
NEW BOOKS

Physical Chemistry for Colleges. A Course of Instruction Based upon the Fundamental Laws of Chemistry. By E. B. MILLARD, Professor of Physical Chemistry, Massachusetts Institute of Technology. Fourth edition. McGraw-Hill Book Company, Inc., 330 West 42d Street, New York, N. Y., 1936. ix + 524 pp. 73 figs. 14.5 × 21 cm. Price, \$3.75.

The present edition of this well-known text is a revision of the third edition with the size and character remaining virtually unchanged. The revision has involved greater clarity of presentation of certain topics, substitution of new concepts for older ones, and substitution of many new problems for old problems. Portions of four or five of the chapters have been partially rewritten, notably the chapters on equilibrium, kinetics of reaction and atomic structure. The chapter on "Physical Properties and Molecular Structure" has been omitted and a new chapter on "Free Energy of Chemical Changes" has been added. The changes which have been made, while not extensive, serve to maintain the up-to-date character of this meritorious book.

F. E. BARTELL

Textbook of Quantitative Inorganic Analysis. By I. M. KOLTHOFF and E. B. SANDELL, University of Minnesota. The Macmillan Company, 60 Fifth Avenue, New York, N. Y., 1936. 749 pp.

It requires only a cursory examination of this book to dispel the feeling of satiety with which one is apt to greet the appearance of a new textbook of analytical chemistry. The reader soon realizes that this text enters a new field and satisfies a need which is not met by other English books. To the advanced student of quantitative analysis the book offers a thorough treatment of the fundamental principles upon which the subject rests, a comprehensive discussion of the apparatus, reagents and practical technique employed in analysis and a valuable key to the literature of analytical chemistry. It should prove invaluable in the training of analytical chemists as contrasted with chemical analysts.

Sections of the book are devoted to gravimetric analysis, volumetric analysis, physico-chemical methods, and analyses of complex materials. In the first two of these sections theoretical parts precede parts given over to practical details and specific directions. The outstanding characteristic of this book is the thoroughness with which the theoretical fundamentals of the subject are treated. The authors justify their remark, "The theory of analytical chemistry does not constitute a special branch of chemistry; rather it comprises the application of our entire scientific knowledge to the particular purpose." The phenomena of precipitation and coprecipitation are given particularly extensive treatment.

In the practical and specific parts the same logical completeness is maintained. Thus nine pages of small print

are devoted to the precipitation of barium sulfate. There is no falling away into the cookbook style sometimes found in elementary texts. Particularly pleasing are the ample references given to the original literature. These as well as the methods treated in the text are thoroughly up-to-date.

In the third section upon physico-chemical methods a wide variety of general methods are briefly explained. Colorimetry is treated in some detail. Here again the student is given an excellent start in the literature. In the final section upon the analyses of complex materials, directions are given for the analyses of brass, steel and silicate rocks.

The book is set in three sizes of type to facilitate its use in elementary courses, material of a more advanced nature being in small type. Problems with answers are given at the end of the chapters. It is a book to be recommended for serious students.

CHARLES H. GREENE

Der Aufbau der Zweistofflegierungen. Eine kritische Zusammenfassung. (The Constitution of Binary Alloy Systems. A Critical Compilation.) By M. HANSEN. Verlag von Julius Springer, Linkstrasse 23-24, Berlin W 9, Germany, 1936. xv + 1100 pp. 456 figs. Price, RM. 87.

This book adequately fills a long felt need in metallurgical research. The available data for each binary system are critically discussed and where possible a probable equilibrium diagram is chosen. An exhaustive bibliography follows each discussion, including most 1935 and even some 1936 references. In all, 828 systems are treated, although a few of these receive very brief notice indeed. The longest is the 18-page discussion and 3-page bibliography devoted to the copper-zinc system.

The only comparable work is the set of diagrams in the "International Critical Tables." But these deal with only 200 odd systems and omit discussion. Since there are points of doubt about nearly all the diagrams, discussion is a necessity.

Practically all the important facts one could glean from an extensive survey of the literature seem to be listed under each alloy system. The discussions might be improved by adopting a standardized order of presentation. Suitable subheadings such as liquidus, solidus, miscibility, intermediate phases, etc., might well be common to all systems extensively discussed.

