NEW BOOKS

Smith's Introductory College Chemistry. By JAMES KENDALL, F.R.S., Professor of Chemistry in the University of Edinburgh. The Century Co., 353 Fourth Ave., New York, 1931. xii + 555 pp. Illustrated. 13.5 × 20.5 cm. Price, $3.25.

This text maintains the traditional Smith arrangement. It will prove just as effective in its field as the other Smith texts.

The arrangement of facts followed by theory throughout the book interspersed here and there with problems illustrating the principles learned is the only way to teach a science. The Smith texts have always done this very well. In that respect this text is just as good as the others.

In abbreviating the College Chemistry nothing essential has been omitted. The text ought to be well received in colleges where the larger volume seemed to contain too much material for the type of course offered.

In regard to the Smith texts as a whole it seems to me that Kendall ought to have the courage of the Founder and introduce the subject by his chapters on the Periodic System and the structure of the atom if he wishes these texts to maintain the supremacy established by Smith when he revolutionized the teaching of General Chemistry in 1906. The time is ripe for another jolt in first year College Chemistry.

JOHN B. ZINN

Qualitative Chemical Analysis from the Standpoint of the Laws of Equilibrium and the Ionization Theory. By LOUIS J. CURTMAN, Associate Professor of Chemistry, The College of the City of New York. The Macmillan Company, 60 Fifth Ave., New York, 1931. x + 539 pp. Illustrated. 14.5 × 22.5 cm. Price, $4.00.

This textbook is planned for a full year's course in qualitative analysis. It is divided into five parts.

The first part, 137 pages, is devoted to Theory and Special Apparatus. It includes much material usually found only in treatises on physical chemistry. Hydrogen Electrode, Buffered Solutions, Concentration Cells, Atomic Structure The Centrifuge, and Werner's Coördination Theory are some of these. All such included topics are treated in such a manner as to show their applications to qualitative analysis. The treatment of ionization is good. The Theory of Debye and Hückel is presented but the useful parts of the older theory are not omitted. Writing equations, including those representing oxidation–reduction reactions, and the solution of problems are carefully and fully explained. The connection between the statement of the theory and the mathematical expressions for the mass law and the solubility product is not given very fully.

The 112 pages devoted to The Metal Ions consists of descriptions of reactions significant in qualitative analysis, equations to represent these reactions and theoretical explanations of the changes which occur.

The 20-page section entitled Calculations is devoted entirely to calcula-

tions connected with standard solutions. However, problems and questions to test the understanding of other calculations appear in appropriate places through the book.

The fourth part, Laboratory Work, includes: directions for making apparatus, a list of all chemicals and the quantity needed by a student in the course, directions for the preparation of an individual kit for each student including the cabinet, bottles, making the solutions and directions for preliminary experiments and analysis for cations.

The fifth section deals with preliminary experiments and analysis for acid ions and includes a plan for a systematic analysis. The acids are identified first because so many acid ions interfere with cation analysis.

The analysis includes tests for 25 cations and 25 anions. The 39 figures are well chosen and very helpful. Eighteen numbered tables of data and many more unnumbered tabulations furnish an enormous amount of information relevant to analysis. The 16-page table of analytical constants is especially valuable. The tables showing the dissociation constants of complex ions and the equivalent conductance of ions at infinite dilution suggest the wide range covered. The book contains an enormous amount of well-chosen and well-presented material on qualitative analysis. It should be extremely valuable to any teacher of qualitative analysis. Teachers might omit some parts of the material presented, but the text is too comprehensive for courses shorter than two quarters.

F. E. BROWN

Lehrbuch der anorganischen Chemie. (Textbook of Inorganic Chemistry.) By Dr. HEINRICH REMY, Professor at the University of Hamburg. Akademische Verlagsgesellschaft m. b. H., Schlossgasse 9, Leipzig C 1, Germany, 1931. Vol. I, xxii + 718 pp. 92 figs. Vol. II, xvi + 450 pp. 32 figs. 15 × 24 cm. Price, Vol. I, RM. 20; bound, RM. 23. Vol. II, RM. 14; bound, RM. 16.80.

