NEW BOOKS

The Adsorption of Gases by Solids. A General Discussion Held by The Faraday Society, January, 1932. Gurney and Jackson, 33 Paternoster Row, London, E. C. 4, England, 1932. iv + 320 pp. Illustrated. 15.5 × 25 cm. Price, 15/–.

This is a collection of some forty papers presented at a General Meeting of the Faraday Society at Oxford. The meeting arose on the initiative of Professor H. S. Taylor and he delivered the General Introduction. The papers were given in three sections, meeting in succession. The sections and the Speakers who delivered the Introductory Papers were as follows:

Section I. Experimental Methods. Introductory Paper by Eric K. Rideal.

Section II. Kinetics and Energetics of Gas Adsorption. Introductory Paper by Professor H. Freundlich.

Section III. Theories of the Adsorption of Gases. Introductory Paper by Professor M. Polanyi.

The definitive papers were presented by the leading investigators in this field from all over the world. They cover most of the modern work on the adsorption of gases and constitute practically a *vade mecum* of our present-day knowledge of this subject.

It is eminently fitting that this volume dealing with the adsorption of gases should be issued by the Faraday Society, and at this time, for in this field also Faraday displayed the same genius and prophetic insight that characterized his great experimental contribution to electromagnetism, the centenary of which has recently been so widely celebrated.

The book should be invaluable to all who are interested in the adsorption of gases.

ARTHUR B. LAMB

Théorie de la Quantification dans la Nouvelle Mécanique. (Theory of Quantization in the New Mechanics.) By LOUIS DE BROGLIE, Professor at the Sorbonne. Hermann et Cie, Éditeurs, 6, Rue de la Sorbonne, Paris, France, 1932. xxviii + 250 pp. 16 × 25 cm. Price, fr. 70.

The subject matter of this book is taken from a course of lectures given by Professor de Broglie in the first semester of 1929–1930 at the Institut Henri Poincaré and is a continuation of the ideas expressed in his earlier book. This one is meant to be complete in itself, however, and for that reason is prefaced by an historical introduction and discussion of the Bohr theory.

The first third of the book treats of the elementary theory of wave mechanics by the usual methods and shows how the various rotators and oscillators are quantized. The second part, which comprises the rest of the book, is called "The general theory of quantization in wave mechanics."

It is now well known that wave mechanics and matrix mechanics are two special cases of the same general theory only differing in the mathe-

matical apparatus. The proof of this is contained in the transformation theory which at the same time presented the general quantum mechanics that was required. The two special cases emphasize, respectively, the states of a system and its dynamical variables. The general theory, however, must be independent of these quantities, which are merely sets of numbers that represent the quantities of fundamental importance. This necessary invariance is enjoyed by the symbolic algebra of non-commutative numbers discovered by Dirac and has been the most popular method in the past. Its power and elegance cannot be questioned but there has always been a suspicion that it was not above reproach from the standpoint of mathematical rigor.

The transformation theory also has the required invariantive properties but in addition is known to be mathematically rigorous. It is essentially a geometrical theory and deals with the properties of certain linear operators in Hilbert space, which is a denumerable space with an infinite number of dimensions.

Professor de Broglie has chosen to use this method and develops the theory of unitary geometry along the same lines as that of Weyl in the first chapter of his celebrated book. He has, however, discussed it in a simpler way and in much greater detail and wherever possible has made use of the physical pictures of wave mechanics. The author's presentation is always clear and logical and the result is a very valuable statement of some of the most general theorems of quantum mechanics.

A book dealing with the fundamentals would not, of course, discuss perturbation theory. But it is to be hoped that Professor de Broglie's next book will deal with the problems of spin and relativistic invariance which have not been discussed here at all.

In a machine age, it would not seem necessary to have to cut all the pages of a book. There are no references to the literature, no index and the printing is rather poor. The price seems hardly low enough to make up for these defects.

G. M. MURPHY

The Theory of Electric and Magnetic Susceptibilities. By J. H. VAN VLECK, Professor of Theoretical Physics in the University of Wisconsin. Oxford University Press, 114 Fifth Ave., New York, 1932. xi + 384 pp. Illustrated. 16 × 24.5 cm. Price, $7.50.

