages and limitations of pulsed methods. Techniques, including especially the use of stimulated echos, for studying metal centers with short phase coherence times are described in some detail. This article is especially welcome in view of the expanding interest in pulsed ESR as a probe of transient redox changes of membrane-bound electron carriers.

Robert R. Sharp, *University of Michigan*

Felix Bloch and Twentieth-Century Physics. Rice University Studies. Volume 66. No. 3. Rice University Press, Houston, Texas. 1980. 247 pp. $7.00 soft-cover; $13.00 hard-cover.

Felix Bloch is most widely known for his demonstration in 1946 of nuclear magnetic resonance of water protons. This achievement, which continues more than 35 years later to have a profound and expanding influence on chemistry, biology, and physics and which foreshadowed the development of an industry, was honored by the Nobel Prize in 1952 (shared with E. M. Purcell). In addition to his discovery of nuclear induction, Dr. Bloch's diverse contributions to physics include measurements of the magnetic moments of the neutron, proton, deuteron, and triton, as well as a recognition of the importance of magnetic interactions in neutron scattering and of electron–lattice interactions in electrical conductivity.

This volume contains a series of 15 papers dedicated to Felix Bloch on the occasion of his 75th birthday. Five of the papers are essentially historical, and the remainder outline recent scientific progress in those research areas that have been profoundly influenced by Dr. Bloch's contributions. That the scientific papers range in scope from physics to chemistry to molecular biology is fitting testimony to the enduring influence and broad significance of his work.

Robert R. Sharp, *University of Michigan*

Kinetics and Dynamics of Elementary Gas Reactions. By Ian W. M. Smith (Cambridge University). Butterworths, Inc., London. 1980. xii + 387 pp. $72.95.

This volume is another Butterworths Monographs in Chemistry series. It is a well-written, logically organized book on recent advances in the dynamics of bimolecular and unimolecular gas reactions. The first four chapters give clear and rigorous discussions of reaction dynamics theories in their modern detailed forms. The following three chapters discuss the types of detailed and sophisticated experiments required for meaningful comparison to theory. A number of experiments and comparisons are described.

The serious research student of gas-phase reaction dynamics should find this volume quite valuable as a review of recent advances and as an overview of the direction of the general area. The student with only a casual interest in chemical kinetics would quite likely find the rigor and detail in this book fairly heavy going.

John W. Simons, *New Mexico State University*

Electrochemical Methods, Fundamentals and Applications. By A. J. Bard (University of Texas) and L. R. Faulkner (University of Illinois). John Wiley and Sons, New York. 1980. xviii + 718 pp.

There has been a need for a self-contained yet thorough monograph on modern electrochemical methods. Several good books have appeared in the last few years, but the present volume appears to be the best suited for use as a text in a specialty course in electrochemistry.

The first four chapters present basic electrochemical theory. Chapter 1 gives an overview of the concepts important to understanding electrochemical reactions, starting with a review of the thermodynamics of electrode processes and going through introductory sections of double-layer theory, electrode reaction rates, and mass-transport phenomena. Use is made of a model wherein the electrochemical cell is viewed as a simple RC circuit. This seems to help integrate the concepts of charging current, cell resistance, and benefits of good cell design into the discussion of faradaic processes. There is also in this chapter a generalized treatment of the effects of coupled chemical reactions on electrochemical observables such as $E_{1/2}$ or current–time curves. Although the subject matter is very fast moving in this chapter, I believe the approach has the benefit of giving the student an early feel for how reaction chemistry affects the experimental parameters.

With this as a backdrop, Chapters 2–4 follow with discussion of cell thermodynamics, kinetics of electrode reactions, and mass transfer by migration and diffusion. I found the chapter on electrode kinetics to be particularly good, with the kinetic model approached from several different tacks and examples taken from organic, inorganic, and organometallic chemistry. Students should get a feel for the complexity of apparently simple electrode reactions from the section on multistep charge-transfer processes.

Chapters 5–10 concentrate on methodologies: constant potential experiments (at microelectrodes); potential sweep methods; controlled current methods; hydrodynamic techniques; impedance methods; and bulk electrolytes. After introduction of the basic theory of a method and an outline of the appropriate experimental approach, the treatments are organized around the effects of charge-transfer kinetics on the experiment (i.e., reversible, quasireversible, irreversible). Detailed treatment of coupled homogeneous reactions is pulled together in a later chapter (Chaper 11). The mechanisms treated are EC, CE, ECE, and EC (catalytic). The treatment of coupled reactions is terse (for example, second-order reactions are given very little attention), but ample literature references are given to allow pursuit of the ideas presented there.

