Book Reviews*

Modern Hot-Atom Chemistry and Its Applications. By Takeshi Tominaga (University of Tokyo) and Enzo Tachikawa (Japan Atomic Energy Research Institute, Tokai). Springer-Verlag, Berlin, Heidelberg, and New York, 1981. 154 pp. $49.50.

Hot-atom chemistry encompasses the multitude of processes by which high-energy atoms engage in chemical transformations in competition with energy loss. Its practitioners have been for the most part physical, inorganic, and organic chemists who, together with radiochemists, have benefitted from the unique opportunities afforded by the study of the atoms recoiling from nuclear transformations. Nucleogenic hot atoms with short half-lives carry their own distinctive labels.

From the initial observation by Szilard and Chalmers 50 years ago that the radioactive iodine produced by neutron bombardment of ethyl iodide broke loose from its parent molecule down to the present day, hot-atom chemistry has had practical implications for the isolation of radioisotopes in useful chemical forms. This aspect has achieved great prominence and literally vital importance in nuclear medicine, in applications ranging from the labeling of pharmaceuticals with short-lived isotopes to selective microsurgery in biological macromolecules.

Hot-atom chemistry has made major contributions to the understanding of bond making, bond breaking, and energy transfer in atomic collisions. Under the leadership of Richard Wolfgang, Al Wolf and Sherry Rowland, hot-atom chemists, starting in the 1950's, have made significant strides toward the discovery of new chemical reactions in the gas phase and the elucidation of their detailed mechanisms, while solid-state chemistry has been furthered by the pioneering hot-atom studies of G. Harbottle and A. G. Maddock.

Despite the fruitful work that has continued to the present, hot-atom chemistry has been a shrinking violet, unappreciated and poorly publicized. It is an irony shared with its parent discipline radiochemistry that just as its techniques become firmly entrenched in a number of allied disciplines, and thus the need for chemists trained in hot-atom chemistry has increased, hot-atom chemistry is less able to attract students. This is primarily because its leaders are identified with such fields as nuclear medicine and gas kinetics, where their hot-atom experiments have have had their most visible impact.

The authors of "Modern Hot-Atom Chemistry and Its Applications" recognize this situation and also that a serious problem has been a lack of books and comprehensive review articles aimed at illustrating for non-specialists the essential aspects of the field.

Tominaga and Tachikawa are experienced and productive workers in the area, and they have done an excellent job of explaining the basic concepts of hot-atom chemistry in the gas, liquid, and solid phases and have admirably achieved their goal of promoting mutual understanding between scientists within the area and those in disciplines related to hot-atom chemistry.

In discussing succinctly but thoroughly the characteristics of hot-atom reactions and their applications in inorganic, analytical, and physical chemistry, geochemistry, biochemistry, and nuclear medicine, and in their coverage of present and future research topics as well as the experimental techniques employed in the creation and physical and chemical detection and separation of hot atoms and their products, the authors have provided a marvelously compact review of what is really happening in the field. Despite being aimed at non-specialists this should be required reading for all investigators carrying out experiments that employ hot-atom techniques. At 32 cents a page, this is a very expensive book. If only I could give a copy to every entering graduate student it would help to attract them to a hot-atom project and assist them greatly in working on it.

Peter P. Gaspar, *Washington University, St. Louis*

The Kinetic Theory of Electromagnetic Processes. By Yuri L. Klimontovich (Moscow State University). Springer-Verlag, New York, NY. 1983. xi + 364 pp. $44.50.

Professor Klimontovich has done theoretical research on a wide range of aspects of the classical and quantum theory of gases and plasmas. He is particularly well-known among plasma physicists for his fundamental contributions to the theory of fully ionized plasmas. In an earlier book, entitled "The Statistical Theory of Non-Equilibrium Processes in a Plasma" (Pergamon, Oxford, 1967), he presented the development of plasma kinetic theory starting from a completely microscopic description of the plasma. In the present volume, Prof. Klimontovich has undertaken the task of presenting the classical and quantum kinetic theory of charged particles and atoms interacting with an electromagnetic field. His unifying approach is to start from a microscopic description of the system, generalizing his formalisms for gases and fully ionized plasmas. The result should be valuable to theoretical chemists and physicists who are interested in this class of problems.