This new textbook is a significant attempt at an instructive presentation of the most recent aspects of inorganic chemistry. The object and method of the author are stated in his preface as follows: "The present book is designed to afford a comprehensive picture of the whole field of inorganic chemistry. This is to be effected by a presentation of the body of facts which have resulted from observation and experimentation, with particular emphasis on the laws which connect them, and the causal relationships which are deducible from them."

The book assumes a general knowledge of elementary chemistry and physics. The author starts with a careful description of the Periodic System, which thereafter serves as the guiding principle in the arrangement and treatment of the chemical elements and their compounds. The first volume is devoted to the elements of the main groups of the periodic system, that is, to the elements whose atomic numbers are 1–3 units greater or 4–1

units smaller than the atomic number of an inert gas. The second volume covers the other elements, that is, the elements of the transition groups (Nebengruppen) and the rare earths (lanthanide group).

Hydrogen is the first element to be discussed, and it serves for the introduction and elucidation of such general matters as electrolysis, electrochemical potential, overvoltage, the mass law, the reaction isochore, strong and weak electrolytes, series spectra, and Bohr's theory. The chapter on the inert gases comes next, and this is followed by a chapter on Kossel's and Lewis' theories of valence. A chapter on the alkali metals is followed by one of 34 pages on crystal structure and x-rays. A similar intercalation of theoretical discussion at appropriate points occurs throughout the remainder of the treatise. It therefore affords a thorough presentation not only of the facts of inorganic chemistry, but also of the theories of general chemistry. A similar procedure has been adopted in certain previous textbooks, but this represents the most up-to-date attempt in this direction.

The descriptive matter is presented from a thoroughly modern point of view. Crystal structure data abound and constant application is made of the coördination theory. The chemistry of many really important elements such as titanium, zirconium, vanadium, molybdenum, tungsten and uranium which usually is given scant attention except in the very largest treatises is here presented very fully. There is also an exceptionally clear and satisfactory chapter on the rare earths.

Every fact of inorganic chemistry that one might like to have available cannot, of course, be included in two medium-sized volumes. Thus, details as to methods of preparation of substances, the industrial and technical aspects of inorganic chemistry, and in particular the metallurgy of the common metals are not very adequately covered. The book should, however, be most useful and instructive to students and teachers of inorganic chemistry who wish to secure a broad and up-to-date knowledge of both the descriptive and theoretical aspects of their subject.

ARTHUR B. LAMB

Bandenspektren. (Band Spectra.) By Dr. W. WEIZEL, Professor at the Technical High School of Karlsruhe. Akademische Verlagsgesellschaft m. b. H., Schlossgasse 9, Leipzig C 1, Germany, 1931. xiii + 461 pp. 139 figs. 17.5 × 25 cm. Price, RM. 43; bound, RM. 45.

This book on molecular spectra is issued as the first supplementary volume to the Wien–Harms "Handbuch der experimentellen Physik." The subject had already been treated in Vol. 22 of the Handbuch, but its subsequent development has been so rapid that the editors thought it advisable to publish this new and fuller account. This was especially true because the theory of band spectra has now become a relatively complete

and stable structure, in so far as it concerns diatomic molecules. Weizel's book is masterly in treatment, and in the reviewer's opinion is by far the best and most complete yet published on the subject.

The book is divided into an introduction and four chapters. In the first chapter (143 pages) the theory of the energy levels of diatomic molecules is developed in a very clear and comprehensive manner, largely in terms of "a somewhat primitive" form of wave mechanics. The second chapter (66 pages) is entitled "The structure of the band spectra of diatomic molecules," and includes a discussion of intensity relations. Chapter III (11 pages) deals briefly but helpfully with the theory of polyatomic molecules.

After laying this solid theoretical foundation, the author uses it in the fourth chapter (222 pages) to classify and explain what is known experimentally about the spectra of diatomic and simple polyatomic molecules. The polyatomic molecules occupy 31 of the 222 pages. This chapter contains an adequate review of practically all important results on these spectra obtained up to June 1, 1931. The chapter is divided into sections, for example: the spectra of hydrogen (H_2); the band spectra of metal vapors; band spectra of diatomic hydrides; spectra of the oxides; spectra of molecules of the type XY_2 (CO_2, NO_2, SO_2, etc.); spectra of organic compounds. Each such section ends with an extensive bibliography of the important literature, omitting, however, older references which have been superseded by more recent work. Nearly every section contains complete tables of molecular constants resulting from the analysis of the band spectra discussed in that section. These data are, however, admittedly not always critical, especially in the case of energies of dissociation, and there are occasional errors and omissions. Numerous convenient tables of wave length or frequency data are included. The book contains numerous helpful explanatory figures.

