

NEW BOOKS

The Optical Principles of the Diffraction of X-Rays.
By R. W. JAMES, M.A., B.Sc., F.Inst.P., Professor of
Physics in the University of Cape Town. (The Crystalline State. Vol. II. Editor: Sir Lawrence Bragg.)
The Macmillan Company, 60 Fifth Ave., New York,
N. Y., 1948. xv + 623 pp. 15 × 23.5 cm. Price,
\$17.50.

To serious students of X-ray diffraction, the publication of this book is an important event, for it is unquestionably one of the great books in this field. It has been awaited ever since it was announced in 1933 in the first volume of the three volume series on "The Crystalline State," edited by Sir Lawrence Bragg. The fifteen year period that elapsed between the appearance of the two volumes is accounted for in part by the war, of course, and in part by the author's moving and taking up new duties in a new country; but no small part must be ascribed simply to the magnitude of the task of writing the book. It is twice the size of Vol. I, and is filled with detailed mathematical treatments, careful comparisons of different theories with each other and with experimental results, and a great many carefully worded discussions, all of which must have required a great amount of effort on the part of the author.

Seldom are advanced scientific books written with such clear presentation of material. Because of this and because of its completeness and authoritativeness, it is sure to become a great favorite with students, as well as with teachers; and for the same reasons it is very unfortunate that the book is so expensive—many students will feel they cannot afford it. The high quality and the pleasing nature of the book is to be expected, of course, from an author who has made fundamental contributions to the subject for over twenty-five years, and at the same time has possessed the faculty of presenting crystallographic matters clearly and concisely, as demonstrated by his little monograph "X-Ray Crystallography" (Dutton & Co., 1930) that has helped many a student pass his examinations.

The book logically begins in the appendices in which are presented principles of vector algebra that are used throughout the book, and the various reciprocal lattice relations of such importance in X-ray crystallography. There is probably no more convenient derivation of these relations published anywhere than this one. In the early chapters the author derives the geometrical theory of diffraction, with intensity formulas for the case of no appreciable rescattering or absorption of radiation in the crystal. The treatment of the case with re-scattering of the waves in the crystal is based on Darwin's treatment; this is followed by Ewald's dynamical theory, which is presented with emphasis on the physics and with a minimum of the mathematical detail, so as to keep the main lines of the argument clear. Later in the book the dynamical theory is extended from the case of dipoles at lattice points to scattering matter distributed uniformly through the crystal (Laue's theory) and to the theory and observation of Kossel lines, Kikuchi lines in electron diffraction, and divergent beam X-ray photography.

The atomic scattering factor, dispersion and the influence of temperature on the diffraction of X-rays takes up a quarter of the book. In the treatment of diffuse scattering arising from thermal vibration of the atoms in crystals, a subject that has seen more than its share of controversy in the past, each party is given his "day in court." The author points out the true conclusions along with the mistakes and shortcomings of the contributors to the field, and continually compares theory with experiment. Few would have objected if less space had been devoted to certain early theories that are now superseded, but the author includes them because "they have had an important place in the development of the subject." This summary and the other brief historical summaries in

the book, which are well documented with references, are very effective and interesting guides to a complex literature.

Although the book is not devoted to methods of crystal analysis, an excellent treatise is included on the use of Fourier series in crystal analysis, including Patterson and Patterson-Harker series, as well as the older series, and discussions of the determination of phases and the optical synthesis of series.

Electron diffraction receives little attention, and molecular and neutron scattering none. The last chapters cover the theory of scattering of X-rays by gases, liquids, amorphous solids, small crystallites with different shapes, lattices with faulty stacking and with periodic disturbances, and fibrous materials.

C. S. BARRETT

The Electronic Theory of Organic Chemistry. By M. J. S. DEWAR. Oxford University Press, 114 Fifth Avenue, New York 11, N. Y. (Oxford at the Clarendon Press). 1949. x + 324 pp. Illustrated. 15.5 × 24.5 cm. Price, \$7.50.

On the advanced level in a field such as theoretical organic chemistry, books should be written by only two classes of authors—mature scholars bent on accuracy and young enthusiasts with fresh viewpoints. The claims of Dr. Dewar to a hearing are under the second classification. In a clearly and vigorously written book, he sweeps across theoretical organic chemistry with a point of view which, while by no means revolutionary, is fresh enough to be stimulating.