This book is written in the style of an advanced textbook, with citations of relevant literature for each chapter, but without exercises for the reader to work out. It would be suitable as an extensive introduction to the kinetic theory of charged particles and atoms in interaction with an electromagnetic field, and it could serve as a useful reference work. The book is well written, but the reader would need to watch for occasional misprints.

Generally speaking, the subject of Prof. Klimontovich's new book is the kinetic theory of partially ionized plasmas, and the particular topics that are treated are characterized by processes that are dominated by weak collective interactions of free and bound charged particles (atoms) and an electromagnetic field. The scope of the book can be judged by a list of the titles of the fourteen chapters. Chapter 1 is an Introduction and Chapter 14 is a Conclusion. The classical theory is discussed in Part I, which comprises Chapters 2–6; the quantum theory is discussed in part II, which comprises Chapters 7–13. The titles are as follows: (2) Free Charged Particles and a Field; (3) Atoms and Field; (4) The Kinetic Equations for a System of Free Charged Particles and a Field; (5) Brownian Motion; (6) Kinetic Equations for an Atom-Field System; (7) Microscopic Equations; (8) The Kinetic Equations for Partially Ionized Plasma. The Coulomb Approximation; (9) Kinetic Equations for Partially Ionized Plasma. The Processes Conditioned by a Transverse Electromagnetic Field; (10) Spectral Emission Line Broadening of Atoms in Partially Ionized Plasma; (11) Fluctuations and Kinetic Processes in Systems Composed of Strongly Interacting Particles; (12) Fluctuations in Quantum Self-Oscillatory Systems; and (13) Phase Transitions in a System Composed of Atoms and a Field.

H. R. Lewis, *Los Alamos National Laboratory*

BASIC: Thermodynamics and Heat Transfer. By D. H. Bacon (Plymouth Polytechnic). Butterworths, London. 1983. 176 pp. $19.95.

This book is aimed primarily at both engineering students and practicing engineers and is part of a series intended for training of engineering staff in the principles and applications of computing. The book does not propose to be either a treatise on thermodynamics or a comprehensive BASIC manual. Rather, it uses the subject of thermodynamics and heat transfer to help the student to become proficient in programming using BASIC.

A brief (8 pp) introduction to the BASIC programming language is given in the first chapter which outlines the elements of the language and summarizes the simple BASIC statements used in the chapters that follow.

A short exposition of basic topics in thermodynamics, property data, processes and cycles, and fluid flow which are usually presented in undergraduate courses is given in Chapters 2 through 5. The second chapter defines some fundamental thermodynamic concepts, including work transfer and heat transfer, goes on to the first law of thermodynamics, the non-flow energy equation and the flow energy equations, and concludes with the second law of thermodynamics, isentropic flow process efficiency, and T–ds relations. The third chapter talks about property data and includes sections on phase changes and ideal and perfect gas relations. The properties of nonreactive and reactive mixtures are discussed, and examples using steam data, refrigerant data, and psychrometric properties are worked out.

Processes and cycles are dealt with in the fourth chapter including reversible processes, non-flow processes, steady-flow processes, and combustion. A description of ideal cycles is followed by steam plant and gas turbine plant cycles. Attention is given to reciprocating engine cycles, refrigeration, air conditioning, and heat pumps. The chapter ends with worked examples of isentropic and combustion processes and of Joule and refrigeration cycles. The fifth chapter is devoted to fluid flow topics such as stagnation of total head properties, adiabatic duct flow, and steam nozzles. Again, worked examples are given on stagnation properties and nozzle flow.

The entire sixth chapter consists of examples and problems on particular applications among which are combined heat and power plants, compression ignition engine indicator diagrams, solar panels, multistage reciprocating air compressors, and spark ignition engine performance.

*Unsigned book reviews are by the Book Review Editor.

