

element series, which he prefers to divide into uranides (uranium through americium) and curides (curium through lawrencium). His arguments for so doing are given in detail in the chapter entitled "Les Transuraniens."

In large part this controversy reduces ultimately to personal preferences in matters of nomenclature, and hence lies outside the area of logical debate. Where it is a question of the interpretation of experimental evidence the correct interpretation no doubt will ultimately be made clear.

Whatever the faults of this book, they are very minor in comparison with its merits as a comprehensive and up-to-date reference on the physical and chemical properties of the transuranium elements.

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B. B. CUNNINGHAM

**Chemistry of Combustion Reactions.** By G. J. MINKOFF, D.Sc., Ph.D., D.I.C., B.P. Research Centre, B.P. Chemical Co., Ltd., Sunbury-on-Thames, and C. F. H. TIPPER, D.Sc., Ph.D., Senior Lecturer, Department of Inorganic, Physical and Industrial Chemistry, University of Liverpool. Butterworth Inc., Medicinal and Scientific Publishers, 7235 Wisconsin Avenue, Washington 14, D. C. 1962. xii + 393 pp. 17 × 25.5 cm. Price, \$14.95.

This treatise attempts to provide a general picture of the knowledge of the chemistry of combustion and flame reactions. Part I deals with the oxidation reactions of hydrogen and carbon monoxide; general experimental techniques and observations are described and followed with detailed discussions of the mechanisms and important radical intermediates. Part II is devoted to a discussion of the gas phase oxidation of organic compounds. A chapter is devoted to consideration of experimental methods, chiefly to outline problems and limitations on the validity of extant data for these complex systems. Succeeding chapters in this part describe results obtained and possible and probable mechanisms for slow combustion of aldehydes and hydrocarbons, oxidation of substituted hydrocarbons, and cool flames and ignition phenomena. Part III, almost half of the book, concludes with a treatment of high-temperature combustion, in which mass and energy transfer processes further complicate the chain reactions considered in Part II. The experimental approach is stressed in this part "to avoid being drawn into premature controversies which will eventually be resolved." Modern spectroscopic and sampling methods are well represented. Studies of energy relaxation and kinetic studies in nonflame systems are included because of pertinence to combustion systems. Chapters are found discussing high temperature pyrolysis of hydrocarbons and derivatives, combustion in stationary flames, and recombination reactions. The literature survey seems to have been broad and reasonably complete through 1960 with many references to 1961 papers in some chapters and a few 1962 references. There are numerous references to the Russian literature. This book is to be highly recommended for those interested in the chemical aspects of combustion reactions.

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JOHN P. CHESICK

**Entropy. The Significance of the Concept of Entropy and its Applications in Science and Technology.** By J. D. FAST, Chief Metallurgist, Philips Research Laboratories, and Professor at the Technical University, Eindhoven, the Netherlands. McGraw-Hill Book Company, Inc., 330 West 42nd Street, New York 36, N. Y. 1962. xii + 313 pp. 16 × 23.5 cm. Price, \$10.75.

In recent years, courses in physical chemistry have been upgraded to the point where the elements of thermodynamics are comprehensively discussed. This creates a problem in the choice of subject matter for the traditional senior or graduate course in thermodynamics. One may, on the one hand, cover the same material in a more rigorous manner, or, on the other, depart from the traditional by extending the graduate course to include an introduction to statistical thermodynamics and to irreversible thermodynamics. If one's choice is to include statistical thermodynamics, one should give serious consideration to this excellent book by Professor J. D. Fast as a text book or for supplementary reading.

The subject matter covered in the book is limited so that it cannot be considered a monograph on "Entropy," but it is more extensive than most books on thermodynamics which contain a section on statistical thermodynamics. In addition to the material usually covered in an introductory text, this book contains much that is not, e.g., paramagnetism, interstitial atoms in metals, substitutional alloys, ferromagnetism, vacancies and dif-

fusion in solids, elasticity of rubber, polymer solutions, radiation thermodynamics, fuel cells, and heat pumps.

