

BOOK REVIEWS

Organic Syntheses. Volume 29. C. S. HAMILTON, Editor-in-Chief. John Wiley and Sons, Inc., 440 Fourth Avenue, New York, N. Y., 1949. vi + 119 pp. 15.5 cm. × 23.5 cm. Price, \$2.25.

The high quality of "Organic Syntheses" and its usefulness as a reference work of established organic preparations is well known to all chemists. This most recent publication of the annual series conforms very closely in style and presentation to the preceding volumes and is an excellent addition in all respects. The thirty-four preparations described have been well chosen and represent diverse fields of interest. Those preparations of particular interest to the reviewer are trimethylene oxide, 1-acetylcyclohexene, 1,2,5-trihydropentane, 2,6-dichlorophenol, acrylic acid and ethyl 2-pyridylacetate.

V. BOEKELHEIDE

The Characteristics of Electrical Discharges in Magnetic Fields. Edited by A. GUTHRIE, Ph.D., and R. K. WAKERLING, Ph.D., Radiation Laboratory, Department of Physics, University of California, Berkeley, Calif. McGraw-Hill Book Company, Inc., New York, N. Y. 1949. xvii + 376 pages. 233 figs. Price, \$3.50.

This volume covers the results of investigations carried out at the Radiation Laboratory at the University of California under contract with the Manhattan District on the characteristics of electrical discharges in magnetic fields. Of particular interest were discharges in gaseous uranium compounds. The material is covered in eleven chapters by several authors. Chapter I (by D. Bohm) deals with the general picture of the internal state of the arc in a qualitative way. In Chapter II (by D. Bohm, E. H. S. Burhop and H. S. W. Massey) the Langmuir-type probe or sonde in its use for plasma exploration in strong magnetic fields is discussed and it is concluded that the drain diffusion theory gives a good account of the order of magnitude of electron currents to a probe in a magnetic field. In Chapter III D. Bohm deals with the minimum kinetic energy for a stable sheath and the Langmuir "plasma-sheath equation" and in Chapter IV he renders some theoretical considerations regarding the minimum pressure necessary for stable operation. In Chapter V corresponding experimental investigations on threshold pressure for stable operation of arcs are described by E. H. S. Burhop, H. S. W. Massey and G. Page. The next two chapters (VI and VII) by W. E. Berkey, E. H. S. Burhop, J. D. Craggs, J. Keene, H. S. W. Massey, and E. H. S. Burhop, H. S. W. Massey, C. Watt, respectively, deal with properties of uranium compounds. There are reported measurements on the absolute values of the cross-sections for ionization of uranium tetrachloride and uranium hexafluoride by electrons and the ionization and dissociation of these substances. In Chapter VIII T. L. Hill and L. H. Aller deal with the mathematical theory of the rate of ion production by an electron beam. By far the largest section of the volume is Chapter IX (160 pages) on the study of the arc plasma by D. Bohm, E. H. S. Burhop, H. S. W. Massey and R. W. Williams. The various arcs used are described, an investigation of the ion-density distribution for different arc conditions, the distribution of currents in the arc plasma, the space potential and electron temperature in the arc, Hash observations and the control of the arc by potentials are dealt with. The next chapter (X) by W. E. Parkins deals with attempts to use electrons produced in a discharge in a region other than the place where the discharge took place. The last chapter (XI) by J. Backus goes into the theory and operation of the Philips ionization gauge type discharge.

The complexity of the phenomenon in the arc is made

very obvious in this volume. The experimental conditions are described in great detail and the necessary simplifying assumptions made in the mathematical treatment are always carefully stated. There is some repetition which is probably unavoidable in a volume produced by several authors. The detailed knowledge of the behavior of discharges in a magnetic field has certainly been advanced by the research described in this book.

GEO. GLOCKLER

Tables de Constantes et Données Numériques. 2.

Constantes Sélectionnées Physique Nucléaire. Établi par R. GRÉGOIRE, Maître de Conférence adjoint à la Faculté des Sciences, Paris, sous la Direction de Frédéric Joliot et Irène Curie. Hermann and C^o, Éditeurs, 6, Rue de la Sorbonne, 6, Paris, 1948. 135 pp. plus 13 graphs and 1 chart. 22 × 27 cm. Price, 1500 Fr. fcs. Price in countries other than France is 20% greater. U. S. agent: Stechert-Hafner, Inc., 31 East 10th Street, New York 3, N. Y.

This useful collection of tables and graphs includes data published through the year 1946. Literature references throughout the tables show the year of publication as part of the numerical key, a valuable feature.