The final three chapters are devoted to double-layer structure and adsorption, electrochemical instrumentation, and spectroelectrochemistry. The latter chapter, in addition to the common echem/optical and echem/ESR techniques, includes treatments of more recent methods such as PAS (photoacoustic spectroscopy), SERS (surface-enhanced raman spectroscopy), surface spectroscopy on electrode surfaces (ESCA, Auger, LEED), and use of semiconductor electrodes. There are a couple of useful appendices, including one on digital simulation methods, and a

good index. All treatments are well referenced, and each chapter (and appendix) is followed by a series of problems. Particularly convenient are the 12 pages of symbols and abbreviations used in the text. The symbols are defined and their usual dimensions are given, along with references to their appearance in the text.

As with any monograph, one can come up with subjects that one thinks could have been given more attention. This reviewer thought that more could have been done with solvation effects and the relationship between charge-transfer rates and molecular structure, to name two areas. Certainly, page limitations force difficult decisions on authors.

I think students will find the reading slow going because a lot is packed into each section. But the treatment is broad, logically presented, well written, and authoritative. Although I have not yet used this text for a graduate course, I plan to do so.

William E. Geiger, *University of Vermont*

Lehrbuch der Organischen Chemie. Volume 19. Auflage. By H. Beyer and W. Walter. S. Hirzel Verlag, Stuttgart. 1981. 943 pp. DM 58.

This edition of the highly successful German textbook for undergraduates has been completely rewritten to keep it abreast of the latest developments. The new features and changes range from reactions and biochemical cycles to nomenclature and units. Even the more important acronyms have been given recognition. Photochemistry, orbital symmetry, photoelectron spectroscopy, ion-cyclotron resonance, and numerous other topics make this edition far different from its beginnings 28 years before, a beginning that was itself an innovation in that it broke from the classic tradition and integrated electronic theory into the presentation of organic chemistry.

Unlike most American textbooks, Beyer and Walter start their book with a substantial section of experimental methods: purification, analysis, structure determination, and spectroscopy. The main content is rich in descriptive detail. In addition to the core topics of aliphatic, aromatic, and heterocyclic compounds in their manifold functional variations, there are chapters on isoprenoids, enzymes, and metabolic processes. References to primary publications, reviews, and books abound throughout. An unusual feature for such a textbook is a name index, which provides a key to the many outstanding chemists whose contributions are cited in the text.

An amusing point, which will forever date this edition, is that the authors zeal for timeliness misled them into abandoning traditional Hantzsch–Widman names for common six-membered heterocycles such as dioxane in favor of a *provisional* IUPAC proposal that was withdrawn at just about the time the book appeared in print. It may be the only textbook ever to use "dioxixan" and "thiazixin", names that aroused a storm of rejection among organic chemists, who accused them of "causing hiccups" and "induced excessive salivation".

The Virial Coefficients of Pure Gases and Mixtures. A Critical Compilation. By J. H. Dymond and E. B. Smith. Oxford University Press, New York and Oxford. 1980. xvi + 518 pp. $69.00.

This is a new edition of a work last published in 1969, and it is three times as long. The discursive material is confined to the forepages, which constitute an introduction to the topics of imperfections in gases and the equations that deal with them. The bulk of the book consists of recommended numerical values for specific gases or mixtures of them, arranged in formula-index order and accompanied by references, and indications of the conditions of measurement and the reliability. A name index for pure compounds and another for mixtures makes access easy. The data have been compiled from publications "up to early 1979".

Infrared and Raman Spectroscopy of Polymers. Practical Spectroscopy Series. Volume 4. By H. W. Siesler and K. Holland-Moritz. Marcel-Dekker, Inc., New York. 1980. 400 pp. $47.50.

This book concerns the application of vibrational spectroscopy to the analysis of polymer composition and structure. It is an excellent introduction to the practical aspects of the subject, spelling out the kinds of information that can be obtained with this technique and giving examples indicating how the spectroscopic measurements that provide this information are made and interpreted.

The content of the book reflects the surge of new applications made possible in the last decade by commercial Fourier transform infrared (FT IR) spectrometers. With their now well-known advantages in signal-to-noise ratios and frequency precision, these spectrometers have been a particular boon to the study of polymers, which have special problems in being inherently multicomponent systems and having spectra in which a subtle feature may assume great import. There have been significant advances in the applications of Raman spectroscopy that are less well appreciated perhaps than those of infrared. The authors discuss these and point out the sometimes special sampling advantages and unique information that Raman does offer.

The emphasis is on experimental aspects and applications. Infrared and Raman spectrometers and their accessories are described, and there is a good account of sampling techniques. Among the subjects considered are quantitative analysis, hydrogen bonding, near infrared spectra, kinetic studies, measurement of chain orientation, IR dichroism, Raman polarization, attenuated total reflectance, crystallinity, mechanical stress, use of isotopic substitution, longitudinal acoustic modes, and Raman resonance spectroscopy. This reviewer's only reservation concerns the second chapter that is meant to be an introduction to the theory of polymer vibrations. At the fundamental level intended, the discussion in this chapter appears to be too brief, relative to the number of equations it contains, to be compatible with a book that is otherwise largely descriptive. Therefore it stands alone, disconnected.