"The Electronic Theory of Organic Chemistry" is the first general discussion of the problems of organic structure and mechanisms in the language of molecular orbitals. The resonance approach, Dewar says, "is most unsuitable from the organic chemist's point of view since it involves a new symbolism and a novel and ungenial outlook." The hope of better things which this statement raises is, in the reviewer's opinion, not fulfilled in the book; for no general operational superiority is demonstrated for the rather nebulous notation of molecular orbitals as an instrument of correlation and prediction, in comparison to the well-developed qualitative resonance scheme. It is healthy, nevertheless, to have this substantial reminder that resonance is not a phenomenon of nature.

As those familiar with Dewar's research papers would anticipate, the so-called π -complexes occupy a prominent place in his discussions of structure and reaction mechanisms. The π -complexes are not as new as the reader might conclude from their presentation here; the economical

representation $\overset{+}{\text{Ag}} \leftarrow \begin{array}{c} \text{C} \\ \parallel \\ \text{C} \end{array}$ implies no more, and perhaps

no less, than the equivalent representation in terms of resonance given by Winstein and Lucas in 1938. The fact that the π -complex notation is a matter of language is often lost sight of in the discussion, as where it is said that the bromonium ion "was originally formulated with a three-membered ring but it is more probably a π -complex." At several points the fertility of the notation is demonstrated, notably by anticipation, in the discussion of the Wagner-Meerwein rearrangement, of current developments indicating the mesomeric nature of the intermediate carbonium ions.

One who expresses forthright and unreserved opinions on many things is sure to share, from time to time, the position of Mr. Gallup on the day after election. While page 86 was being printed, devoted to an explanation of why a bimolecular allylic rearrangement (S_N2') will probably never

be found, a paper appeared by Kepner, Winstein and Young proving the existence of this mechanism. Even without such experimental work, it would be hard to credit Dewar's transition state involving five collinear atoms in view of the ease of the ortho Claisen rearrangement and consideration of models.

The book shows broad interest in fundamentals and an unusual feeling for reaction mechanisms. However, the problems are often not simple and the facts are not treated in as careful a manner as is usually necessary for reliable conclusions to be reached. For example, few of the mechanisms given for prototropy and carbonyl reactions would retain their simple beauty if the facts of general acid-base catalysis were considered. References are provided unevenly; of the ideas discussed, the disapproved ones are credited to their authors with more regularity than those which are believed to be correct. The contents of some cited papers are ignored to the point of presenting a superficial conclusion already recognized as untenable. Internal evidence suggests that the author has not had time to become familiar with the details of all the problems he discusses. These facts impose a serious limitation on the use of the book; for it is not an authoritative review of the status of the numerous problems considered. It is, as Sir Robert Robinson says in the foreword, a "connected series of original essays." As such, it promises to start many discussions and to stimulate a number of researches.

PAUL D. BARTLETT

Recent Advances in Analytical Chemistry. Editors: R. E. BURK, *Plastics Dept., E. I. du Pont de Nemours and Co., Wilmington, Delaware,* and OLIVER GRUMMITT, *Morley Chemical Laboratory, Western Reserve University, Cleveland, Ohio.* (*Frontiers in Chemistry, Vol. VII.*) Interscience Publishers, Inc., 215 Fourth Ave., New York 15, N.Y., 1949. v + 209 pp. Illustrated. 15.5 × 23.5 cm. Price, \$4.50.

Like previous volumes of the "Frontiers" series, the current volume includes reports by the authorities who presented the specific lectures. The reports are in the form of summaries of the seven lectures presented which, for this series, included the following phases of analytical chemistry: Voltammetry (polarography) and amperometric titrations (I. M. Kolthoff); inorganic analysis with organic reagents, and some recent colorimetric and gravimetric organic reagents (John H. Yoe); application of infrared spectroscopy in analysis (Otto Buck); electron microscopy and microanalysis—new methods in chemistry (James Hillier); fractionation, analysis and purification of hydrocarbons (Frederick D. Rossini); and applications of the mass spectrometer (J. A. Hipple).