Chemical applications of band spectrum data are not stressed: for example, very little is said about the problem of chemical binding and valence, and little or nothing about the use of band spectrum data in calculating specific heats and entropies, or in estimating heats of activation.

ROBERT S. MULLIKEN

Physical Chemistry for Colleges. By E. B. MILLARD, Professor of Physical Chemistry, Massachusetts Institute of Technology. Third edition. The McGraw-Hill Book Company, Inc., 370 Seventh Ave., New York, 1931. ix + 522 pp. Illustrated. 14.5 × 21 cm. Price, $3.75.

The first edition of this book appeared in 1921 and the second edition in 1926. The present third edition contains some 111 pages more than the first edition and 64 more than the second. Errors, which were fairly numerous in the first edition, have been largely eliminated; a few still

remain. As stated in the preface to the first edition, "The limitations of the orthodox laws of physical chemistry have been emphasized more than is commonly done in beginning courses in physical chemistry."

All the more important phases of physical chemistry are included in this book. The inclusion of so many topics in a book of this size will be criticized by some as having resulted in a too highly condensed treatment of certain important topics, such, for example, as that of liquefaction of gases, which is confined to a single short paragraph. It is the opinion of the reviewer that the chapter on properties of substances in the liquid state could be improved by a slight expansion in which the kinetic theory as related to this state would receive ample discussion. A more rigorous treatment of the evaluation of boiling point constants and freezing point constants would be helpful. This is especially desirable since the values for the constants as given in the tables cannot be obtained by use of the methods described in the text. In the chapter on thermochemistry confusion would be avoided by adopting a convention to be observed throughout in referring to heats of combustion. As it is, one does not always know whether the author refers to heats of combustion at constant pressure or at constant volume. This cannot help but be troublesome to the student in his attempts to solve the problems given in this chapter.

The chapters on chemical kinetics, on atomic structure and on heterogeneous equilibrium have been revised. The latter has been distinctly improved by the inclusion of diagrams and discussions which give a desirably complete and condensed treatment of this important chapter. A new chapter on photochemical change has been added. Of outstanding value are the excellent groups of questions and problems given at the end of each chapter. Important additions of these have been made in the present edition. On the whole this new, third edition represents a distinct improvement over earlier editions, is a book which possesses real merit, and deserves a prominent place among the better texts in physical chemistry.

F. E. BARTELL

Molecular Rays. By RONALD G. J. FRASER, Ph.D. (Aberdeen). The Macmillan Company, 60 Fifth Ave., New York, 1931. xiii + 204 pp. 14.5 × 22 cm. Price, $3.75.

The author of this excellent book, "Molecular Rays" (in the Cambridge Series of Physical Chemistry), has himself spent three years in Professor Stern's laboratory. With his background of intimate acquaintance with the details of the molecular ray technique, Dr. Fraser attempts to give an account of the fundamentals of this new field of research. The author succeeds so well that one cannot read the pages of this book without catching some of the inspiration of the subject. Those who read will appreciate, perhaps for the first time, the beauty and the power of the molecular ray

method, and will become firm believers in the marvelous possibilities which undoubtedly are to attend its future development.

The book, with a two-page Foreword by Professor Stern, is composed of seven chapters, headed as follows: The Production and Measurement of Molecular Rays; Gas Kinetics; Problems of the Gas–Solid Interface; The Diffraction of Molecular Rays; The Magnetic Deviation of Molecular Rays; The Electric Deviation of Molecular Rays; Chemical Equilibria, Ionization, Spectroscopic Applications. An appendix gives a brief discussion of the relationships among, and conversion factors for, average velocity, root mean square velocity and the most probable velocity. Both an author and a subject index are supplied.