On the whole, this book with its many references to the current literature is an excellent survey of how vibrational spectroscopy is being used to study polymers. It is of obvious value to polymer scientists and to those who, for any reason, have an interest in polymers or vibrational spectroscopy.

Robert G. Snyder, *University of California*

Nuclear Reactor Safety Heat Transfer. Edited by O. C. Jones, Jr. (Brookhaven National Laboratory). Hemisphere Publishing Corp., Washington, DC. 1981. xix + 959 pp. $99.00.

This is a massive textbook, the material in which was originally assembled for a summer school at the International Centre for Heat and Mass Transfer in 1980. The editor points out that it is "more of an organized composite summary of nuclear safety heat transfer technology". It begins with a section titled Overview, which places nuclear power generation in historical perspective, treats nuclear power generation with thoroughness, and relates safety issues to thermohydraulics. The following sections are titled Fundamental Concepts; Design Basis Accident: Light Water Reactors; Liquid Metal Fast Breeder Reactors; and Special Topics. Each section is composed of several chapters contributed by active investigators in the field. The viewpoint is that of a nuclear engineer. Of particular interest is the chapter The Accident at Three Mile Island, which describes the accident dispassionately and in detail and then discusses its implications for the heat-transfer engineer.

The book is reproduced from typescript and provided with numerous figures and references, but it unfortunately lacks running headings.

Synchrotron Radiation Research. Edited by H. Winick and S. Daniach. Plenum Press, New York and London. 1980. xx + 754 pp. $65.00.

Sychrotron radiation provides a source of ultraviolet and X-ray radiation of high intensity and strong continuum not available by conventional means. This characteristic has made a major impact on photophysics and has led to interdisciplinary applications, including investigation of structure of proteins, conformation changes in biological materials, analysis for trace elements, and the nature of solid surfaces. Such applications are discussed in nineteen contributed chapters, following three chapters that treat respectively the subject in overview, the properties of synchrotron radiation, and sources, research facilities, and instrumentation.

Arctic Air Chemistry. Proceedings of the Second Symposium on Arctic Air Chemistry. May 6–8, 1980. Edited by K. A. Rahn. Pergamon Press, New York and Oxford. 1981. 162 pp.

This Proceedings was published as a special issue of *Atmos. Envir. 15*, 8 (1981)].

Ten years ago most atmospheric chemists had not thought about arctic air. Those few who did probably thought it was always as clean as evidenced by the tourist brochures of Alaska in summer. Undaunted by the brochures, a hardy band of atmospheric chemists have studied the arctic air in winter. Surprisingly, the northern-most point in Alaska finds itself embedded in a remarkable influx of aerosol particles coming mainly from yet further north. Chemical analysis of this material found sulfate to be a major component, with smaller, but remarkably large contributions from carbonaceous material (often as much as 20% soot). A second man-made component appeared to include Pb, Br, Ni, Cu, Cr, and Zn, possibly small particles condensed from high-temperature combustion processes. Natural aerosols included ocean-derived material, mainly NaCl, and soil-derived substances (Si, Al, Fe, ...).

Meteorological analysis of air trajectories shows that the winter arctic air is similar to a large, slowly stirred soup bowl with contributions of aerosol coming in at the edges and the mixed soup pouring out, sometimes southward over Alaska. Chemical analysis, particularly of the Mn/V ratio in the aerosols, has led to a remarkable understanding of long-range transport (often over 3000 km) and of the role of precipitation in removing aerosols from air parcels that might otherwise have contributed. These tracer analyses indicate that major contributors are air parcels polluted in Europe (and the U.S.S.R.) that follow a dry trajectory

into the arctic airmass via Siberia. By contrast, aerosols from northeastern United States tend to blow out over the Northern Atlantic and thus are subject to precipitation removal before the air penetrates the arctic.

The 21 papers are divided into five sections. Most of the papers are well written and describe important contributions. Some coherence is provided by six articles authored (in part) by the editor; however, this volume is not meant to be the last word on arctic air. These papers are mostly in the form of progress reports that make it clear that more needs to be done. This volume thus provides a detailed snapshot of the state of our knowledge, much as a single still scene with most of the characters on-stage gives an idea of a movie. When the book of this movie is finally written, the loose ends tied together and the whole subject indexed and filed, this newfound "Arctic Haze", will have contributed much to our knowledge of the atmosphere. Meanwhile, this volume provides the best available information concerning our present understanding.

Donald H. Stedman, *University of Michigan*

Biological Roles of Copper. Ciba Foundation Symposium Number 79 (new series). Excerpta Medica, Amsterdam, and Elsevier/North Holland, New York. 1980. viii + 343 pp. $56.50.