The Table of Contents (reviewer's translation) serves to indicate the scope of these tables:

I. Universal Constants.	Page 2
II. Half-lives and Transmutations of Atoms.	2
III. Transformation of Natural and Artificial Radioactive Atoms with Emission of β - and γ -rays.	76
IV. Transformation of Natural Radioactive Atoms with Emission of α - and γ -rays.	88
V. Energy Balance of Nuclear Reactions.	90
VI. Mass Differences Between [Doublet Ions].	93
VII. Physical Atomic Weights of Atoms.	94
VIII. Characteristics of Stable Atoms.	98
IX. Cross Sections.	102
X. Energy of Fission Neutrons.	107
Bibliographic References.	107
Graphs.	
Chart of Stable and Radioactive Nuclei.	

Tables II, III, and IV together cover about the same material as that included in Seaborg and Perlman's "Table of Isotopes." In contrast to Seaborg and Perlman's table, Grégoire does not estimate the reliability of isotopic assignments. Table II includes decay constants as well as half-lives for the radioactive nuclei. Tables III and IV include range and half-thickness data as well as figures on energy of the radiations. The segregation of radiation properties in these tables is useful in some respects, but the principal table, Table II, would have been more useful, in the reviewer's opinion, had it included an indication of mode of decay for the radioactive nuclei.

Table V gives the energy or threshold (in mev.) for about 165 nuclear reactions. Table VI gives mass spectrographic data for about 40 doublets. Table VII includes values for packing fractions and mass defects. Table VIII gives values for spin, magnetic moment, g-factor, and quadrupole moment of stable nuclei. Table IX is devoted principally to neutron cross sections. It lists radiative capture, scattering, and total cross sections for various neutron energies. Table X, Energy of Fission

Neutrons, refers to delayed neutrons and not to the primary fission neutrons.

The graphs include range *vs.* energy curves for protons, alpha particles, and electrons, and absorption coefficient *vs.* energy curves for photons in aluminum, copper, and lead.

It is almost inevitable that a large compilation of data will show some errors and omissions. Although this volume is not without such faults, workers in nuclear science will find it to be a comprehensive and useful compilation.

W. M. MANNING

An Advanced Treatise on Physical Chemistry. Volume I. Fundamental Principles. Properties of Gases. By J. R. PARTINGTON, Professor of Chemistry, University of London. Longmans, Green and Company, 55 Fifth Avenue, New York, N. Y. xlii + 943 pp. Illustrated. 16 × 24.5 cm. Price, \$25.00.

This book is the first volume of what promises to be an amazing *tour de force*, a three or four volume treatise on Physical Chemistry. It is stated that the treatise will lay emphasis on the experimental side, but there is no indication that the theoretical side is to be neglected. Furthermore, a real attempt has been made to give complete references to the literature and especially the early literature. The results of Professor Partington's historical research may very well prove to be the most valuable part of his treatise.

Volume I begins with a preface which is a very philosophical discussion of the problems of scientific education. After an explanation of the system of literature references and symbols used, there follows one hundred and fourteen pages of an Introduction to Mathematics which begins with differential calculus and ends with partial differential equations. Thereafter follow sections on Thermodynamics, Kinetic Theory of Gases, Statistical Mechanics, Wave Mechanics, Thermometry and finally, the Properties of Gases.

Readers will be of two minds about the desirability of including the mathematical introduction and perhaps the chapter on wave mechanics. In these days when elementary texts in physical chemistry run to a thousand pages, this series might be regarded as a four year course in physical chemistry. It would have been particularly suitable for use in former times when the professor of physical chemistry had also to teach his students elementary calculus. This remark is not intended to be facetious. The book is written with a clarity of style and a wealth of detail and illustrations that would make it readable by the undergraduate student of chemistry if he only had four years to spend on it.

There are no doubt errors and inconsistencies in the book, but it would be captious indeed to hunt for these when so tremendous a job has been done so well. Professor Partington is to be congratulated on the completion of the first volume of the great task, the more so as it was written under trying conditions. He states that he often had a bundle of manuscript under his arm as he ducked in and out of air raid shelters.

Professor Partington states that he does not intend to become a protagonist for any particular theory in his presentation of physical chemistry. It is difficult to judge how well he adheres to this policy in dealing with such orthodox subjects as thermodynamics. The reader seldom realizes how much he is at the mercy of the judgment of the author of a critical text. If the author appears to be impartial and weighs all the evidence dispassionately, he can introduce special pleading without being detected, whereas if he disposes of some nonsense in a summary manner, he is at once suspect.

Professor Partington accepts the viewpoint of Lewis and his co-workers with respect to the Third Law. He does not discuss the entropy of helium, nor does he give much space to the interesting and remarkable properties of liquid helium. One is impressed by the difficulty that the more one tries to cover everything in a treatise, the

more one must omit. The discussion of gases deals with equations of state, virial coefficients and other properties which will appear to the average chemist to be more physics than chemistry.