The seventh and last chapter is on heat transfer and begins with conduction and convection, including the general equation for conduction and steady state two-dimensional conduction. The discussion then proceeds to transfer coefficients, both overall heat and surface heat, and to heat exchangers, including the NTU method. The next section of the chapter concentrates on radiation including gray bodies enclosed in black surroundings, electrical analogy for gray body radiation, and radiation heat transfer for unenclosed surfaces. Nine worked examples on heat transfer topics complete the chapter. The book ends with a short selection of problems, the solutions of which involve the writing of computer programs.

Any reader who expects to emerge from reading this book with either a comprehensive knowledge of thermodynamics and heat transfer or with the skills to write elegant programs will be disappointed. However, the book does have the important advantages of teaching computing in BASIC by practical example and, conversely, of showing how computing can be applied to the solution of real engineering and mathematical problems.

Isaac Eliezer, *Oakland University*

Solid Hydrogen. By Jan Van Kranendonk (University of Toronto). Plenum Press, New York and London. 1983. xv + 306 pp. $39.50.

Quantum solids, of which solid hydrogen is the example *par excellence*, are studied almost exclusively by physicists who are either theorists or low-temperature experimentalists. This has the consequence that developments in the area which are of potential interest and use to chemists are slow to be picked up. The book under review should help greatly to induce tunneling through the barrier between chemistry and physics. It contains as clear an exposition as one is ever likely to find that is both a scholarly summary of progress to date and an indicator of where valuable research is still to be done.

The subtitle of the book is as follows: theory of the properties of solid H_2, HD and D_2. To quote from the preface: "The aim of the book is first of all to provide a self-contained account of the theoretical interpretation of the main properties of the solid hydrogens, in particular the spectroscopic properties in a broad sense". The understanding of the properties is achieved by treating the effect of the intermolecular interaction as a small perturbation on the properties of the free molecules. This approach should be gratifying to those many physical chemists who have a good working knowledge of the spectroscopy and statistical mechanics of molecules in the gas phase.

The book begins with a discussion of the properties of isolated hydrogen molecules and then developes the interpretive tools for analyzing quantitatively localized vibrational and rotational states as well as lattice vibrations. In the last three chapters, cluster formation by specific nuclear spin symmetry species, phase transitions, and rotation diffusion are discussed. These are all important topics in current research on the solid hydrogens.

Some research areas, e.g., the theory of NMR and relaxation processes, are excluded because the author believes that they are dealt with well in other places. Also, group theory and many-body technqiues are avoided. If the former is taken as providing description rather than explanation, its omission can be understood.

J. A. Morrison, *McMaster University*

Biosynthesis of Isoprenoid Compounds. Volume 2. Edited by J. W. Porter and S. L. Spurgeon (William S. Middleton Memorial Veterans Hospital and University of Wisconsin). John Wiley and Sons, New York. 1983. xiii + 552 pp. $120.00.

The objective of the editors of this series was to provide a comprehensive review of the current status of information on the biosynthesis of isoprenoid compounds. The first volume covered aspects of biosynthesis significant to more than one class: the formation of the isopentenoid unit, isomerization, and the prenyl transferase reaction. This was followed by treatments of the monoterpenes, sesquiterpenes, diterpenes, and triterpenes. Volume 2 completes the sequence with chapters on the biosynthesis of carotenoids and photoregulation of carotenoid biosynthesis. The remaining chapters are devoted to groups of isoprenoids which are of special interest because of their biological properties: lipids of archaebacteria, ubiquinone and related compounds, dolichols, vitamin A, abscisic acid, trisporic acids, ecdysteroids, and juvenile hormones. A chapter on the biosynthesis of rubber is also included.

