

## NEW BOOKS

A System of Qualitative Analysis for the Rare Elements. By ARTHUR A. NOYES and WILLIAM C. BRAY. The Macmillan Company, New York City, 1927. 536 pp. 22 × 14.5 cm. Price, \$5.00.

Widespread use, to say nothing of imitations more or less shameless, has attested, for thirty years, the value of A. A. Noyes' Qualitative Chemical Analysis. From time to time outlines of a more comprehensive system have appeared in various periodicals and as communications to various societies. Now we have a finished masterpiece which insures to its authors long-continued preëminence in the qualitative field, as well as considerable influence upon the quantitative procedure of the future. The contributions of twenty-nine collaborators, distributed over the long period of development of the book, are duly acknowledged.

"Qualitative Analysis for the Metallic Elements" might describe the contents more exactly, as practically all are included—even hafnium separated from zirconium. The rare earth group is to a large extent resolved, and the balance of the fractionations indicated by references. The fact that whole pleiads are detected along with thallium, lead, thorium, bismuth and uranium should be emphasized. Acid radicals are not included, except some containing metallic elements. Incidentally it appears that a comprehensive system for detection of acid radicals constitutes a new world for conquest.

The "Confirmatory Experiments," two hundred pages crammed with experiments and references, afford reading of absorbing interest, and form in many respects the most valuable feature of the book. As the authors remark; this material, if presented in the discursive manner customary in periodicals, would fill a bulky volume. Lastly come "Reactions of the Elements" in tabular form, the first really satisfactory summary of the kind that the reviewer has seen.

The authors tend to diverge sharply from traditional procedures and to introduce striking novelties, such as ethyl acetate as extracting agent or solvent, or the free use of concentrated perchloric acid alone or with hydrobromic, formic or other acids. As reagents for the alkali group we find the unfamiliar sequence: magnesium uranyl acetate, sodium bismuthinitrite, antimony trichloride, sodium hydrotartrate or 6-chloro-5-nitrotoluenemetasulfonate, and silicotungstic acid. Only a study of the confirmatory experiments can show how great are the economies of time and effort, as well as the safeguards against error, gained by the analyst who will restock his reagent shelves.

A modern introductory chemical course consisting mainly of diluted physical chemistry, followed by the usual half year of "qualitative" will afford very scanty preparation for the task set by Noyes and Bray. While we cannot return to the days when the majority of chemists had a really

minute knowledge of inorganic properties and reactions, it is a pity to see the breed so nearly extinct as it is at present. Who knows but that its partial regeneration may be one of the good effects of this remarkable book?

G. S. FORBES

**Outlines of Theoretical Chemistry.** By FREDERICK H. GETMAN, Ph.D., formerly Associate Professor of Chemistry in Bryn Mawr College. Fourth edition, revised and partly rewritten. John Wiley and Sons, Inc., New York City, 1927. xii + 728 pp. 179 figs. 22 × 14.5 cm. Price \$3.75.

In the preface of the first edition, the author stated: "The book is designed to meet the requirements of classes beginning the study of theoretical or physical chemistry. A working knowledge of elementary chemistry and physics has been presupposed in the presentation of the subject. . . . With the exception of a few paragraphs in which the application of the calculus is unavoidable, no use is made of higher mathematics, so that the book should be intelligible to the student of very moderate mathematical attainments. . . . In selecting material for this book, the author has been guided in a large measure by his own experience in teaching theoretical chemistry to beginners and to advanced students. . . . While the treatment of each topic is brief, effort has been made to avoid the sacrifice of clearness to brevity."

The latest edition of "Outlines of Theoretical Chemistry" is about 250 pages larger than the first edition, which appeared in 1913, and 100 pages larger than the preceding edition. The book underwent a drastic revision and extensive remodeling in the second edition (1918); and was again brought up to date in 1922, when much new material, including the results of recent work on atomic structure, was included. In the latest edition, "Outlines of Theoretical Chemistry" has once more been revised and extended, but in order to prevent it from becoming too voluminous, certain sections have been deleted or greatly abbreviated.