Since experimental data on solid transformations are often meager, contradictory, or subject to varying interpretations, it is not to be expected that the author's chosen equilibrium diagrams will be final or complete. But no general criticism can be made of his selections.

Naturally it is possible to criticize details. For example, the equilibrium diagrams of cobalt do not show the high temperature transformation to hexagonal cobalt discovered in 1930 by Hendricks, Jefferson and Shultz and

since abundantly verified. In the Fe-Ni system the author states that it is impossible to detect superstructures by x-ray diffraction because of the nearly equal atomic numbers. However, Jette and Foote recently pointed out that in this and some other cases it is possible to take advantage of critical absorption limits. Nickel radiation is largely absorbed by Fe atoms, leaving the Ni atoms as the only effective scatterers, so that superstructures could be detected.

Such criticisms could be multiplied without altering the fact that the book contains an essentially complete summary of all the experimental data on binary metallic systems. Alloys of nitrogen, sulfur, carbon, phosphorus, and other nonmetals which form metallic alloys are also included.

The systems are printed in the order of the initial letter of the chemical symbol and so can be found rapidly without referring to the index. An author index is lacking. The book is beautifully printed and bound.

RALPH HULTGREN
ALDEN B. GRENINGER

Organic Chemistry. A Brief Introductory Course. By JAMES BRYANT CONANT, President of Harvard University, Formerly Sheldon Emory Professor of Organic Chemistry, Harvard University. Revised, with the assistance of MAX TISHLER, Ph.D. The Macmillan Company, New York, 1936. ix + 293 pp. 27 figs. 14.5 × 22 cm. Price, \$2.60.

This brief text is intended primarily for students in pre-medical, biological, and general science curricula. It gives an excellent presentation of the fundamental notions of organic chemistry and their relations to biology and to industry. The 1928 edition¹ has been revised thoroughly—some changes have been made in the arrangement of material and new sections have been added. The additions include a chapter on unsaturated alcohols and acids, and on compounds of biological interest. The subject of geometrical isomerism, which was not covered in the first edition, is given a brief but adequate discussion. The revision retains a novel feature of the first edition, namely, the introduction to the subject by way of the alcohols. This book is so arranged that a teacher who prefers to start in the more orthodox fashion, with the hydrocarbons, may do so with little difficulty.

The revision includes reference to newer industrial processes and products such as the synthesis of higher alcohols from olefins, *n*-butyl alcohol from acetaldehyde, chloroprene from acetylene, and fluorine derivatives of methane. The traditional exposition of degradation through the series, $R-CH_2OH \longrightarrow R-CO_2H \longrightarrow RCONH_2 \longrightarrow R-NH_2 \longrightarrow ROH$, has been abandoned for reasons of scientific integrity. In the last step rearrangements occur so frequently and are sometimes so complete as to render this method valueless in the determination of structure. Unfortunately no suitable substitute can be offered in a book of this scope.

It is pleasing to note that the idea of structural units has been introduced in dealing with the natural polymers,

rubber and cellulose. It would have been possible to extend a similar treatment to the proteins.

The present volume differs from the author's larger book² in the omission of mechanisms and theoretical interpretations. The brief text is unusually adequate and differs from many similar books in that a sound exposition of the principles of organic chemistry has not been sacrificed for the sake of brevity, and no undue emphasis has been given to fields of the author's special interests.

(2) J. B. Conant, "The Chemistry of Organic Compounds. A Year's Course in Organic Chemistry," The Macmillan Company, New York, 1933. x + 623 pp.

JOHN R. JOHNSON

Invisible Radiations of Organisms. By OTTO RAHN, Professor of Bacteriology, Cornell University. With an Introduction to the Physics of Radiation, by Sidney W. Barnes, Research Associate in Physics, University of Rochester. Verlag von Gebrüder Borntraeger, Koester-Ufer 17, Berlin W 35, Germany, 1936. x + 215 pp. 52 figs. 15 × 22.5 cm. Price, RM. 13.20.