Carotenoid biosynthesis is treated extensively in a chapter of over 100 pages with 502 references. The literature appears to have been covered up to 1980. The review follows the traditional pattern: formation and desaturation of phytoene, formation of alicyclic carotenes, later modifications, and formation of C_{30} carotenoids. Inhibitors and regulation of biosynthesis are then discussed. Chapter 2 concerns the occurrence of photoregulation, the biosynthetic steps under control, and the mechanism of photoregulation. An unusual group of terpenoids is dealt with in Chapter 3. They are simple derivatives of the basic diterpene skeleton, either phytanyl or 16,16′-biphytanyl. These are found linked to polyols, e.g., glycerol, and through the polyols to a variety of polar components. They occur naturally as the membrane lipids of a peculiar series of organisms, the archaebacteria. Chapter 4 is another extensive review, this time of ubiquinone, rhodoquinone, plastoquinones, tocopherols, menaquinones, and phylloquinone. Then follows a review of the dolichols, a group of poly-*cis*-isoprenoid alcohols. Phosphorylated and glycosylated derivatives of these alcohols function in the glycosylations leading to glycoproteins and cell wall polymeric glycans. Topics which are covered include structures and distribution of dolichols, their biosynthesis, phosphorylation and dephosphorylation, saccharide derivatives, and control of poly-prenyl phosphate-mediated glycosylations. A chapter on rubber is appropriate for this volume. There does not, however, appear to be much current activity in the area of biosynthesis. Chapter 7 concerns the formation and function of vitamin A with literature covered up to 1980. The current status of the biosynthesis of abscisic acid, a sesquiterpenoid plant hormone, is discussed in Chapter 8. Trisporic acids, modified apocarotenoids produced by zygomycete fungi, are treated in Chapter 9. Their physiological function is in the control of sexual development in these fungi. The final two chapters are devoted to insect hormones: ecdysteroids and juvenile hormones, two of the three major types of hormones which control molting and metamorphosis in insects. Chapter 10 is a review of the occurrence of ecdysteroids, their formation, and their metabolism. Chapter 11 is a review of juvenile hormones, their site of synthesis, biological activity, biosynthesis from acetate and propionate, and the regulation of their production.

Each chapter is written by an expert in that area and the volume will be very useful, particularly as a reference source, and it should be in all chemistry and biochemistry libraries. However, its high cost will discourage purchase by individual researchers.

Trevor C. McMorris, *University of California, San Diego*

The Alkaloids. Volume XXI. Edited by Arnold Brossi. Academic Press, New York, NY. 1983. xix + 368 pp. $49.50.

This 21st volume in the continuing series, originally edited by the late R. H. F. Manske, perpetuates the fine tradition and high scientific quality of its predecessors. The book is divided into seven chapters and continues to focus on the source, isolation, characterization, synthesis, biosynthesis, and pharmacology of plant alkaloids. However, this volume also expands to discuss chemically related, nitrogenous substances from amphibians, mammals, actinomycetes, and sponges. Chapter one is a discussion of the acridone alkaloids, concentrating primarily on the chemistry, structure–activity relationships, and pharmacology of acronycine. Chapter two is a review of the quinazolinocarboline alkaloids, which are of restricted distribution in four different plant families, particularly the Rutaceae. The structure elucidation, synthesis, biosynthesis, and pharmacology of these alkaloids are discussed. Chapter three is an intriguing look into the chemistry and biological activities of saframycin, renieramycin, naphthyridinomycin, and mimosamycin-type isoquinolinequinone antibiotics from actinomycetes and sponges. Chapter four is a thorough treatise on the source, synthesis, biosynthesis, and pharmacology of the pyrrolo[3,4-*b*]quinoline alkaloid camptothecin. The use of tritium isotopes and proton/carbon magnetic resonance spectrometry in arriving at an elegant biogenetic hypothesis for camptothecin is particularly fascinating. Chapters five and seven deal with amphibian and mammalian "alkaloids", respectively, and are filled with interesting chemistry and some pharmacology. The amphibian alkaloids are represented by diverse chemical nuclei including steroids, spiropiperidines, *cis*-decahydroquinolines, and octahydroindolizidines while the mammalian alkaloids are principally isoquinolines and β-carbolines. Finally, chapter six is a particularly comprehensive discussion of the simple isoquinoline alkaloids dealing with the occurrence, isolation, identification, chemistry, biosynthesis, and pharmacology of these bases. This volume continues the excellent precedent set by earlier volumes and is an indispensable addition to the library of anyone in the field of alkaloid chemistry.