The author introduces each section with a lucid statement of the problem at hand, follows this with a pictorial description of the solution, and finally with a more exact mathematical treatment with all approximations clearly spelled out. In almost all instances he supplements the discussion with numerical examples which give the reader an excellent idea of the order of magnitudes of the quantities involved.

The various topics discussed in this book are uniformly well treated. Chapter 1 is concerned with classical thermodynamics and contains sections on the second law, Carnot cycles, and the concept of temperature which are outstanding for their clarity. Chapter 2 introduces one to the statistical concept of entropy and discusses the specific heat of an Einstein solid and the vibrational specific heat of gases. The choice of the Einstein solid seems to this reader pedagogically wise since its treatment is mathematically simple and at the same time yields practically all the properties of a real solid. The failure of the model at low temperatures is pointed out and is followed by a description of the improved Debye model without presenting the mathematical detail for this model.

The application of the concept of entropy is discussed in Chapter 3. After a classical presentation of the free-energy concept and chemical equilibrium, the author considers the problem of paramagnetism and the production of low temperatures in sufficient detail so that the methods introduced serve as a basis for the treatment of the remaining topics in the chapter. These topics have already been enumerated above (second paragraph).

Quantum mechanics and statistics as treated in Chapter 4 begin with Heisenberg's uncertainty principle, Schrödinger's equation, and the problem of the particle in a box. The presentation is clear, concise, and yet more detailed than that given in other books of this type. The discussion of Bose-Einstein, Fermi-Dirac, and Maxwell-Boltzmann statistics as well as their comparisons which follow is exceptionally good. The chapter ends on the subject of electrons in solids.

The last two chapters, 5 and 6, are devoted to the entropy of monatomic and diatomic gases. The material covered is the usual, but one must again comment that the treatment is clear, concise, and more detailed than the usual.

It should be obvious from the above that this reader has enjoyed this book, and while exception might be taken to a few points in the text, these are trivial when considered in the light of the whole book. Professor Fast's book is strongly recommended for chemists, metallurgists, and writers of text books. It could well serve as a model for the latter.

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**Progress in Medicinal Chemistry. Volume 2.** Edited by G. P. ELLIS, Bengel Laboratories Limited, Holmes Chapel, Cheshire, and G. B. WEST, School of Pharmacy, University of London. Butterworths, London. 1962. ix + 201 pp. 16 × 25.5 cm. Price, \$11.25.

This compact volume, a worthy companion to Volume 1 of the series, consists of five chapters: 1, The Patenting of Drugs by F. Murphy; 2, The Testing and Development of Analgesic Drugs by A. H. Beckett and A. F. Casy; 3, Mechanisms of Neuromuscular Blockade by W. C. Bowman; 4, 2-Halogenoalkylamines by J. D. P. Graham; and 5, Anaphylactic Reactions by G. E. Davies. These articles, written by experts in their respective fields, provide authoritative, thorough, yet concise, reviews of the five topics.

Chapter 1 gives a clear, detailed, and up-to-date account of the procedures and problems involved in the patenting of drugs. Although the discussion of the requirements for securing patents in various countries is limited to those of the United Kingdom, the United States, France, and Germany, two tables conveniently summarize the scope and other characteristics of patents in numerous other countries.

In Chapter 2 are described the various types of analgesics which are capable of relieving moderate to severe pain and the tests used to assess their analgesic activity and addictive liability in animals and in man. This article admirably summarizes the status of the long and arduous search, still in progress, for a potent analgesic which is free of addictive liability and other undesirable side-effects. Although a considerable amount of structure-activity data is presented in the course of discussion of the development of clinically useful analgesics, full treatment of structure-action relationships as well as consideration of mechanisms of action, metabolism, and analgesic antagonists have been reserved for treatment in a future volume of this series.