Each chapter includes a brief historical and theoretical introduction, a discussion of the principles involved and equipment (where pertinent) used and available, typical applications and usefulness of the technique. The lectures are not designed to add to the knowledge of the specialist in a specific field, but rather to present a comprehensive picture of current knowledge which will enable the nonspecialist to understand and evaluate the possibilities of each technique. Copious illustrations, together with data, diagrams and typical graphs help to give a clear cut picture of the capabilities of the specialty covered. The two chapters by Yoe deal with the general qualifications required of suitable organic reagents and with the use of specific recent reagents for silver, palladium, iron, titanium and tungsten.

The chapter on infrared includes the history, origin of infrared spectra, design and development of some instruments, applicability to quantitative analysis with particular emphasis on the hydrocarbons and usefulness in structure studies. The other instrumental chapters are similar in purpose, all being supplied with a small, though sufficient, number of literature references.

Each chapter comprises a readily understandable comprehensive outline of the subject covered in somewhat

greater detail than could be assimilated by merely listening to the lectures.

H. A. FREDIANI

Isotopic Carbon. Techniques in Its Measurement and Chemical Manipulation. By MELVIN CALVIN, Professor of Chemistry, CHARLES HEIDELBERGER, JAMES C. REID, BERT M. TOLBERT, and PETER F. YANKWICH, Instructor in Chemistry. All members of the Scientific Staff of the Radiation Laboratory, University of California, Berkeley. John Wiley and Sons, Inc., 440-4th Avenue, New York 16, N. Y., 1949. xiii + 376 pp. 107 figs. 15 × 24 cm. Price, \$5.50.

In this book are collected the personal and vicarious experiences of Professor Calvin and his associates at the University of California with the carbon isotopes. Also included is an exhaustive digest of the literature on methods of synthesis of labelled molecules and techniques of measurement of these isotopes. The dust jacket offers this book as "A complete manual . . . for those who wish to use the isotopes of carbon as tracers in chemistry and biology. . ." and while the book could hardly be expected to fulfil such a broad claim, it will be of great value to anyone involved in problems of measurement of any of the low energy activities such as that of C-14, or in problems of synthesis of labelled molecules from the available chemical forms of the carbon isotopes. The table of contents shows the topics treated: Chap. 1. Production and Properties of Isotopic Carbon; 2. Measurement of Carbon-13; 3. Characteristics of Carbon Tracer Radiations; 4. Instruments for Radioactivity Measurement; 5. Detectors for Radioactivity Measurement; 6. Sample Preparation I; 7. Sample Preparation II; 8. Vacuum Techniques in Organic Chemistry; 9. Synthesis of Carbon Labelled Compounds; 10. Criteria of Purity; 11. Degradation Procedures; 12. Biosynthetic Methods; Appendix I. Isotope Dilution Methods; II. Statistical Treatment of Counting Data; III. Determination of Coincidence Corrections; IV. Determination of Counter Efficiency; V. Self Absorption Data; VI. Numerical Examples; VII. Flow in Vacuum Systems; VIII. Vacuum Gauges and Manometers; IX. Induction Stirrer for Use with Vacuum or Closed Systems.

Because the authors are personally familiar with a large fraction of the experimental procedures, many of them having been developed in their own laboratories, the book offers a wealth of detail which is usually omitted in journal publications. This value is lacking in those sections which merely reprint the literature without comment. Chapters 3 to 7 and Appendices II, III and V treat in considerable detail the procedures for preparing and measuring sample of C-14. Many of these minor, but quite important, points of technique are either new or have been available only as hearsay. Much of this material is directly applicable to other low energy β activities such as S³⁵. Chapter 9 presents all, apparently, of the methods that have been used in the synthesis of carbon labelled compounds.

Stable tracer carbon has been here treated as a stepchild. Syntheses with C-13 are presented along with those with C-14, and justifiably, since the problems are almost identical. But while there are more than one hundred pages devoted to the various problems associated with measuring the radioactive isotopes, the measurement of C-13 is reviewed in less than six. This ratio is not a measure either of the relative importance or of the relative complexity of handling stable and radioactive carbon. The authors do not examine the factors that determine the unique applicability of one method or the other to certain types of problems nor do they emphasize the complementary function, so nicely demonstrable with the carbon isotopes, of stable and radioactive tracer methods.