Paul L. Schiff, Jr., *University of Pittsburgh*

Sulfilimines and Related Derivatives. By S. Oae and N. Furukawa (University of Tsukuba). American Chemical Society, Washington. 1983. xii + 340 pp. $84.95 (export $101.95).

Sulfilimines, the nitrogen analogues of sulfoxides, have been an object of interest to the authors for some time, as a natural extention of Professor Oae's extensive research on sulfoxides. This book is the first comprehensive survey of this somewhat obscure class of compound; it apparently covers the subject through 1982.

A short introductory chapter sets the subject in perspective and is followed by a chapter on preparative methods. Another chapter is devoted to spectroscopy, structure, conformation, and configuration. In it, the authors present their reasons for consistently preferring the semipolar

representation of the C–N bond over the conventional double bond. Two chapters are required to deal with reactions, and separate chapters are devoted to N-unsubstituted sulfilimines and to examples in which the sulfur is a chiral center. *N*-Halosulfilimines have a chapter to themselves, as do the oxidized derivatives, sulfoximines and sulfondiimines. The concluding chapter describes utilization of sulfilimines; it is only 3 pages long, and the subject is evidently still in its infancy. Although specific factual information is abundant in the form of tables and diagrams, the book remains pleasantly readable.

This book is well indexed, and it is a work that will probably be a standard reference source for some time.

The Chemistry and Technology of Coal. By James G. Speight (Exxon Research and Engineering Co.). Marcel Dekker, New York. 1983. xii + 528 pp. $69.75.

This book is the distillation of a long career in the chemistry of fossil fuels, and its content reflects the accumulated experience of the author as a fuel scientist. The larger part of the book is subtitled Coal Properties. Its ten chapters describe the origin of coal, its geology, mining, and classification, the physical properties of it, solvent extraction, thermal decomposition, and its chemical structure and reactions. The second part of the book consists of four chapters dealing with coal utilization, including combustion, carbonization, liquefaction, and gasification.

The perspective and insight that this book conveys are unusually good. The amount of information in it is quite large, and would qualify it as a major reference work were it not for the abysmally inadequate referencing. There are no reference numbers in the text and only short, unnumbered bibliographies. For example, the chapter Evaluation and Properties of Coal is 43 pages long, but it has only eleven entries in its bibliography, and most of them are to other books rather than to primary sources. Most tables and figures are credited with their source, a fact that supplies additional references, but a large number of tables are presented without any indication of the origin of the data in them. The explanation for this state of affairs is that the book was developed out of notes prepared by the author for use in a course taught at the University of Alberta, and it is stated in the preface to have been written as a teaching text. It fits that purpose well, except for the price, for it is authoritative and thorough, but its length immediately makes one think of it as a work of reference, which it clearly is not. The publishers press release, stating that it is "Packed with...current references", is misleading.

High Performance Liquid Chromatography in Forensic Chemistry. By Ira S. Lurie and John D. Wittmer, Jr. (Drug Enforcement Administration). Marcel Dekker, New York. 1983. xi + 439 pp. $65.00.

The book is in eight chapters; the first two are on general chromatography, the middle three cover theory and applications of three types of liquid chromatography, and the last three are on applications. The chapters are of uneven quality, so the utility of the book depends upon the strengths and weaknesses of the reader.

Chapter 1 on theory contains no unique information, and it contains a significant number of errors in the equations presented. The expert will recognize the errors, but the novice will not, so it is not advisable to learn chromatographic theory from this book. The second chapter is a more useful review of hardware and contains a plethora of schematic and engineering diagrams.

The following three chapters provide background on the chemistry of adsorption, reversed-phase, and size-exclusion chromatography. The chemistry is well explained in each of the chapters. Of the three, the most in-depth and also readable coverage is that of the reversed-phase chapter. It covers so-called ion-pair chromatography in some detail. The chapter on size exclusion is quite full of practical information.