Chapter 3 is devoted mainly to the physiology of neuromuscular transmission and to consideration of the possible mechanisms by which neuromuscular block is produced. Differences in the modes of action of various types of blocking agents are clearly de-

fined and laboratory tests for assessing the potential utility of these drugs are outlined. The actions, uses, and side-effects of the clinically useful agents are also described. The chemical aspects of neuromuscular blockade are not discussed here but will be the subject of a chapter in Volume 3 of the series.

The chemistry, pharmacology, mode of action, and clinical applications of the 2-halogenoalkylamine class of adrenergic blocking agents are fully and lucidly treated in Chapter 4. Although the clinical utility of these drugs has been limited, the relationship of their unique chemical properties to their pharmacological actions continues to intrigue the chemist and biologist. Thus the discussion of structure-activity relationships in this chapter, which up-dates earlier reviews of this topic, is particularly worthwhile.

The last chapter presents a concise account of the complex subject of anaphylactic reactions and the relationship of these laboratory phenomena to allergies. Very little chemistry is discussed here for, apart from the antihistamines and bronchodilators which are used with limited success, effective drug therapy of allergies is almost entirely lacking. This chapter is written in a way that permits the chemist who is unfamiliar with the subject to gain some knowledge of the principles and problems involved in a field where further research on several fronts is sorely needed.

All chapters are uniformly well written and, although the subjects are not treated in the exhaustive manner of the Progress in Drug Research series, provide thorough summaries of the status of these fields. The literature through 1960 appears to be well covered and some 1961 references are included. The printing and appearance of the book are excellent, although a disconcertingly large number of minor typographical errors are found in Chapter 4.

This volume is highly recommended not only to those chemists and biologists directly interested or active in the fields under discussion but to all workers who maintain a general interest in synthetic drugs and their modes of action.

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**Chemical Carcinogenesis.** By DAVID B. CLAYSON, M.A., Ph.D., Lecturer in the Department of Experimental Pathology and Cancer Research, the University, Leeds. Medical Book Department, Little, Brown and Co., Boston 6, Mass. 1962. 16 × 24 cm. 467 pp. Price, \$15.00.

This careful and critical review of chemical carcinogenesis will be of much use to all interested in the field. The collation of data alone in this field would be very worthwhile, and the thoughtful evaluation further increases the worth. The author's association with the group at the University of Leeds, long working with chemical carcinogenesis, adds much to the practical worth.

The problem of chemical carcinogenesis is covered under four general headings: its relevance to cancer in man, the experimental methods available, types of chemical shown to be carcinogenic, and the theories that have been advanced. An additional service which the author provides is to give a number of structural formulas, particularly when multiple names have been given to the same substance. This work is of material help to all those interested in carcinogenesis and is an almost essential companion to the catalog of chemical carcinogens of Shubik and Hartwell.

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**Brookhaven Symposia in Biology. Number 15. Enzyme Models and Enzyme Structure.** By Biology Department, Brookhaven National Laboratory. Brookhaven National Laboratory, Associated Universities, Inc., Upton, L. I., N. Y. 1962. ix + 337 pp. 17.5 × 25.5 cm. Price, \$3.50.

This volume contains the proceedings of a symposium held at Brookhaven in June, 1962. There are 17 papers, contributed by invited speakers, transcripts of the discussion which followed each paper, and two pages of good photographs of participants in informal poses.

The papers cover a wide range of subjects. Some of them deal with basic chemical and physical studies which affect the enzymologist's thinking, though they do not deal with enzymes directly or even with enzyme models. Among these are a paper on side-chain interactions in myoglobin crystals, by J. C. Kendrew, and a paper on general aspects of electron transfer in solution, by H. Taube.

A second category comprises papers which are progress reports on the work being done to elucidate the structure of specific enzymes. For example, there is a paper by B. S. Hartley which

gives a partial amino acid sequence of chymotrypsinogen, in which 224 of the 242 amino acid residues are at least tentatively located.