Quite a large number of books relating to the bioinorganic chemistry of copper have recently appeared or are about to appear. This book, however, is clearly different from the others in that it is directed toward the clinician rather than the inorganic chemist or biochemist. It contains a series of 15 papers and associated discussions from a symposium on the Biological Roles of Copper held at the Ciba Foundation, London, March 11–13, 1980. The papers deal with the nutritional, physiological, and toxicological aspects of copper metabolism. They do not, however, tend to be very critical (or accurate) with respect to the copper enzymes on a molecular level, and the discussions mostly emphasize how little is really known about copper metabolism. Alternatively, this is the first source to appear which combines and summarizes the extensive literature in this field. A few high points worth emphasizing are the chapter by Danks, Copper Deficiency in Humans, which gives an extremely well-stated overview of this topic, and the chapters by Sourkes, Copper, Biogenic Amines, and Amine Oxidases, and Harris et al., Copper and the Synthesis of Elastin and Collagen, which present very good recent reviews of the physiological aspects of amine oxidases and lysyl oxidase in particular.

In summary, this book is an important resource for researchers involved in the bioinorganic chemistry of copper, as it presents a concentrated, recent overview of copper metabolism and the effects and treatment of deficiency and overload, topics which are not often covered in the usual review literature.

Edward I. Solomon, *Stanford University*

Enantiomers, Racemates and Resolutions. By Jean Jacques and Andrē Collet (Centre National de la Recherche Scientifique, Collēge de France) and Samuel H. Wilen (The City University of New York). Wiley-Interscience, New York. 1981. xv + 447 pp. $52.50.

This book should be read by any chemist who has need to resolve a compound into its enantiomers or who has occasion to work with a material of intermediate optical purity—that is, a substance that is a mixture of the racemate with one of the enantiomers. People who work frequently with such materials should buy the book—it bids fair to become a classic in the field of stereochemistry, being notable for both scholarship and clarity of presentation.

It is divided into two parts of roughly equal length. The first deals with the physical properties of enantiomers and of mixtures thereof in all proportions, while the second deals with the resolution of racemates.

Since symmetry plays such a crucial role in crystal structure, it is to be expected that physical differences between enantiomers and racemates will be most pronounced in the solid state. The authors build from crystal structure data, through sophisticated phase rule analyses, to general conclusions about the properties of mixtures of enantiomers in the solid state and in equilibria of crystals with melts, solutions, and vapors. Theirs is the best treatment available of the problems one faces in avoiding material losses in the isolation and purification of optically impure substances in synthetic studies or in avoiding changes in optical purity in mechanistic studies. Both the authors and the publishers are to be commended for the number and the quality of diagrams used here.

The second part, dealing with resolutions, may, perhaps, attract a wider readership. This reviewer would suggest that one not plunge immediately into this section without a preliminary perusal of the first part, upon which it rests. This section of the book is notable for its success in demystifying the art of resolution; it is strongly recommended to those contemplating entry into the field of experimental stereochemistry. Again, the authors and publishers are to be commended for their generous use of structural formulas in texts and tables.

It is necessary to note that some of the material in the second part has appeared previously in part or in whole (Wilen, S. H. *Top. Stereochem.* **1971**, *6*, 107–176. Wilen, S. H. "Tables of Resolving Agents and Optical Resolutions"; University of Notre Dame Press: Notre Dame, IN, 1972. Collet, A.; Brienne, M. J.; Jacques, J. *Chem. Rev.* **1980**, *80*, 215–230). These earlier publications have been updated, pruned, expanded, and synthesized to produce a final product that is at once broader and deeper than its progenitors, thanks particularly to the first section. The existence of these earlier works does not, in my opinion, in any way constitute valid cause for overlooking this fine book.

James H. Brewster, *Purdue University*

A Guidebook to Mechanism in Organic Chemistry. Fifth Edition. By Peter Sykes (Christ's College, Cambridge). Longman Inc., New York. 1981. xii + 397 pp. $19.95.

This soft-cover book is clearly intended for purchase by students as well as by libraries, and the publisher is offering it at a realistic price. An undergraduate honors student or a graduate student who needs to refresh his memory will find the book well suited to his purposes.

Since the third edition of this work was reviewed (*J. Am. Chem. Soc.* **1971**, *93*, 2360) the author has added two chapters: Symmetry Controlled Reactions and Linear Free Energy Relationships. Both chapters are well written. The former is limited to a consideration of processes that yield to the simplest frontier orbital analysis.

Organic chemists have been thinking about orbital symmetry for less than 2 decades, whereas they have been trying to deduce mechanisms from thermodynamic information for a very long time. It is perhaps not surprising, therefore, that the chapter on linear free energy relationships is twice as long as the one on orbital symmetry. This relative emphasis would be hard to justify on other than historical grounds.

I am glad that I did not review the first edition of this book when it appeared 20 years ago, for at that time I could see little merit in the presentation of reaction mechanism as *faits accomplis*. Even now, years after the subject became a part of every organic chemistry course, I prefer those treatments that include some attention to methodology, which requires documenting conclusions with examination of data. It has become clear, however, that there is need for a *primer* of reaction mechanisms that can be used by a broad spectrum of students in chemistry and related disciplines. The success of Dr. Sykes' book, now in its fifth edition, is proof enough.