This excellent treatise on the theory of electric and magnetic susceptibilities is written by the world's leading authority in this field. There is no similar modern theoretical treatment of the general subject existent. The author has to a considerable extent avoided the more specialized and elementary discussions given in Debye's and Smyth's books on electric moments and Stoner's book on magnetism and atomic structure. He has

solved the pedagogical problem presented by the existence of classical, old quantum theoretical, and quantum mechanical treatments of susceptibilities in a sensible and satisfactory way. Three of the thirteen chapters (I, II, IV) are devoted to classical foundations, the classical theory of the Langevin–Debye formula, and the classical theory of magnetic susceptibilities. The author opens the chapter on susceptibilities in the old quantum theory with the paragraph "To some readers it may seem like unburying the dead to devote a chapter to the old quantum theory. Everyone knows that the original quantum theory developed by Bohr in 1913 has been refined and in a certain sense replaced by the new quantum mechanics of Heisenberg, Schrödinger, Born and Dirac. However, there is perhaps no better field than that of electric and magnetic susceptibilities to illustrate the inadequacies of the old quantum theory and how they have been removed by the new mechanics. We shall merely summarize the results of applying the old theory, without giving any mathematical analysis. Also, we shall contrast descriptively with these results some of the outstanding features of the new quantum mechanics of susceptibilities, thereby giving a qualitative account of some of the new improvements which may perhaps satisfy some readers who do not wish to read the mathematics in the two following chapters." This discussion of the old quantum theory leads to the gradual development in the reader of an intuitive feeling for this field of theory, in which intuition is especially valuable. An excellent brief discussion of quantum mechanical foundations is given in Chapter VI, followed in VII by the quantum mechanical derivation of the Langevin–Debye formula. In accordance with the author's policy of introducing difficult theory only when unavoidable, electron spin is handled by the machinery of the semi-mechanical model (Pauli, Heisenberg, Jordan) rather than by the Dirac theory. The thorough and clear discussion of special applications of the theory of susceptibilities with extensive comparison with experimental results is given in five chapters, dealing with electric moments (III), dielectric constants and diamagnetic susceptibilities of atoms and monatomic ions (VIII), paramagnetism of free atoms and rare earth ions (IX), para- and diamagnetism of free molecules (X), and the paramagnetism of solids (XI). Two concluding chapters contain discussions of Heisenberg's theory of ferromagnetism, the magnetic susceptibility of free electrons (Pauli, Landau) with applications to metals, Kerr effect, Faraday effect and other relevant topics.

The book provides a nearly exhaustive survey of developments in this field up to the beginning of 1931. The method of correlating magnetic moments of molecules and complex ions with the nature of the chemical bonds involved, discovered early in 1931, is not mentioned. Mention of an interesting chemical application of magnetic data, the interpretation

ten years ago by G. N. Lewis of the observed variation in the partial molal paramagnetic susceptibility of solutions of oxygen in liquid nitrogen as due to the formation of diamagnetic O_4 molecules, is also omitted.

The book is characterized by clear exposition and interesting style, which, combined with the sound and reliable treatment, should make it a valuable text for an advanced course as well as the authoritative reference book in the field. Much of the text, especially the interpretation of experimental results, can be understood without a knowledge of quantum mechanics. The volume is handsomely printed, with pleasing typography and binding.

LINUS PAULING

The Kinetics of Homogeneous Gas Reactions. By LOUIS S. KASSEL, Ph.D., U. S. Bureau of Mines Experiment Station, Pittsburgh, Pa. American Chemical Society Monograph. Published by the Chemical Catalog Co., Inc., 419 Fourth Ave., New York. Price $6.50.

This is a book which must interest both students and workers in the field of gas reactions, and is, in the opinion of the reviewer, the best book on the subject which has thus far appeared.

It opens with a chapter which contains certain general propositions concerning the energy of activation, this being followed by one which gives a brief account of that portion of statistical mechanics needed for the subsequent development. Next there is a series of chapters on the theoretical side of the subject, one each on bimolecular, trimolecular, unimolecular and complex reactions. The first of these contains a brief but clear account of the recent developments of London, Eyring and Polanyi on the quantum mechanics of activation. The chapter on unimolecular reactions is based on the theory of activation by collision, the almost defunct radiation hypothesis being properly relegated to an appendix.