"The book has been written strictly from the experimental standpoint, and is intended primarily to give a balanced survey of the whole field rather than a minute examination of its separate parts" (from Author's Preface). The book is written in clear, forceful English, with enough detailed but simple mathematical development to make the important equations clear. Particularly attractive are the author's treatments of methods of "detecting" molecular beams, and of problems involved when molecular beams impinge on solid surfaces, including the effects, scattering, reflection, adsorption, condensation and diffraction. Chemists will be interested to note, in Chapter 7, the critical judgment which Dr. Fraser passes on the three attempts which have been made to test the radiation hypothesis by using a collision-free molecular ray, namely, the experiments of Kröger with iodine, Mayer with pinene and Rice, Urey and Washburne with nitrogen pentoxide. The author gives good reasons for doubting whether any of these attempts really establishes the conclusion which it is generally supposed has been established, although the author predicts that the molecular ray method of studying chemical reactions may yet prove of value.

Chemists and physicists who expect to follow the future literature accounts of developments in this most fascinating field of the molecular ray would do well to digest the contents of Dr. Fraser's book.

EDWARD MACK, JR.

Elektrochemie der Kolloide. (Electrochemistry of Colloids.) By Prof. Dr. WOLFGANG PAULI AND Dr. EMERICH VALKÓ. Verlag von Julius Springer, Linkstrasse 23–24, Berlin W 9, Germany, 1929. xii + 647 pp. Illustrated. 16 × 24 cm. Price, $17.00.

Pauli and Valkó have produced a book which undoubtedly takes a place amongst the chief works on colloid science. It is always of great service to science when a leading investigator who has been active during the greater part of the development of a subject puts together his experience and records his reasoned judgment upon the work of his contemporaries.

The book comprises several very different parts, beginning with a 56-

page introduction dealing with such topics as solutions, valency, etc., at which most readers will boggle on account of its elementary nature but which nevertheless proves useful for reference in elucidating the personal standpoint of the authors. This is followed by a section comprising at least a quarter of the book in which the attempt is made to discuss from one comprehensive standpoint all electrolytes and colloids, basing the treatment upon the theory of interionic attraction and including rather complete references to all those who have contributed toward the composite picture built up by the authors.

This monographic dissertation is of indispensable importance to research workers, alike in the fields of colloids and of dissociation theory. Never again will it be possible to give an adequate account of one of these subjects without considering the other. The treatment, however, is only for the advanced student or research worker because insufficient care has been taken to keep the matter precise and explicit or even in some cases to define the terms and the mathematical symbols employed. It is necessary, therefore, to refer to the original literature whilst reading this section. Indeed throughout it is evident that the subject of colloids has not yet wholly freed itself from the reproach of ambiguity and confusion of thought.

In one thing the reviewer is disappointed, namely, the assumption that the theory of strong electrolytes needs merely to be applied rather than to be modified in view of the incomparably wider range of experimental behavior brought under consideration. It seems more reasonable to expect that much is to be learned from the behavior of charged colloids and their accompanying ions which could hardly be suspected or established from the contemplation of the properties of potassium chloride. Rather than, for example, to assume that all possible electrolytic material contained in a colloidal particle (such as FeOCl in a ferric hydroxide sol) is 100 per cent. dissociated even though it may not take any part in conductivity or osmotic pressure and migrates as a whole with the colloidal particle in an electric field, it is surely better to attempt to learn from such cases in how far the assumption of complete dissociation is justified. It is logical to ponder this, and such observations as the breakdown of the principle of ionic strength for such polyvalent colloids as soap, and then to apply the results in appropriate measure to ordinary electrolytes. The authors do not discriminate between the arbitrary ephemeral conception of 100 per cent. dissociation and the physical phenomena of interionic attraction which are permanently real and important even if their present formulation should prove to be only approximate.

The authors again do not sufficiently emphasize the fictitious nature of many of the mathematical expressions in which electricity is treated as a continuum rather than as electronic, and no regard at all is paid to real atomic, molecular and colloidal dimensions and the localized nature of

charges and valencies. Consider, for example, a nonylate ion, a large amino acid, a zwitter ion or a plane surface with charges spaced widely apart, in comparison with the fictitious assumption of continuous distribution of the single charge of electricity as well as the opposing charge regarded as spread out in either a uniform sphere or plane, implicit in some of the formulations. Often after describing a point of view or a formulation, the authors do express their misgivings but unfortunately they do not go back and revise the treatment accordingly.