Martin Stiles, *University of Kentucky*

Nonaqueous Solution Chemistry. By O. Popovych (City University of New York) and R. P. T. Tomkins (New Jersey Institute of Technology). Wiley-Interscience, New York. 1981. xiii + 500 pp. $52.50.

This book provides a broadly based introduction to the physical chemistry of nonaqueous solvent systems. A title such as "Physical Chemistry of Nonaqueous Solutions of Electrolytes" would, therefore, have been more descriptive of the topics emphasized.

Chapter 1 provides an introduction to the field with a brief historical perspective and selected comparisons of aqueous and nonaqueous solution phenomena. An outline of subsequent chapters completes this chapter. Chapter 2 reviews the nature of forces among ions and molecules. Equations for ion–ion, ion–dipole, ion–quadrupole, ion–induced dipole, dipole–dipole, dipole–induced dipole, and dispersion interactions are presented. Unfortunately the equations utilized are those applicable only to simple point charges or point dipoles. It would have been better if expressions incorporating appropriate intramolecule, intermolecular, and thermal averaging were also provided. Comments about and illustrations of the relative magnitudes of these, as well as hydrogen bonding and specific donor–acceptor, interactions are made. The nature of the solution process is then discussed in terms of these interactions. The authors incorporate treatments of preferential solvation in mixed solvents and of differences in anion and cation effects in their discussion.

Chapter 3 reviews useful classification schemes for solvents and then illustrates the available range of solvent behavior with seven, well chosen, examples. Among the properties treated in these latter sections are self-dissociation, acid–base chemistry, solubility, electrochemistry, and solvent structure. Thermodynamic properties of nonaqueous solutions of electrolytes are treated in Chapter 4. Chapter 5 deals with extrathermodynamic techniques commonly used for comparisons of solvent and ion properties. Transfer functions and single ion functions are discussed along with a number of illustrative examples. Acid–base chemistry is the topic of Chapter 6; acidity concepts, acidity scales, and titrations are discussed. Transport properties such as electrolytic conductance, transference numbers, diffusion, and viscosity are treated in Chapter 7. Chapter 8 discusses the application of electronic, vibrational, and magnetic resonance spectroscopy to the definition and characterization of solute–solvent interactions. Chapter 9 covers electrode processes including voltammetry and electrical double layer phenomena. Sol-

vent-dependent kinetic phenomena are the subject of Chapter 10. Finally, selected technological applications of nonaqueous solvents are presented in Chapter 11. These applications include hydrometallurgy, batteries, and electrodeposition.

In general, the book provides an authoritative, well-balanced coverage of the current status of a very complex subject although material on electrochemical and thermodynamic phenomena is presented in more depth than that on other topics. An expansion of Chapter 11 to incorporate additional topics would have been justified. As an introduction to the field, the book would have been more valuable if the authors had provided more specific primary references for many of their factual statements. "Nonaqeuous Solution Chemistry" is, nevertheless, a valuable supplement to previously available works on nonaqueous solutions since it provides a convenient collection of topics previously scattered throughout the literature.

Duane F. Burow, *University of Toledo*

Materials Science Research. Volume 13. Sintering Processes. Edited by G. C. Kuczynski (University of Notre Dame). Plenum Press, New York and London. 1980. xi + 575 pp. $55.00.

This volume is the Proceedings of the Fifth International Conference on Sintering and Related Phenomena, which was held at the University of Notre Dame, Notre Dame, Indiana in June 1979. It contains the text, reproduced directly from the authors' typescripts, of 45 papers and two abstracts. A brief subject index is also included. Over 40% of the papers originated from nine countries other than the US, but all the papers are in English. The papers are divided into the following categories (number of papers in each catagory in parentheses): Ostwald ripening and statistical theories (6), models (10), liquid-state sintering (4), sintering of covalent materials (7), sintering of oxides (17), and small particles and catalysts (3).

The volume contains a number of brief review papers that present critical analyses of topics such as sintering of metal powders, sintering models, shrinkage equations, swelling, liquid-phase sintering, sintering of covalent materials, and the relationship between sintering research and industrial requirements. The majority of papers, however, are research papers that report new experimental results and/or present new or modified theories. Computer simulations of sintering and precipitation processes are presented in several papers, but most papers report new experimental results. Over half a dozen papers deal with the sintering of alumina, with and without additives, but only two papers are devoted to the sintering of catalysts. (The Proceedings of the 4th International Conference on Sintering and Related Phenomena, Volume 10 in the Materials Science Research Series, contained a significantly larger fraction of papers dealing with the sintering of heterogeneous catalysts.)

Materials scientists engaged in all aspects of ceramic and metal sintering will find valuable contributions to these areas in this book.