After this theoretical treatment comes a discussion of the experimental material. There is a chapter on second order reactions, including reactions involving free atoms, one on third and one on first order reactions, and two on complex reactions, including chain reactions, reactions in dilute flames, explosions involving branching chains and reactions in which the chains begin on the wall. The first three of these chapters include full discussions of practically all known simple reactions; in the last two, on complex reactions, the material is selected to illustrate the principles involved, and the treatment is in some instances quite brief, causing a slight loss in clarity.

As may be inferred from the arrangement of the material, the subject is treated from what is essentially a theoretical point of view. The theory being first developed, the experiments can be discussed with it in mind and their significance fully understood; nevertheless, the chapters on the experimental work are so written that the worker who is chiefly interested in the experimental results can find them readily enough. Indeed, there is a

wealth of material in these chapters which, for many purposes, will make reference to the original work unnecessary. A critical attitude is taken throughout; the viewpoint of the original author on a given subject is not necessarily accepted, and whenever it has seemed desirable to the author of the book, the results have been recalculated; when this has been done, it is clearly so stated in the text. An author who uses the critical method will necessarily be in disagreement with many of his readers; but the reviewer is convinced that in this particular instance the opinions of the author are, on the whole, quite sound.

The book is certainly one to be heartily recommended; it seems unfortunate that the high price will discourage many from purchasing it.

OSCAR K. RICE

Galvanische Elemente und Akkumulatoren. Darstellung der Theorie und Technik nebst Patentregister. (Treatise on Theory and Technics of Primary Cells and Storage Batteries with Index of Patents.) By PROFESSOR C. DRUCKER AND DR. A. FINKELSTEIN. Akademische Verlagsgesellschaft m. b. H., Margrafenstrasse 6, Leipzig C 1, Germany, 1932. vii + 425 pp. 140 figs. 17.5 × 24.5 cm. Price, RM. 34; bound, RM. 36.

This is a useful book that deals with both primary cells and storage batteries. It is written especially for the engineer and chemist engaged in the production and utilization of batteries, but the book should find wider use as a general reference book. The text covers 247 pages and is followed by a section of 168 pages listing German, English and American patents relating to batteries, with brief abstracts.

The first chapter traces the historical development of various types of batteries and serves as an introduction to the theoretical discussion of modern types in Chapter 2.

The major portion of the text is devoted to the materials used in making batteries, the methods employed in manufacturing them, and their electrical characteristics. General references to recent books are given at the beginning of several chapters and numerous patents are cited in the text.

Three chapters deal with the Leclanché type which is extensively used and popularly known as the "dry cell." Properties of natural ore (pyrolusite) and artificially prepared manganese dioxide are compared. Physical and chemical properties of zinc, carbon, graphite and materials for the electrolyte are discussed. Various types of machines used in making batteries are illustrated. Electrical characteristics, applications and tests are described.

The last three chapters deal in a similar manner with storage batteries, including both the acid and alkaline types.

Some errors in the text have been corrected (see unnumbered page following the subject index), but others have escaped in the proof reading. On

pages 46, 54 and 55 several errors in writing the ionic equations have occurred. The units of resistivity in Table 2, page 35, and Table 26, page 163, are inconsistent. In the former table an exponent has been omitted in the heading of the last column. The footnote on page 212 has no relation to the subject matter of Table 30.

The book contains much valuable information and should be helpful to those concerned with this subject.

GEORGE W. VINAL

Handbuch der anorganischen Chemie. (Handbook of Inorganic Chemistry.) Edited by R. ABEGG, FR. AUERBACH and I. KOPPEL. Vol. IV (Dritte Abteilung, zweiter Teil, B, Lieferung 2). Complex Cyanides of Di- and Trivalent Iron. Verlag von S. Hirzel, Königstrasse 2, Leipzig, Germany, 1932. iv + 210 pp. 19 figs. 18 × 25.5 cm. Price, RM. 24.