This book is a very clear and precise presentation of the problem of mitogenetic radiation. It is extremely well written and the subject matter is arranged in a logical order.

The work has been written primarily to awake the interest of biologists. Hence, the introductory chapter (30 pages) gives an elementary description of the physics of radiation. The results of the electromagnetic and quantum theory of light are presented in a somewhat popular style and the various methods of intensity and frequency measurements are discussed with special emphasis on the limitations of the physical methods. The second and third chapters discuss the spectra of the light emitted by chemical and biochemical reactions and the effects of radiation on such reactions and on living cells.

Chapters IV, V and VI give a lucid account of the work on mitogenetic radiation and the proposed explanations of the mitogenetic effect. The investigations of Gurwitsch and Reiter and Gabor on onion roots, of Baron, Siebert, Tuthill and Rahn on yeast cells, and the use of bacteria and larger organisms as detectors are discussed in considerable detail. Against the negative results of Moissejewa the author quotes the investigations of Paul. The work with physical and physico-chemical detectors is considered to be inconclusive. Chapter IV ends with a short account of other radiations of biological importance, injurious human radiations, necrobiotic rays, infra-red and beta radiations. The peculiar properties of mitogenetic radiations, the effect of intermittent irradiation, production of secondary radiation and retardation of mitosis by an overdose are discussed in Chapter V. In Chapter VI the various interpretations of the mitogenetic effects are compared with the experimental facts. The author concludes that a cell is susceptible to mitogenetic radiation only when it is in a particularly physiological state.

The concluding chapter, VII, deals with the radiation from nerves, tissues and blood and connects the problem of mitogenetic radiation with the problems of growth, healing of wounds and cancer.

(1) Reviewed by W. H. Hunter, *THIS JOURNAL*, 51, 1619 (1929).

This monograph can be highly recommended to biologists as well as to chemists and physicists. It is written with great ability and remarkable fairness. Dr. Rahn is convinced, from his own experiences, that mitogenetic radiations exist, but he very frankly admits the occasional failure of the experiments and the contradictory nature of some results. In pointing out the mistakes of the mitogeneticists and their opponents, he has succeeded in giving a valuable guide for further research, which is needed before the proof of existence of the mitogenetic effect can be accepted.

HANS MUELLER

Die Korrosion metallischer Werkstoffe. (The Corrosion of Metallic Materials.) Vol. I. **Die Korrosion des Eisens und seiner Legierungen. (Corrosion of Iron and its Alloys.)** By OSWALD BAUER, OTTO KRÖHNKE and GEORG MASING, Editors. Verlag von S. Hirzel, Königstrasse 2, Leipzig, Germany, 1936. 560 pp. 219 figs. Price, RM. 37.50; bound, RM. 39.

This, the first of a series of four volumes, deals only with iron and iron alloy corrosion. Three additional volumes are in preparation. The second will cover the corrosion of non-metals, the third corrosion prevention, and the fourth will discuss important technical corrosion problems.

The first chapter, theoretical (by G. Masing), pp. 31-126, discusses: A—Corrosion of metals in electrolytes, under the headings, fundamental electrochemical phenomena, inhibited electrode phenomena, solution of metals accompanied by formation of hydrogen, corrosion accompanied by electrochemical consumption of oxygen, protective films, passivity, electrochemical behavior of alloys; B—Corrosion of metals by gases, under the headings, general, optical determination of the thickness of films, oxidation of metals, thick films. A short appendix on the behavior of metals with liquid non-electrolytes is included. The second chapter, the corrosion of iron (by C. Carius and E. H. Schulz), pp. 127-407, deals with corrosion as a physical chemical phenomenon, formation of galvanic cells, formation of rust, corrosion in natural waters and aqueous salt solutions, and atmospheric corrosion. In discussing the corrosion of commercial irons they include the effect of composition, heat treatment, surface condition, method of working, corroding media including chemicals, the effect of stresses, etc. There is a chapter on highly corrosive steels (by K. Daeves), pp. 408-429, and a chapter on acid and scale resistant iron alloys (by E. Houdremont and H. Schottky), pp. 430-529. This last chapter discusses: A—Iron-chromium alloys under phase diagrams, heat treatment and strength, other physical qualities, corrosion resistance with extensive tables, commercial requirements of heat resistant alloys, technical behavior, possibilities for utilization, and discussion; B—A short section on iron-nickel; and C—Iron-silicon alloys is included. Two pages of corrections and a well arranged name and subject index are included.