Sieghard E. Wanke, *University of Alberta and Fritz-Haber-Institut MPG, Berlin*

Contemporary Polymer Chemistry. By H. R. Allcock and F. W. Lampe (Pennsylvania State University). Prentice-Hall, Inc., Englewood Cliffs, N.J. 1981. vii + 599 pp. $28.95.

This book provides a general, introductory survey of polymer chemistry for students of the physical sciences and biochemistry. The authors include a chapter on inorganic polymers that is related to their research and a short chapter on biomedical applications of synthetic polymers.

Since this volume is suggested, by the authors, to be used in beginning polymer courses, topics are developed from first principles. A highly useful list of references is provided at the end of each chapter, along with study questions.

The text is divided into four parts: synthesis and reactions, thermodynamics and kinetics, physical characterization, and lastly, fabrication, testing, and uses of polymers.

Part I consisting of the first nine chapters deals with condensation, free radical, ionic, coordination, photolytic, radiation, and electrolytic polymerizations. The emphasis is on descriptive chemistry, which is helpful to the student with no prior exposure to polymer science.

Part II, Chapters 10–13, discusses thermodynamics, equilibria, and polymerization kinetics. Complete derivations of the kinetic expressions are presented.

The third part describes molecular weight determinations including light scattering, ultracentrifuge, solution viscosity, and gel permeation chromatography. Also glass transitions, conformational analysis, and X-ray diffraction are discussed. The chapter on X-ray diffraction is highly informative and well written.

The final part discusses fabrication, testing, and biomedical applications. Preparations of films, fibers, molded objects, and surface coatings are illustrated and described clearly.

There are three appendices, and the first on polymer nomenclature is highly abridged. Properties and uses of selected polymers provide structures and systematic and trade names. Appendix III contains a long list of references to additional topics. "Contemporary Polymer Chemistry" is a valuable addition to the relatively small number of textbooks that are suitable for introductory polymer courses.

W. R. Cabaness, *The University of Texas at El Paso*

Spectroscopic Properties of Inorganic and Organometallic Compounds. Volume 14. Edited by D. M. Adams (University of Leicester) and E. A. V. Ebsworth (University of Edinburgh). The Royal Society of Chemistry, London. 1982. xv + 413 pp. $146.00.

In 1967 the Royal Society of Chemistry, recognizing that the established "Annual Reports" series could no longer encompass the growth of chemistry, began the Special Periodical Reports to provide detailed review coverage in the major areas of chemical research. This volume continues the series dealing with the title subject. It covers the literature through late 1980 utilizing primary sources and Chemical Abstracts. Determination of molecular structure in the gas phase by electron diffraction, although not strictly a spectroscopic method, is also covered, as the series of volumes that dealt with that topic was discontinued after 1978.

Except for the added chapter, the organization is the same as before. The bulk of the volume deals with Nuclear Magnetic Resonance (B. E. Mann, 133 pages, 2363 ref). Coverage is complete for nonproton nuclei but includes only nonroutine proton references. Subjects include stereochemistry, dynamic structures, paramagnetic compounds, and solid state spectra. Of necessity, coverage is very terse. Nuclear Quadrupole Resonance (K. B. Dillon, 20 pages, 143 ref) is discussed by periodic group. Rotational Spectroscopy (S. Cradock, 13 pages, 140 ref) is arranged by number of atoms per molecule as is the chapter on Vibrational Spectra of Small Symmetric Species; Single Crystal and Other Solid State Spectroscopy (D. M. Adams and P. D. Hatton, 24 pages, 300 ref). The authors note that this field is so developed that "progress" is limited to work on new compounds and refinement of existing data. They call for a critical assessment of the extant body of facts.

Characteristic Vibrations of Main-Group Element Compounds (S. Craddock, 14 pages, 227 ref) is a review by periodic group as are Vibrational Spectra of Transition-Element Compounds (J. S. Ogden, 22 pages, 413 ref) and Vibrational Spectra of Some Coordinated Ligands (G. Davidson, 66 pages, 380 ref) (which contains a section of potentially ambidentate ligands). The literature of Mössbauer Spectroscopy (J. D. Donaldson, S. M. Grimes, and M. J. Tricker, 85 pages, 889 ref) spans 43 isotopes and is arranged by isotope in order of decreasing citations. The added chapter on Gas-Phase Molecular Structures Determined by Electron Diffraction (G. Gundersen and D. W. H. Rankin, 24 pages, 199 ref) is organized by main period group and by transition element.

The coverage of the literature appears to be complete. The subject of electronic spectroscopy is, unfortunately, not included. The level of presentation is extremely high and the organization is logical. Too rarely do the authors expand upon their concise listing of studies done to add either details from the literature citation or their own comments (although the sheer volume of the literature covered is a mitigating factor). As in the previous volume in this series, the Author Index has been excluded, and a list of abbreviations used would have been helpful. Although the price will certainly limit its distribution, this work provides a valuable compilation and examination of the literature of this very important subject.