In a sense, the first five chapters act as an introduction to the last three applications chapters. Forensic toxicology has benefitted from the speed and resolution of liquid chromatography, but a large number of problems remain. Drugs that are members of larger chemical groups, such as tricyclic antidepressants and benzodiazepines, present challenges to the specificity and sensitivity of the method. The large number of metabolites produced creates even more difficulty in relating a chromatogram to physiological condition. Nonetheless, considerable progress has been made, and a fair number of approaches have been tried.

The following chapter on explosives is organized in categories defined by the detector employed. The coverage is good, and the amount of immediately applicable information is balanced well by strategies for future improvements. The final short chapter covers the analysis of ink. It is well written and covers ball pen ink and non-ball pen ink.

The strength of the book is the review of the literature. As a pedagogical resource it cannot be recommended over other works on chromatography. The book is a useful introduction to the problems and challenges of forensic chemistry for the knowledgable chromatographer.

S. G. Weber, *University of Pittsburgh*

Books on Mathematics and Physics

The Physics of Amorphous Solids. By Richard Zallen. John Wiley and Sons, New York. 1983. xi + 304 pp. $36.95.

Intended as a tutorial presentation of the solid-state physics of glasses, including organic polymers.

Neutron Scattering and Muon Spin Rotation. Applications of Neutron Scattering in Chemistry. By R. E. Lechner and C. Rieker. **Transport Mechanisms of Light Interstitials in Metals.** By D. Richter. Springer-Verlag, Berlin, Heidelberg, and New York. 1983. ix + 229 pp. $37.00.

Contains two contributions on "the most advanced experimental techniques in condensed-matter research".

Dynamics. By S. Neil Rasband. Wiley-Interscience, New York. 1983. xi + 272 pp. $32.95.

Designed to serve as a text for a one-semester course at the senior or graduate level; treats classical dynamics in the perspective of the recent advances made possible by computers.

Transmission Electron Microscopy: Physics of Image Formation and Microanalysis. By Ludwig Reimer. Springer-Verlag, Berlin, Heidelberg, and New York. 1984. xii + 521 pp. $46.00.

A book derived from a series of university lectures. It is a revised version of the first part of an earlier work in German and it contains a very large set of references.

Similarities in Physics. By John N. Shive and Robert L. Weber. Wiley-Interscience, New York. 1982. xiii + 277 pp. $27.95.

Written for science and engineering students acquainted with the first principles of physics, to show how similar phenomena in mechanics, acoustics, optics, electricity, heat, etc., may be tied together conceptually to provide a more comprehensive view of nature.

Dielectric Physics. By A. Chelkowski. Elsevier Scientific Publishing Co., Amsterdam and New York. 1980. xii + 396 pp. $80.50.

Written for physicists primarily, and developed from a series of lectures for fourth- and fifth-year physics students in Poland.

Table of Definite and Infinite Integrals. By A. Apelblat. Elsevier Scientific Publishing Co., Amsterdam and New York. 1983. x + 458 pp. $106.50.

Outside of the preface, this book contains only mathematical functions, intended "to provide mathematicians, scientists, and engineers with a collection of finite and infinite integrals of elementary and special functions".

Gaussian Basis Sets for Molecular Calculations. Edited by S. Huzinga. Elsevier Scientific Publishing Co., Amsterdam and New York. 1984. viii + 426 pp. $102.00.

Consists of 19 pages of text, followed by a table of polarization functions, and then the newly prepared Gaussian basis sets from lithium to radon.

Basic Microcomputing and Biostatistics. By Donald W. Rogers. Humana Press Inc., Clifton, N.J. 1983. 304 pp. $39.50.

Written to teach programming skills and statistical data processing to people in the physical and life sciences. Contains problems and their solutions and many programs.

Pattern Recognition Approach to Data Interpretation. By Diane D. Wolff and Michael L. Parsons. Plenum Press, New York and London. 1983. xiii + 219 pp. $29.50.

Intended for use as a tool in evaluating the information generated by a set of experiments, using examples from chemistry, geology, physics, and the environmental, biological, and medical sciences, and stressing the "how to" approach.