The authors might well have included a discussion of the various experimental conditions that must be considered in designing an experiment involving the use of carbon tracers. These conditions determine the particular isotope, the method of measurement and the necessary pre-

cision, and the isotopic concentration of the labelled compounds. This last determines the scale of the synthesis of the compounds. Particularly when a micromole scale is demanded to maintain a high tracer concentration the synthesis may be the most difficult hurdle met.

The exposition is generally clear and lucid and considering the large number of authors the style is quite uniform. The errors introduced are few and those are not seriously misleading. The book is well made but the price is high for one with such a rapid rate of obsolescence. Had the extraneous material, such as the chapters on vacuum methods and some of the introductory and survey material, been left out, the book could have been published in pamphlet form under the title "Techniques in the Use of Radioactive Carbon" without appreciably impairing its value which, on the topics appropriate to that title, is quite considerable.

WARREN W. MILLER

Advances in Carbohydrate Chemistry. Vol. 3. Edited by W. W. PIGMAN, The Institute of Paper Chemistry, Appleton, Wisconsin, and M. L. WOLFROM, The Ohio State University, Columbus, Ohio. Academic Press, Inc., Publishers, 125 East 23rd Street, New York 10, N. Y. 1948. xxiii + 424 pp. 15 × 23 cm. Price, \$8.50.

The third volume of the "Advances" appeared in 1948, and by now will be found on the desks, on the shelves, in the mountains and at the beaches, wherever carbohydrate chemists are at work or play throughout the world. For those chemists who are not yet familiar with the excellent historical and critical up-to-date reviews comprising this series, a brief glance at the contents of the new volume will show the wide range of topics and indicate their appeal especially to the teacher and the research chemist in the many fields in which carbohydrates play major roles.

The book opens with a short obituary of Dr. R. Max Goepf, Jr., a former member of the Executive Committee of the "Advances."

The titles and authors of the reviews are as follows.

"Historical Aspects of Emil Fischer's Fundamental Conventions for Writing Stereo-Formulas in a Plane," (22 pp.), by C. S. Hudson, National Institutes of Health, U. S. Public Health Service, Bethesda, Maryland.

"The Structure and Reactivity of the Hydrazono and Osazone Derivatives of the Sugars," (22 pp.), by E. G. V. Percival, The University of Edinburgh, Scotland.

"The Chemistry and Configuration of the Cyclitols," (33 pp.), by Hewitt G. Fletcher, Jr., National Institutes of Health, U. S. Public Health Service, Bethesda, Maryland.

"Trityl Ethers of Carbohydrates," (33 pp.), by Burckhardt Helferich, Chemisches Institut der Universität, Bonn am Rhein, Germany.

"Glucose and the Unfermentable Reducing Substances in Cane Molasses," (16 pp.), by Louis Sattler, Department of Chemistry, Brooklyn College, Brooklyn, N. Y., and the New York Sugar Trade Laboratory, New York, N. Y.

"The Halogen Oxidation of Simple Carbohydrates, Excluding the Action of Periodic Acid," (56 pp.), by John W. Green, The Institute of Paper Chemistry, Appleton, Wisconsin.

"The Molecular Constitution of Cellulose," (44 pp.), by Jack Compton, Viscose Research Department, Celanese Corporation of America, Rome, Georgia.

"Isotopic Tracers in the Study of Carbohydrate Metabolism," (22 pp.), by Samuel Gurin, Department of Physiological Chemistry, School of Medicine, University of Pennsylvania, Philadelphia, Pennsylvania.

"Products of the Enzymic Degradation of Starch and Glycogen," (60 pp.), by Karl Myrbäck, Biokemiska Institutet, Stockholms Högskola, Stockholm, Sweden.

"The Polysaccharides of *Mycobacterium tuberculosis*,"

(26 pp.), by M. Stacey and P. W. Kent, Chemistry Department, The University, Birmingham, England.

"The Chemistry of Streptomycin," (48 pp.), by R. U. Lemieux and M. L. Wolfrom, The Ohio State University, Columbus, Ohio.