These criticisms which the reviewer is impelled to make are not intended to detract from the important achievement of showing once for all the essential identity of the operative processes of electrochemistry, whether they be termed colloid science, electrokinetics, electrocapillarity, electromotive force or theory of electrolytes.

There follow next 200 pages of general description of colloid behavior, simply and comprehensively presented, although important chapters such as Brownian movement, viscosity and structure are only most briefly referred to. Then comes one of the most valuable parts of the book, namely, the 100-page summary of the authors' knowledge of the proteins. The book then concludes with much briefer summaries devoted to metal sols, silicic acid, stannic acid, hydroxides, sulfides and sulfur, soaps, dyes and carbohydrates in their behavior as colloids; to these students and investigators may be referred for an authoritative and in many cases first hand account.

JAMES W. MCBAIN

Thermochemie. (Thermochemistry.) By Dr. W. SWIETOSLAWSKI, Professor of Physical Chemistry at the Polytechnical High School of Warsaw. Akademische Verlagsgesellschaft m. b. H., Leipzig, Germany, 1928. xi + 253 pp. 28 figs. 17 × 25 cm.

The first chapter in this book is on general calorimetry; and though relatively brief, provides an unusually satisfactory introduction to research in this field, particularly because it is not only a clear but also a suggestive exposition which tends to direct the reader's thought toward a critical evaluation of procedures. It does not, however, go far enough in this direction to serve the purposes of the fully prepared experimentalist, since though published in 1928, it omits all reference to the systematic studies of error that have been published in America during the last decade, a neglect of which might well impair very seriously the value of any work in this field which aimed at high precision. The careful worker who uses this book had better, therefore, supplement it with White's "The Modern Calorimeter" (A. C. S. Monograph, 1928) where calorimetric precision is adequately discussed.

The general treatment of calorimetry is continued by descriptions

of the special techniques employed in measuring specific heats, heats of fusion and evaporation, of solution and dilution; and is followed by a sound and especially suggestive discussion of the methods of thermochemistry proper: which include procedures for testing the completion of reaction, absence of superimposed effects both physical and chemical, and variability of thermal effects caused by the use of different neutral media, varying excess of one ingredient, indeterminate contamination and so on. This part of the work, which deals with insidious sources of error in chemical calorimetry that too frequently escape the notice of physicists, is for purposes of instruction important. It is followed by a lengthy discussion of the thermochemist's favorite method of bomb calorimetry, which leads to an interesting critique of the uncertainties and errors characteristic of past work on heats of combustion, and ends with an attempt to evaluate the probable precision of the more important earlier data derived from determinations of this heat. Much good advice is incidentally included in this discussion.

The second half of the book is an analysis of thermochemical data. The author discusses here the principles whereby these data, especially those of heats of combustion, may be made to yield knowledge about the characteristic heats of simple atomic combinations and the variability of these with differences of structure in the molecular species where they occur as characteristic groups. He then applies these principles systematically, by the use of critically evaluated data, to the determination of the "thermal characteristics" or heats of formation of the groups which define all the most important genera of organic compounds: C—C and C—H, C=C, C≡C in hydrocarbons both aliphatic and cyclic; C=O, C—O—C, C—OH,  in aldehydes and ketones, alcohols and esters; and so on, including the characteristic radicals of amines, cyanides, amides, nitro-bodies and other genera. The discussion is detailed, thorough-going and convincing, and gives to this part of the work the character of critical research rather than that of a mere summary exposition. The author discovers in the total mass of data which he has laboriously correlated, only two fairly invariable "thermal characteristics:" those namely of C—C and C—H in the saturated hydrocarbons; but he establishes, so far as the data permit, the ranges of the variability of those for other groups and, by intercomparisons, the characteristic effects upon them of increasing molecular mass and of certain types of structure. His summaries thus demonstrate on the one hand the extreme hazard of calculating from such characteristics (unless very roughly indeed) any but a very limited group of heats of reaction; but on the other, they clearly show in a qualitative way the typical influence upon these characteristics of certain molecular configurations. As a critique of the present position of thermo-

chemical theory and as a stimulation to further work in this difficult field—which is thus shown to be as yet only made ready for intensive cultivation—this section of the work is particularly valuable.

The book closes with tentative applications of the data obtained by the preceding analysis of combustion heats to the determination of heats of atomic combinations of C, H, O, N, S and the halogens, to the calculations of heats of molecular transposition and of dissociation, and with a final discussion of general import.