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Phosphorus Chemistry. Proceedings of the 1981 International Conference. ACS Symposium Series. No. 171. Edited by L. D. Quin (Duke University) and J. G. Verkade (Iowa State University). American Chemical Society, Washington, D.C. 1981. 640 pp. $57.00.

This volume is based on the International Conference on Phosphorus Chemistry Program which was held at Duke University, June 1981. The symposium consisted of 128 papers of organic, inorganic, and biological interest and 128 poster session contributions. This volume contains the manuscripts provided by the 128 oral participants. The authors were asked to restrict their manuscripts to 4 pages of text each. The symposium included sessions on: New Organic Synthetic Methods Based on Reagents Containing Phosphorus; Biochemistry of Phosphorus Compounds; New Synthetic Methods for Phosphorus Compounds; Biologically Important Phosphorus Compounds, Natural and Synthetic; Organic Synthetic Methods Based on Reagents Containing Phosphorus; Phosphorus Heterocycles; Phosphazenes; New Organophosphorus Compounds of Commercial Interest; Inorganic Phosphates; Compounds with Monocoordinated and Dicoordinated Phosphorus; Compounds with Pentacoordinated and Hexacoordinated Phosphorus; New Phosphorus Ligands and Complexes; Reaction Mechanisms Involving Organic and Inorganic

Phosphorus Compounds; Stereochemistry of Phosphorus Compounds; Spectroscopy of Phosphorus Compounds; Photochemistry of Phosphorus Compounds; and Bonding and Theory of Phosphorus Compounds. A listing of poster contributions and their authors is included in the appendix.

Having attended the meeting, one notices that data have been omitted in order to keep the manuscripts to less than 4 pages, and as such, we have a compilation of communications, *not* full papers. If such symposia are to present only previously unpublished material and it is the intention that this material *not* be published elsewhere, this problem must be addressed and a remedy for this situation found.

This is a specialized and timely book which will find a place on library shelves and in the personal library of those intimately involved in phosphorus chemistry.

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Heterocyclic Chemistry. Volume 2. Edited by H. Suschitzky and O. Meth-Cohn (Senior Reporters). The Royal Society of Chemistry, London. 1981. Available in the USA from the American Chemical Society. xx + 441 pp. $155.00.

This volume comprehensively reviews the literature abstracted by Chemical Abstracts from July 1979 to June 1980. As in Volume 1, the material is arranged first by ring size and then by heteroatom content. The range goes all the way from three-membered rings, which are covered in 50 pages, to macrocycles (>10 atoms in a ring), which require 18 pages. The essence of each publication is recorded in the succinct style characteristic of the Specialist Periodical Reports, with liberal use of structural formulas and equations. The references appear at the foot of the page of citation, a feature that greatly aids the reader. Not only primary publications are cited but also reviews, books, and patents.

A book such as this represents a great deal of work by a devoted team, and the eleven contributors who collaborated with the Senior Reporters deserve the appreciation of heterocyclic chemists especially and of organic chemists in general. Their work provides a substantial aid in the constant struggle to keep one's awareness of new developments reasonably current. The format encourages browsing, but a table of contents of no less than 14 pages comes close to serving as an index for those who seek specific information. There is also the usual author index.

Comprehensive Chemical Kinetics. Volume 16. Liquid-Phase Oxidation. Edited by C. H. Bamford and C. F. H. Tipper. Elsevier Scientific Publishing Co., Amsterdam and New York. 1980. xi + 264 pp. $78.00.

This multivolume series is by now well-known for its critical reviews of kinetics, in which mechanism and reliability of data are discussed. This volume is particularly important because of the great current interest in oxygen and the various types of oxides. Autoxidations involving triplet and singlet molecular oxygen and ozone are covered.

Free-radical oxidations of hydrocarbons are reviewed by T. Mill and D. G. Hendry. Their chapter includes the industrially important oxidation of cumene. Oxidation of aldehydes, of importance concerning stability in storage, is reviewed by L. Sajus and I. Sêrêe de Roch. Oxidation of alcohols, ketones, ethers, esters, and acids is the subject of a chapter by E. T. Denisov. The last chapter, by D. L. Trimm, has an especially wide scope and treats oxidation of compounds of sulfur, nitrogen, and chlorine. This volume is obviously valuable to chemists of widely separated interests, from industrial chemistry to biochemistry. The reviews include material published through "mid-1978". The index, which is substantial, is specific for this volume, and thus facilitates its use independently.

Intramolecular Forces. Edited by Bernard Pullman. D. Reidel Publishing Co., Dordrecht and Boston. 1981. ix + 567 pp. $76.00.