NELSON K. RICHTMYER

Some Aspects of the Luminescence of Solids. By F. A. KROGER, Natuurkundig Laboratorium, N. V. Philips Gloeilampenfabrieken, Eindhoven (Netherlands). Elsevier Publishing Company, Inc., 215 Fourth Avenue, New York 3, N. Y., 1948. xi + 310 pp. Illustrated. 15.5 × 21 cm. Price \$5.50.

This monograph on inorganic luminescent solids, based on experimental work by Kroger and associates at the Philips Lamp Company in Holland, does not pretend to give a comprehensive account of the present status of solid-state luminescence, nor does it present a general survey.

The emphasis is largely on luminescent efficiency, absorption, excitation and emission phenomena, and their temperature dependence. After an elementary, descriptive presentation of the theoretical basis for luminescence in solids, the properties of aluminate, molybdate, silicate and tungstate phosphors, and of manganese, titanium and uranium as activators are discussed in detail. Much of the work is reported for the first time. The experimental data are largely semi-quantitative with no indication of probable errors, and the correlations, in many cases, are only qualitative, e.g., the correlation of absorption edge and the maximum of emission. The relevant published researches of other investigators are briefly mentioned. A tabulation, complete with emission color and original references, of 949 different phosphors according to 43 activators is extremely useful for reference purposes.

Kroger has an easy and enthusiastic style of presentation that occasionally reverts to the first person. A few odd expressions such as "cheap transition" denoting the transition requiring the least energy indicate that English is not the native language of the author and in general add to the charm of the presentation.

Investigators in luminescence can most painlessly become familiar with the work of one of the currently most active groups in phosphor research by reading this book.

FERD E. WILLIAMS

Max Planck in seinen Akademie-Ansprachen. Erinnerungsschrift der Deutschen Akademie der Wissenschaften zu Berlin, Akademie-Verlag, Berlin, 1948. 204 pp. 1 illustration. 15 × 24 cm. Price, DM 8.75.

Max Planck was a member of the German Academy of Sciences in Berlin from 1894 to his death in 1947 and its permanent secretary for mathematics and the natural sciences from 1912 to 1938. As a memorial to him the Academy has published this little book containing some of the addresses he made to the Academy, whether upon his admission or upon some festive or memorial occasion or when welcoming newly elected members in response to their remarks at the time of their admission; and when necessary to make Planck's response intelligible to the reader, the address of the newly elected member is also reproduced.

In his acceptance speech on admission Planck made clear his own philosophy of the rôle of the theoretical as contrasted with the experimental physicist, and not the least interesting of his later responses to new members are those in which the member expressed a different philosophy, as in the case of Einstein. The last essay was a Leibniz-day address of 1935. The little volume begins with a picture of Planck and closes with a list of 235 titles of his articles published between 1879 and 1948 (a seventy-year span) assembled by Max von Laue.