As to whether this treatise will serve a real need and will meet with a good reception in spite of the high potential barrier of price, the reviewer has no notion. But the many friends of Professor Partington in this country will wish him success in his effort.

WORTH H. RODEBUSH

Infrared Determination of Organic Structures. By H. M. RANDALL, Emeritus Professor and Former Chairman Department of Physics, University of Michigan; R. G. FOWLER, Associate Professor of Physics, The University of Oklahoma; NELSON FUSON, Department of Chemistry, Johns Hopkins University; and J. R. DANGL, Research Physicist. D. Van Nostrand Company, Inc., 250 Fourth Avenue, New York, N. Y., 1949. v + 239 pp. Illustrations. 22 × 29 cm. Price, \$10.00.

Infrared spectra have now become an asset of almost incomparable value to all chemists interested in structural problems in organic chemistry. The facility and certainty with which the presence, or absence, of a large number of structural features in a molecule may be established through infrared studies must defy the imagination of those unfamiliar with the method. Who does not remember occasions when Nature has been reluctant to afford him a crystalline derivative in the attempt to define the presence of a given group? Who has not at times thrown reagent after reagent into futile attack upon a function to which approach is barred by the gross bulk of hindering substituents? Light is not easily denied access, and more important, in the infrared region it is sensitive to the molecular vibrations of atomic groupings which are devoid of useful chemical reactivity. All of us are much indebted to the handful of investigators whose courage and vision led them to attack and surmount the very considerable problems involved in developing infrared techniques, once a very difficult experimental discipline, accessible only to the few, to the status of an easily usable (though, alas, expensive) tool for all chemists. The belief of these men that the domain of infrared studies transcended the fundamental theoretical study of small molecules has certainly been justified in the event, and is as certainly destined to be more so in the future. In this connection, we must remember that uncounted numbers of correlations are yet to be established, and we must not cavil at the inevitable missteps and false assignments which will be made as the more obscure and difficult objectives are subjected to attack.

The present book contains a large amount of important data, and a good deal of ancillary material which will be of much use to those who wish to orient themselves in the field. It must be emphasized that the work should not be considered as presenting the present status of the field as a whole. Most of the data presented were obtained in the course of a study of penicillin by infrared methods, carried out in Dr. Randall's Laboratory during the most recent Great War. In consequence of this arbitrary objective, the types of compounds investigated were admittedly limited in scope. None the less, a large number of common classes were studied. The reviewer has had access to most of the factual information contained in the book for some years, in the form of reports submitted by the Michigan Laboratory during the penicillin program sponsored jointly by the British and American governments, and has found the material to be of very great use in the solution of organic structural problems not obviously related in any way to penicillin. In only a few instances does the preoccupation of the program from which the present book devolved with a specific objective appear to have led to conclusions which are inaccurate or misleading in a more general framework. Thus, the lactone carbonyl group is stated to be characterized by an

absorption band at 5.48–5.50 μ . In fact, this assignment is based on the study of a group of *oxazolones*, a very special type of five-membered lactone. Experience in the reviewer's Laboratory, and elsewhere, has shown that the simple saturated five-membered lactone carbonyl group absorbs at 5.65–5.70 μ , that β,γ -unsaturated five-membered lactones absorb at sensibly shorter wave lengths, and that six-membered lactones are substantially indistinguishable from esters of comparable structure. The factual material in the book is well presented. Charts or catalogs, arranged by functional groups and by wave lengths, are present, and the actual records of the spectra of almost four hundred compounds are included.

The authors have attempted, not without success, to paint in bold outline the procedure which should be used in applying infrared data to structural problems and have illustrated their explication by the case method. The section can be valuable and instructive; it will serve as an introduction to the field for some, and will convert others. But we must remember, that in applying this very valuable tool, we enter the realm of the intellect, and once the simple fundamentals have been mastered, each investigator will find his own approach, and will have the opportunity to illumine the field and his own problems in uncounted different ways.

R. B. WOODWARD

The Aromatic Diazo-Compounds and Their Technical Applications, 2nd Edition. By K. H. SAUNDERS, M.C., M.A. (Cantab.), B.Sc. (London), F.R.I.C., Chemist, Imperial Chemical Industries, Ltd., England. Edward Arnold & Co., London; Longmans, Green & Co., Inc., 55 Fifth Avenue, New York, N. Y., 1949. xi + 442 pp. 15 × 23.5 cm. Price, \$10.00.