The present book is a compilation of published and unpublished data. Most of the material is critically reviewed. The authors are apparently unfamiliar with much of the literature, especially that outside of Germany.

They refer to the first edition only of Speller's "Corrosion, Causes and Prevention." Of the four English and two German bibliographies mentioned by Speller they refer only to that of Rabald. The reviewer has checked many of the articles mentioned in Speller's (second edition) selected bibliography and finds only a few of those dealing with the topics which one would expect to find mentioned by the authors in Volume I. One finds no mention of the extensive work on soil corrosion, very little mention of the principles and methods of corrosion testing. On the whole, however, the present work is a valuable, well-prepared addition to the literature on the important subject of corrosion.

MERLE RANDALL

Introduction to Quantum Mechanics with Applications to Chemistry. By LINUS PAULING, Ph.D., Sc.D., Professor of Chemistry, California Institute of Technology, and E. BRIGHT WILSON, JR., Ph.D., Society of Fellows, Harvard University. McGraw-Hill Book Company, Inc., 330 West 42d Street, New York City, 1935. xiii + 468 pp. 15.5 × 23.5 cm. Price, \$5.00.

In spite of the many introductions to quantum mechanics which have appeared in the last few years, there would still seem to be room for a book on this subject addressed to the chemist and emphasizing the aspects of particular interest to him; this niche is admirably filled by the volume under review. It begins with a survey of classical mechanics and the old quantum theory. Then the Schrödinger wave equation is introduced, and its properties and the physical significance of its solutions are discussed. The hydrogen atom is discussed in great detail, and tables of eigenfunctions for a number of the lower energy levels are given; these should be convenient for reference for anyone who is making calculations with hydrogen-like functions. A great deal of the book is devoted to perturbation theory and its application to the electronic structure of atoms and molecules and to the binding energies of molecules, topics of great importance to the chemist, presented in detail and in easily comprehensible form. An elementary account of electron spin, sufficient for the purposes of the book, is given in an early chapter. There are also chapters on the variation method (with applications also in later chapters), the rotation and vibration of molecules, absorption and emission of radiation, some miscellaneous applications, and the general theory, including matrix mechanics and the uncertainty principle. Some useful mathematical material is given in appendices. Some topics usually treated in elementary books on wave mechanics are omitted as of little immediate use to the chemist. The reviewer cannot agree with the authors that this ground for omission holds in the case of aperiodic processes, but the inclusion of this subject would undoubtedly have required considerably more space, and in general the topics are well selected to fulfill the purposes for which the book is intended. Detailed application of the theoretical development to experimental material is confined for the most part to a few of the simplest cases, such as the hydrogen atom, the helium atom, the hydrogen molecule, and the hydrogen molecule-ion (in which cases great detail

is given). Inclusion of more material of this sort probably would have been desirable, but again would have lengthened the book, and enough of the theory is given to make reference to the original literature sufficiently easy.

The wave equation is introduced in an early chapter as a fundamental hypothesis. This course is quite as satisfactory as any other from a purely logical point of view, though the reviewer believes that some preliminary discussion of the relation between wave and corpuscle aspects of radiation and matter, designed to show the reasonableness of this hypothesis, would have made matters easier for the beginner. The first two chapters on classical mechanics and the old quantum theory do not quite seem to take the place of such a discussion. However, in general, the book is clearly and carefully written, so as to reduce the mathematical difficulties to a minimum. A reviewer's opinion of the clarity of an exposition of a subject with which he is already acquainted is perhaps to be questioned; in this case the reviewer's judgment on this matter has been corroborated by conversation with people who have been reading the volume with the purpose of learning the subject. He believes, therefore, that there is no doubt that this book will prove extremely valuable to those studying the subject for the first time. But, also, its later chapters constitute an excellent reference work for investigators doing research in this field, especially useful for the detailed accounts given of many important subjects.