EDWIN B. WILSON

BOOKS RECEIVED

September 10, 1949—October 10, 1949

- JOHN LEO ABERNETHY. "Principles of Organic Chemistry." W. B. Saunders Company, Philadelphia, Pennsylvania and London. 1941. 317 pp. \$4.00.
- ROGER ADAMS, Editor-in-Chief. "Organic Reactions." Vol. V. John Wiley and Sons, Inc., 440 Fourth Avenue, New York 16, N. Y. 1949. 446 pp. \$6.00.
- ROGER ADAMS AND JOHN R. JOHNSON. "Laboratory Experiments in Organic Chemistry." The Macmillan Company, 60 Fifth Avenue, New York, N. Y. 1949. 525 pp. \$3.25.
- G. BRYANT BACHMAN. "Organic Chemistry." (International Chemical Series.) McGraw-Hill Book Company, 330 West 42nd Street, New York 18, N. Y. 1949. 432 pp. \$4.25.
- JELKS BARKSDALE. "Titanium, its Occurrence, Chemistry and Technology." The Ronald Press Company, 15 East 26th Street, New York 10, N. Y. 1949. 591 pp. \$10.00.
- R. S. BURDON. "Surface Tension and the Spreading of Liquids." Second Edition. Cambridge University Press (American Branch), 51 Madison Avenue, New York 10, N. Y. 1949. 92 pp. \$3.00.
- GEORGE L. CLARK, LEONARD K. NASH AND ROBERT B. FISCHER. "A Basic Course in the Theory and Practice of Quantitative Chemical Analysis." W. B. Saunders Company, Philadelphia, Pennsylvania, and London. 1949. 448 pp. \$4.25.
- JACKSON W. FOSTER. "Chemical Activities of Fungi." Academic Press, Inc., 125 East 23rd Street, New York, N. Y. 1949. 648 pp. \$9.50.
- STANFORD GOLDMAN. "Transformation Calculus and Electrical Transients." Prentice-Hall, Inc., 70 Fifth Avenue, New York 11, N. Y. 1949. 439 pp. \$8.35.
- C. A. JACOBSON, Editor and Compiler. "Encyclopedia of Chemical Reactions." Vol. III. Reinhold Publishing Corporation, 330 West 42nd Street, New York, N. Y. 1949. 842 pp. \$12.00.
- MAURICE LECAT. "Tables Azéotropiques. Azéotropes binaires orthobares." Vol. I, Second Edition. Chez l'Auteur, Uccle-Bruxelles, 29, Rue Auguste Danse. 1949. 406 pp. Prix, mille frs. belges.
- HOWARD J. LUCAS AND DAVID PRESSMAN. "Principles and Practice in Organic Chemistry." John Wiley and Sons, Inc., 440 Fourth Ave., New York 16, N. Y. 1949. 557 pp. \$6.00.
- A. R. MILLER. "The Adsorption of Gases on Solids." Cambridge University Press (American Branch), 51 Madison Avenue, New York 10, N. Y. 1949. 133 pp. \$2.50.
- CHARLES E. O'HARA AND JAMES W. OSTERBURG. "An Introduction to Criminalistics. The Application of the Physical Sciences to the Detection of Crime." The Macmillan Company, 60 Fifth Avenue, New York, N. Y. 1949. 705 pp. \$10.00.
- FRANK A. PATTY, Editor. "Industrial Hygiene and Toxicology." Vol. II. Interscience Publishers, Inc., 215 Fourth Avenue, New York 3, N. Y. 1949. 1138 pp. \$15.00.
- H. M. RANDALL, R. G. FOWLER, NELSON FUSON AND J. R. DANGL. "Infrared Determination of Organic Structures." D. Van Nostrand Company, Inc., 250 Fourth Avenue, New York, N. Y. 1949. 239 pp. \$10.00.
- F. J. W. ROUGHTON AND J. C. KENDREW, Editors. "Haemoglobin. A Symposium based on a Conference held at Cambridge in June 1948 in memory of Sir Joseph Barcroft." Interscience Publishers, Inc., 215 Fourth Avenue, New York 3, N. Y., and London. 1949. 317 pp. \$8.50.
- WILLIAM E. SIRI, with Contributions by Ellsworth C. Dougherty, Cornelius A. Tobias, James S. Robertson, Rayburn W. Dunn and Patricia F. Weymouth. "Isotopic Tracers and Nuclear Radiations with Applications to Biology and Medicine." McGraw-Hill Book Company, 330 West 42nd Street, New York 18, N. Y. 1949. 653 pp. \$12.50.
- G. W. WHELAND. "Advanced Organic Chemistry." Second Edition. John Wiley and Sons, Inc., 440 Fourth Avenue, New York 16, N. Y. 1949. 799 pp. \$8.00.
- "Cosmic Radiation." Colston Papers based on a Symposium promoted by the Colston Research Society and the University of Bristol in September, 1948, now published as a Special Supplement to "Research," a Journal of Science and its Applications. (Butterworths Scientific Publications, London.) Interscience Publishers, Inc., 215 Fourth Avenue, New York 3, N. Y. 1949. 189 pp. \$5.50.
- "Proceedings of the International Congress on Rheology. Holland, 1948." Edited by the Organising Committee. (North-Holland Publishing Company Amsterdam.) Interscience Publishers, Inc., 215 Fourth Avenue, New York 3, N. Y. 1949. 641 pp. \$11.00.