As Professor Koppel, the surviving editor of this Handbuch, points out, the complex cyanides of iron, which all contain iron in the anion, are closely related among themselves not only in properties and methods of formation but also in their reciprocal transformations. They exhibit, however, marked differences from the simple salts of iron where the iron functions as cation. For this reason, these compounds have been treated jointly in a separate volume.

This separate presentation is also justified by the extensive investigations which have been made of these compounds and the very considerable number of them that have been prepared. Indeed, an inspection shows that while a total of 396 pages has been devoted in the Handbuch to all the simple compounds of iron, this monograph solely on the complex cyanides of iron occupies some 212 pages. Even then a great deal of the information has been presented in a highly compact, but still very illuminating, fashion in tables and graphs.

This mode of treatment has the further advantage of making patent also the gaps and deficiencies in our knowledge, so that this volume should not only be a great convenience to those working in this field but should stimulate and suggest further investigations therein.

ARTHUR B. LAMB

An Introduction to Organic Chemistry. By IRA D. GARARD, Ph.D., Professor of Chemistry in the New Jersey College for Women, Rutgers University. John Wiley and Sons, Inc., 440 Fourth Ave., New York, 1932. ix + 296 pp. 15 figs. 15.5 × 23.5 cm. Price, $3.00.

This brief volume encompasses the theoretical and laboratory parts of a short course in organic chemistry. Two hundred and thirty-eight pages are devoted to text, and 36 to a laboratory manual introducing 28 well-chosen experiments. The diagrams are generally good and the style of the author, simple and lucid. A wise effort to correlate organic and in-

organic chemistry is apparent. Though but few errors in proof reading are noted, it is certainly regrettable to have homologous misspelled in the definition of that term. The author apparently does not admit the commonly recognized distinction between empirical and molecular formulas, and unnecessarily complicates matters by designating ordinary structural formulas as "semi-graphic." It is unfortunate that writers persist in conveying to students the idea that an asymmetric carbon atom, rather than an asymmetric molecule, is essential to optical activity. The older names are used throughout where the newer and more acceptable terms glycosides and alkoxides are to be expected. In such a brief though comprehensive text certain omissions are quite obviously demanded, but to omit all reference to Grignard reactions, and to malonic ester and to acetoacetic ester is almost equivalent to cutting off a dog's tail just behind his ears as far as an appreciation of organic syntheses is concerned. The author set himself a difficult task in preparing a brief text and he did surprisingly well with it. Where students' time is at a premium, and where laboratory assistance is not readily available, this book will serve excellently to introduce theoretical and experimental organic chemistry.

G. ALBERT HILL

BOOKS RECEIVED

August 15, 1932–September 15, 1932

WILDER D. BANCROFT. "Applied Colloid Chemistry. General Theory." Third edition. McGraw-Hill Book Company, Inc., 330 West 42d St., New York. 544 pp. $4.00.

FRANZ FISCHER, Editor. "Gesammelte Abhandlungen zur Kenntnis der Kohle." Vol. X, 1930. Verlag von Gebrüder Borntraeger, W 35 Schöneberger Ufer 12a, Berlin, Germany. 613 pp. RM. 56; bound, RM. 58.50.

D. D. KARVÉ AND G. D. ADVANI. "Model Essays in Organic Chemistry." Sind Juvenile Coöperative Society, 1873 Elphinstone St., Karachi, India. 300 pp. Rs. 5/-; Sh. 8/-, net.

GEORG KRÄNZLEIN. "Aluminiumchlorid in der organischen Chemie." Revised edition. Verlag Chemie G. m. b. H., Corneliusstrasse 3, Berlin W 10, Germany. 144 pp. RM. 12.

GUSTAV TAMMANN. "Lehrbuch der Metallkunde. Chemie und Physik der Metalle und ihrer Legierungen." Fourth, enlarged, edition. Verlag von Leopold Voss, Salomonstrasse 18B, Leipzig C 1, Germany. 536 pp. RM. 48; bound, RM. 49.50.

"Transactions of The Electrochemical Society." Volume LXI. Published by The Electrochemical Society, Inc., Office of the Secretary, Columbia University, New York City. 568 pp.