O. K. RICE

Die Thermodynamik einheitlicher Stoffe und binärer Gemische, mit Anwendungen auf Verschiedene physikalisch-chemische Probleme. (The Thermodynamics of Simple Substances and Binary Mixtures, with Application to Various Physico-chemical Problems.) By DR. J. J. VAN LAAR. G. E. Stechert, New York, or P. Noordhoff N. V., Groningen und Batavia, 1936. 279 pp. Price, \$8.00; bound, \$9.00.

The first 145 pages are devoted to the chemical elements. Here the equation of state is developed in detail and the various constants entering into the thermodynamic equations are presented in tabular form. In the second part of the book there is a chapter on Gibbs' thermodynamic potential and the application of the theorem of homogeneous functions to the study of mixtures. The complexities of the equilibrium between phases of binary mixtures are treated in considerable detail. The book may find some use as a reference source for data and for the equations of classical thermodynamics, but it certainly will not prove of any value as a textbook in America. One looks in vain for the numerous experimental and theoretical advances which have been made in this country and abroad in recent years. The reviewer could locate nothing on the third law or the modern applications of statistics. Two pages are devoted to Debye's electrolyte theory which is followed by a page on Ghosh's theory. Both presentations were very disappointing. The activity concept is dismissed as "ein leeres Wort." There are very few data in the book which have been obtained since 1920. The entire presentation is not only mathematically formidable, but appears to be unduly complicated and terrifying.

VICTOR K. LA MER

Gmelin's Handbuch der anorganischen Chemie. (Gmelin's Handbook of Inorganic Chemistry.) Edited by R. J. Meyer. **Aluminium-legierungen.** Patentsammlung geordnet nach Legierungs-systemen. (Aluminium Alloys. A Collection of Patents.) Parts I-II. By A. Grütznert with the Collaboration of G. Apel. Verlag Chemie, G. m. b. H., Corneliusstrasse 3, Berlin W 35, Germany, 1936. 342 + 526 pp. Price, RM. 35 + 40.50.

This collection of patents on aluminum alloys is published as an Appendix to the volumes on Aluminum (Part A) of Gmelin's Handbook of Inorganic Chemistry, 8th Edition. The Introduction states that it covers completely the patent literature on these alloys from 1887 to May, 1935. The patents are arranged in a continuous table. The constituent elements of each alloy are listed serially in alphabetical order and the alloys thus characterized are themselves also arranged in alphabetical order. This makes it possible to find out quickly and easily whether an alloy of any given composition is protected by patents, and the very laborious and time-consuming search through the patent literature of all countries which would otherwise be required, is thus avoided.

This volume does not attempt to cover at all the literature dealing with aluminum alloys published in scientific journals, etc., since this information is available in the volumes on Aluminum (Part A) of the Gmelin Handbook.

ARTHUR B. LAMB

Dynamics of Rigid Bodies. By WILLIAM DUNCAN MACMILLAN, A.M., Ph.D., Sc.D., Professor of Astronomy, The University of Chicago. McGraw-Hill Book Company, Inc., 330 West 42d Street, New York, N. Y., 1936. xiii + 478 pp. 80 figs. 16 × 23.5 cm. Price, \$6.00.

This book is the third of a series on theoretical mechanics by the same author, the first two being "Statics and the Dynamics of a Particle" and "The Theory of the Potential." The present volume is independent of the first two, however, and contains a good deal of general dynamical theory besides the specialized applications to rigid bodies. Thus, the algebra of vectors, systems of free particles, impulsive forces, Lagrange's and Hamilton's equations are treated quite fully, in addition to a wide variety of problems involving rigid bodies.

Although this work covers a difficult field and will be especially useful to advanced students, the presentation is in general clear and complete, so that any reader with a knowledge of elementary physics and the usual undergraduate courses in differential equations should find it very profitable reading. A number of mathematical concepts are described in the text in connection with their application to dynamical problems; for example, the algebra of matrices, which is used in the last chapter in the discussion of the method of periodic solutions.