Since 1936, when the first edition of this book appeared, there has been continued interest in aromatic diazochemistry and numerous advances made both from a theoretical and technical view-point. Hence, the second edition of this useful monograph on aromatic diazo-compounds is about twice the size of the first. The author has retained only certain paragraphs of the first edition and added much new material so that the text has increased from 215 to 402 pages. The index has been much improved over the first edition and now has 39 pages instead of 8.

The book concerns primarily the fundamental organic chemistry of diazo reactions and is not a treatise on merely the azo-dye industry or processes: technical applications are merely mentioned and citations to journals and patents given. The author has made an excellent selection of information on reactions, structural considerations and theoretical topics.

Chapters I and II contain information on the formation of aromatic diazo-compounds, diazo oxides, diazoimines, nitrosoacylamides, diazonium salts, heterocyclic diazo-compounds, theories of diazotization, and a discussion of the stability and stabilization of various types of aromatic diazo-compounds. The reactions of diazo-compounds (Chapters II–VIII) are systematically classified and the fundamental reactions and reagents discussed. The scope of these six chapters may be indicated by the classification of these reactions: (A) substitution in aryl nucleus; (B) diazo-function retained but converted to diazotates, diazo-anhydrides O-azo-compounds, ethers, cyanides, sulfonates, etc.; (C) diazo-function lost but nitrogen atoms retained in formation of azo-, diazoamino-, diazoimino-compounds, triazines, hydrazines, etc.; (D) cyclic compounds with either retention of the nitrogen atoms or loss of these atoms; and (E) derivatives formed by replacement of the diazo-group. Analytical procedures and applications are summarized in Chapter IX, and the action of light on diazo-compounds and a good survey of "Diazotypes" are given in Chapter X. The monograph concludes with a review of the various theories of the con-

stitution of diazo-compounds (Chapter XI). At appropriate places in the preceding chapters the author presents the current ideas concerning the mechanisms of diazotization, coupling and replacement reactions.

Although the author disclaims complete literature coverage, the citations given are quite numerous and well chosen. Excellent bibliographies up through 1948 are given at the end of each sub-division or chapter.

The book is well written and the author has done a good job of assembling and systematizing the mass of information on this versatile diazo-reaction. Only a very few typographical errors in formulas were noted. This is an excellent monograph and certainly can be recommended as the first book to consult for all kinds of information about diazo-compounds.

RALPH L. SHRINER

On the Systems Formed by Points Regularly Distributed on a Plane or in Space. By M. A. BRAVAIS, Ecole Polytechnique, Paris. Translated by Amos J. Shaler, Massachusetts Institute of Technology from original in *Journal de l'Ecole Polytechnique*, Cahier 33, Tome XIX, Pages 1–128, Parts, 1850. Published by the Crystallographic Society of America, 1949. Price, \$3.40 (members); \$3.90 (non-members).

It is not often that the opportunity arises for reviewing a scientific book written a century ago. Bravais' treatise published exactly 100 years ago and translated now into English for the first time provides such an occasion. As a necessary preliminary to the further development of the theory of space groups, it is an essential part of the theoretical background of modern knowledge of crystalline solids.

The content of a unique study such as this speaks fully for itself. When Bravais made this investigation it was already generally assumed that a crystal is built up by the regular and indefinite repetition of small groups of atoms along series of lines parallel to its axes. He here deduced as a purely geometrical problem the fourteen possible types of repetition consistent with crystalline symmetry.

Every serious student of the solid state needs to understand this work and its place in the development of theoretical crystallography; we should all be grateful to the translator and the Crystallographic Society for making it available in English. And we must hope that the reception of this little book will be sufficiently broad to encourage a parallel translation into English of Schoenflies' "Theorie der Kristallstruktur" which is the culminating development of the geometry of the crystalline state.

RALPH W. G. WYCKOFF

BOOKS RECEIVED

May 10, 1950–June 10, 1950

- ELLIOT R. ALEXANDER. "Principles of Ionic Organic Reactions." John Wiley and Sons, Inc., 440 Fourth Avenue, New York 16, N. Y. 1950. 318 pp. \$5.50.
- EMIL KIRSCHBAUM. "Destillier- und Rektifiziertchnik." Springer-Verlag, Reichpietschufer 20, Berlin W 35, Germany. 1950. 465 pp. Paper, DMark 45.—; bound, DMark 49.50.
- M. G. MELLON (edited by). "Analytical Absorption Spectroscopy." John Wiley and Sons, Inc., 440 Fourth Avenue, New York 16, N. Y. 1950. 618 pp. \$9.00.
- F. F. NORD (edited by). "Advances in Enzymology." Volume 10. Interscience Publishers, Inc., 215 Fourth Avenue, New York 3, N. Y. 1950. 533 pp. \$7.50.