This is a volume of Proceedings, generated by The Fourteenth Jerusalem Symposium on Quantum Chemistry and Biochemistry, held in April 1981. It consists of the texts of 34 papers that are reproduced directly from the authors's widely varying typescripts. The papers are fully illustrated and include references and usually an abstract. It is good to see a subject index included in such a volume, a feature especially useful in a volume produced only 5 months after the symposium.

Reactive Intermediates. Volume 2. Edited by M. Jones, Jr., and R. A. Moss. John Wiley & Sons, New York. 1981. ix + 396 pp. $52.50.

The appearance of a second volume establishes the intended character of this work as a serial publication "to provide authoritative, critical, and selective analyses of the recent literature". A group of eleven contributors (including the editors) present nine chapters that review arynes, carbanions, carbenes, carborations, free radicals, nitrenes, silylenes, and, new with this volume, metal–carbene complexes and diradicals. They cover the publishing period 1977–1979, with a few references to earlier years or to 1980. An idea of the activity in these various fields is given by the fact that the carbene and free-radical chapters are by far the longest, whereas those on arynes and silylenes are less than a fifth as long as the carbene chapter.

The text is written in a most readable, illuminating way, guiding the reader's perception and appreciation rather than reporting all new information impartially. This approach helps one to discern the major patterns and direction of thrust of recent research. Curiously, some chapters report only the authors and source in the list of references, whereas others include the full title of each paper cited. The latter method is certainly helpful but must be considerably more expensive. There is a good subject index.

Books on Applied Chemistry

Manufacture and Processing of PVC. Edited by R. H. Burgess. MacMillan Publishing Co., Inc., New York. 1982. 276 pp.

Covers the essential features of the poly(vinyl chloride) industry in a group of chapters written by chemists from Imperical Chemical Industries.

Applied Catalysis. Volume 1. Edited by D. A. Whan. Elsevier Scientific Publishing Co., Amsterdam, The Netherlands. 1981. 124 pp. Subscription $88.75 for six issues.

A new journal, publishing news and short notes as well as original papers and reviews.

Dryin '82. Edited by A. S. Mujumdar. Hemisphere Publishing Corp., Washington, D. C. 1982. 254 pp. $70.00.

Contains 37 articles, some of which are reports presented at meetings, on both theory and practice.

Inorganic Chemical Industry, Processes, Toxic Effluents and Pollution Control. Edited by M. Sittig. Noyes Data Corp. 1978. 317 pp. $42.00.

Contains directions or descriptions for manufacturing processes for a wide range of "heavy chemicals", derived essentially from patents, and not critically reconciled.

Advances in Chemical Engineering. Volume 10. Edited by T. B. Drew, G. R. Cokelet, J. W. Hoopes, Jr., and T. Vermeulen. Academic Press, New York & London. 1978. 336 pp.

Contains four contributed reviews on heat transfer in fluids, balling and granulation, pipeline network design, and mass-transfer measurements.

Mechanics of Cellular Plastics. Edited by N. C. Hilyard. MacMillan Publishing Co., Inc., New York. 1982. 401 pp. $58.00.

Consists of nine contributed chapters, in which the mathematics of an engineering approach is prominent.

Masters Theses in the Pure and Applied Sciences. Volume 25. Edited by W. H. Shafer. Plenum Press, New York and London. 1981. 297 pp. $75.00.

Reports titles and authors for theses submitted in 1980.

Crystallography for Solid State Physics. Edited by V. Srivastava. John Wiley & Sons, Inc., New York. 1982. 348 pp. $21.95.

Intended as an introductory, self-contained textbook for graduate or undergraduate students.

Calculator Programming for Chemistry and the Life Sciences. Edited by F. H. Clarke. Academic Press, New York & London. 1981. 226 pp. $24.50.

Contains chapters on Molecular Formulas, Coordinate Transformations, Potentiometric Titrations, and Correlation Analysis.

The Technology of Plasticizers. Edited by J. K. Sears and J. R. Darby (Retired). John Wiley & Sons, Inc., New York. 1982. 1166 pp. $130.00.

Written "for the young researcher in polymer and plasticizer application areas", with a strong emphasis on poly(vinyl chloride). Contains a substantial appendix of useful tables of plasticizers, solvents, etc., and their properties.

Environmental Engineering and Sanitation. Third Edition. Edited by J. A. Salvato. John Wiley & Sons, Inc., New York. 1982. 1163 pp. $55.00.

The subjects range from diseases to recreation, with sections on pesticides, radiation, and food, all at a highly applied level.

Waste Management. Planning, Evaluation, Technologies. Edited by D. C. Wilson. Oxford University Press, New York. 1982. 530 pp. $69.00.

The emphasis is on economics and planning, but there are sections on incineration, converting waste to fuels, pyrolysis, and biological processes.

Polymer Latices and Their Applications. Edited by K. O. Calvert. MacMillan Publishing Co., Inc., New York. 1982. 262 pp. $40.00.

Presents a concise account of the technology of the polymer latex industry from a practical standpoint.