The index is satisfactory, and in general the mechanical details, such as choice of type, page arrangement, printing and binding are of the usual high standard maintained by the publisher. Very few misprints were noticed.

This reviewer regrets that the conventional method of defining the Eulerian angles was used, since it seems much

simpler to call θ and φ the ordinary polar coordinates of the moving ζ -axis and then to define the third angle as usual (wave mechanicians would appreciate in addition the use of some other symbol besides ψ).

Except for the above trifling criticism, this reviewer found considerable pleasure and profit in reading the book and recommends it to anyone who is interested in dynamics.

E. BRIGHT WILSON, JR.

BOOKS RECEIVED

June 15, 1936–July 15, 1936

- RENÉ ARDITTI. "Les Théories Quantiques." Hermann et Cie., Éditeurs, 6 Rue de la Sorbonne, Paris, France. 33 pp. Fr. 8.
- E. DARMOIS. "Un Nouveau Corps Simple. Le Deutérium ou Hydrogène Lourde." Hermann et Cie., Éditeurs, 6 Rue de la Sorbonne, Paris, France. 41 pp. Fr. 10.
- CARL J. ENGELDER, TOBIAS H. DUNKELBERGER and WILLIAM J. SCHILLER. "Semimicro Qualitative Analysis." John Wiley and Sons, Inc., 440 Fourth Ave., New York, N. Y. 265 pp. \$2.75.
- WILLIAM FOSTER. "Inorganic Chemistry for Colleges. A Textbook for Students who have had a Preparatory Course in Chemistry." Second edition. D. Van Nostrand Co., 250 Fourth Ave., New York, N. Y. 925 pp. \$3.90.
- FRANK LAUREN HITCHCOCK and CLARK SHOVE ROBINSON. "Differential Equations in Applied Chemistry." Second edition. John Wiley and Sons, Inc., 440 Fourth Ave., New York, N. Y. 120 pp. \$1.50.
- BRUNO LANGE. "Die Photoelemente und ihre Anwendung. Teil 2. Technische Anwendung." Johann Ambrosius Barth Verlag, Salomonstrasse 18B, Leipzig C 1, Germany. 94 pp. RM. 6.75.
- JAMES MURRAY LUCK, Editor. "Annual Review of Biochemistry." Vol. V. Annual Review of Biochemistry, Ltd., Stanford University P. O., Calif. 640 pp. \$5.00.
- FRANK H. MACDOUGALL. "Physical Chemistry." The Macmillan Company, 60 Fifth Ave., New York, N. Y. 721 pp. \$4.00.
- MARCEL MATHIEU. (1) "Réactions Topochimiques. Généralités." (2) "La Nitration de la Cellulose. Réaction Topochimique." (3) "La Gélatinisation des Nitrocelluloses. Réaction Topochimique." Hermann et Cie., 6 Rue de la Sorbonne, Paris, France. (1) 57 pp. Fr. 12. (2) 65 pp. Fr. 12. (3) 73 pp. Fr. 12.
- J. W. MELLOR. "A Comprehensive Treatise on Inorganic and Theoretical Chemistry. Vol. XV. Ni, Ru, Rh, Pd, Os, Ir." Longmans, Green and Company, 114 Fifth Ave., New York, N. Y. 816 pp. \$20.00.
- M. QUINTIN. "Activité et Interaction Ionique. II. Étude Expérimentelle de l'Activité des sels de Métaux Lourds." Hermann et Cie., 6 Rue de la Sorbonne, Paris, France. 90 pp. Fr. 18.
- R. STREBINGER. "Praktikum der quantitativen chemischen Analyse. Teil I. Gewichtsanalyse, Elektroanalyse, Gasanalyse." Verlag Franz Deuticke, Wien, Austria. 100 pp. M. 2.80.
- WOJECZ SWIETOSLAWSKI. "Ebulliometry." Jagellonian University Press, Krakow, Poland. 196 pp.
- CLARENCE J. WEST, Editor. "Annual Survey of American Chemistry." Vol. X, 1935. Published for the National Research Council by Reinhold Publishing Corporation, 330 West 42d St., New York, N. Y. 487 pp. \$5.00.