A third category of papers deals with studies of organic reactions (in the absence of any enzyme) which might serve as models for enzymic processes. An example is provided by a paper by W. P. Jencks on phosphate ester cleavage.

Finally, there are, of course, papers which deal directly with studies of enzyme catalysis. These include, for example, a general paper by R. A. Alberty on the interpretation of steady state kinetic data, one by D. E. Koshland, *et al.*, on the mechanism of action of chymotrypsin, one by H. Beinert, *et al.*, on the application of low temperature optical and electron paramagnetic resonance spectroscopy to the study of oxidative enzymes, etc.

The book as a whole can be recommended not only to enzymologists, but also to "outsiders," who are not themselves active in research in enzymology, for it represents an up-to-date cross section of what the modern enzymologist does and what he is interested in learning from others. The price is only \$3.50, and it is worth that much for the photographs alone.

DEPARTMENT OF BIOCHEMISTRY CHARLES TANFORD  
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**The Thermochemical Properties of Uranium Compounds.** M. H. RAND, M. R., D. Phil., Senior Scientific Officer at the Atomic Energy Research Establishment, Harwell, and O. KUBASCHEWSKI, Dr. phil. not., Dr. phil. habil., Senior Principal Scientific Officer at the National Physical Laboratory, Teddington. Oliver and Boyd Ltd., Tweeddale, 14 High Street, Edinburgh 1, England. 1963. 19 × 25 cm. 96 pp. Price, 30s.

This useful book has collected under one cover a wealth of information on the thermodynamic properties of uranium compounds (including alloys). It will be useful for libraries and for research groups involved in uranium and heavy element technology. The data are well referenced and tabulated and easy to locate. The authors have done more than merely to record existing data, but have used various chemical observations to help estimate new thermochemical functions where none now exist. Finally, there is a section illustrating a variety of uses to which such data can be applied.

Unfortunately there are some curious omissions and oversights. Very little complex ion (including hydrolysis) data are included, and in general aqueous species get rather poor coverage. In this respect, the volume is not as useful as previous summaries of the chemistry of uranium and the actinides. On page 12, a statement is made that there are no heat data available for the  $UO_2^{2+}(aq)$  ion. Yet both Latimer and the Bureau of Standards list a heat of formation (involving an estimated entropy). Still another oversight has resulted from apparently not noticing the latest values on the heats and free energies of formation of  $U^{4+}(aq)$  and  $UCl_4(c)$  from this reviewer's own laboratories. These kinds of oversights are perhaps a little too numerous throughout the book, and tend to detract somewhat from an otherwise satisfactory endeavor.

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**Theory and Applications of Ultraviolet Spectroscopy.** By H. H. JAFFÉ and MILTON ORCHIN, Professors of Chemistry, University of Cincinnati. John Wiley and Sons, Inc., 440 Park Avenue South, New York 16, N. Y. 1962. xv + 624 pp. 15.5 × 23.5 cm. Price, \$15.00.

The authors have set for themselves the task of writing a book which begins as a primer in valence theory and which works its way up to interpretation of electronic spectra of complex molecules, both organic and inorganic. No particular background is assumed for the reader, the first three chapters (70 pages) treating such topics as light absorption laws, classification of the electromagnetic spectrum, elementary description of atomic orbitals, and Hückel MO description of simple molecules. The views in these first three chapters are more or less standard.

The next six chapters (125 pages) represent an introduction to the fundamentals of molecular electronic absorption spectra including a very elementary account of character tables and symmetry representations, promotion schemes, and term levels for several key molecules ( $H_2$ , ethylene, butadiene, benzene, and formaldehyde), intensity theory, Franck-Condon principle, transition polarizations, excited state geometry, MO and VB descriptions of excited states, chromophore theory, and theory of substitution and solvent effect. Some of these topics are covered in quite some detail; *e.g.*, intensities, Franck-Condon