FREDERICK BARRY

An Introduction to Organic Chemistry. By ROGER J. WILLIAMS, Professor of Chemistry, University of Oregon. Second edition. D. Van Nostrand Company, Inc., 250 Fourth Ave., New York, 1931. xi + 585 pp. 14 × 22.5 cm. Price, $3.50.

The second edition of this popular text is revised, not rewritten. This means that except for the placement of the chapter discussing alicyclic compounds in a better strategic position from the pedagogical standpoint, no fundamental changes have been made. Painstaking revision and addition of material have brought the text thoroughly up to date. The theoretical treatment presenting the compounds of carbon as an integral part of the general science of chemistry, and not as a more or less remotely related branch of this science, constitutes the soul of the book, and remains unchanged. The electronic and other modern theories introduced to show this relation are very adroitly associated with previously accepted theories as if tactfully to indicate advisability, if not absolute necessity, of their adoption. In other words, newer theories are given ample opportunity to edge the older ones out of the science. The general picture of the state and progress of industrial application of organic chemistry is a very satisfactory feature of the book. The publishers have done their part in making the book attractive and durable.

C. E. BOLSER

Nucleic Acids. By P. A. LEVENE, The Rockefeller Institute for Medical Research, and LAWRENCE W. BASS, Assistant Director of Research, The Borden Company. American Chemical Society Monograph. The Chemical Catalog Company, Inc., 419 Fourth Ave., New York, 1931. 337 pp. 14 figs. 15.5 × 23.5 cm. Price, $4.50.

This book, the 56th in the series of monographs of the American Chemical Society, takes rank as an authoritative and concise survey of our present knowledge of nucleic acids, to which the senior author, through his own investigations, has contributed so large a share.

The great importance of nucleic acids and their components as constituents of the living cell further contributes toward making this monograph indispensable, not only to the biochemist, biologist, physiologist and physician, but to all who may be interested in synthetic work, structure

and analytical methods in the fields of purine, pyrimidine and sugar chemistry.

The detailed methods given for the separation and preparation of the most important compounds discussed, together with their chemical and physical properties, contribute greatly to the value of this volume to the teacher and investigator interested in organic chemistry and biochemistry.

The monograph, containing eleven chapters, is divided into two parts. Part I, including seven chapters, deals with the components of the nucleic acids. In Part II, the nucleic acids themselves are taken up. The discussion of sugars in Chapter I deals only with their most essential features, "Inasmuch as the present state of sugar chemistry has been reviewed in detail in several monographs." Imidines, imido esters and imidazoles are considered in Chapter II only in so far as they facilitate the understanding of the reactions of the purines. In Chapters III and V are discussed the pyrimidines and purine bases which occur in nucleic acids. The individual compounds are discussed from the standpoint of their discovery, and the historical development of their chemistry and structure. A description of their physical and chemical properties and detailed methods for their separation and preparation, identification and quantitative determination are also given. Chapter IV contains a historical account of the development of uric acid chemistry. Because of the significance of the nucleosides, those groups containing sugar in glucosidic union with nuclein bases, in the development of the structure of nucleic acids, sixty pages in Chapter VI are devoted to the historical development of the structure of the naturally occurring purine and pyrimidine nucleosides. The descriptive part of this chapter deals with the separation of the various nucleosides obtained from nucleic acids, their chemical and physical properties, and their derivatives. A large number of synthetic nucleosides are briefly described. The nucleotides, which are phosphoric esters of the nucleosides, are discussed in Chapter VII. The individual members of this class, including inosinic acid, adenylic acid, guanylic acid, xanthylic acid, and also the pyrimidine nucleotides, together with a number of synthetic nucleotides, are considered from the standpoint of their preparation and properties, rates of hydrolysis and dissociation constants.

In Part II of the monograph is given an account of the discovery of nucleic acids and of their components, a discussion of the structure of nucleic acids, and detailed methods for their preparation with a short chapter on nucleic acids of higher order. The final chapter is devoted to an account of the results of recent investigations on the enzymes, nucleinase, nucleotidase and nucleosidases.

In addition to the text the monograph contains a comprehensive and well arranged author and subject index.

D. BREESE JONES