The arrangement of the book is that of many introductory works on this subject. The chapter headings are: Fundamental Principles; Gases; Liquids; Solids; Relation between Physical Properties and Molecular Constitution; Elementary Principles of Thermodynamics; Solutions; Dilute Solutions and Osmotic Pressure; Solutions of Electrolytes; Colloids; Thermochemistry; Homogeneous Equilibrium; Heterogeneous Equilibrium; Chemical Kinetics; Electrical Conductance; Electrolytic Equilibrium and Hydrolysis; Electromotive Force; Electrolysis and Polarization; Photochemistry; Electrical Theory of Matter; Radioactivity; Atomic Structure. The chapters on chemical kinetics, colloids and photosynthesis are particularly good, and the chapter on thermodynamics has been much improved.

"Outlines of Theoretical Chemistry" has steadily improved with each edition. It is carefully and well written and Dr. Getman is to be commended for the clear, concise and simple manner in which he introduces the beginner to the theoretical side of chemistry. An admirable feature is the numerous and well-selected problems which are placed at the end of most of the chapters for the purpose of testing the student's mastery of the subject matter of the chapter. In the opinion of the reviewer, this book is one of the outstanding introductory texts on the subject.

Necessarily, some of the topics are treated very briefly and therefore superficially—a fault which it would be difficult to avoid in a book of the scope of "Outlines of Theoretical Chemistry." Perhaps, however, half a loaf is better than no bread, especially as the student is enabled to round out and to expand the topics presented by means of the numerous references to original papers, and the list of authoritative books given at the end of each chapter.

The reviewer feels that the section on the activity concept is too meager in view of the large amount of investigation that has been carried out in this field during the past decade, and that Debye and Hückel's theory of solutions of strong electrolytes might have been presented somewhat more fully. In the opinion of the reviewer, it is unfortunate that, like so many writers, the author is not consistent in the use of prefixes, and that he employs the hybridism "unitrivalent." Being human, the author has allowed a few misprints to remain in the text, but most of these are obvious. There are, however, a few cross references to pages in the preceding edition of the book. From experience, the reviewer appreciates the difficulty of preventing this. These, however, are but minor defects in a book which contains a wealth of excellent, thoroughly serviceable, well-arranged and well-selected material.

Dr. Getman is to be congratulated on the continued success of his "Outlines of Theoretical Chemistry." The improved new edition is certain of a cordial welcome from its many old friends. To them it requires no recommendation; to others it can be warmly commended as an introduction to the study of theoretical chemistry.

The mechanical execution of the book is excellent.

H. JERMAIN CREIGHTON

**Müller-Pouillet's Lehrbuch der Physik.** 11. Auflage, Dritter Band, Zweite Hälfte. Kinetische Theorie der Wärme. By KARL F. HERZFELD, München, unter Mitwirkung von H. G. Grimm, Würzburg. Friedr. Vieweg und Sohn Akt.-Ges., Braunschweig, 1925. 436 pp. 52 figs. 25.5 × 17 cm.

The present volume is not an older edition circumspectly patched and sprinkled with recent references. It is, for the most part, a brand new production aiming to develop the applications of the kinetic theory

and to enlarge the circle of those who can use it with facility. The author, recently transplanted from Munich to Baltimore, emphasizes his desire to make clear the physical content of every statistical formula, as well as that of the corresponding thermodynamical formula, without presupposing unusual mathematical ability upon the part of his readers.

Starting with elementary and familiar considerations, theorems and equations in their first approximations are developed—"learning put lightly, like powder in jam." Next come "Verfeinerung der Betrachtung," "Exkurs," "genauere Diskussion," also footnotes and paragraphs in fine print to tempt the reader further. Through the references, only, would the limits of modern speculation be reached. The author with all his erudition is now primarily a teacher, again almost a propagandist, but a pedant never. In such fashion he treats kinetic theory of gases (elementary presentation), general statistical mechanics (postponing, however, Liouville's theorem and the ergodic hypothesis), gases, liquids, solids, solutions, disperse systems, quantum theory, advanced statistical discussion. Only at the very end come the numerical values, and this is the only feature at which the chemist might cavil.

Such a work is peculiarly helpful to those who cannot "take a course" and so have to dig things out for themselves; to the doctoral candidate in those last desperate hours before his "oral;" or—publish it not—to the lecturer on physical chemistry in the last moments before he meets his class. The trend of modern chemistry in many of its aspects is so obviously toward the kinetic and the statistical, that Herzfeld's book, supplemented perhaps by Tolman's *Statistical Mechanics*, will be welcomed by all those who read aright the signs of the times.

G. S. FORBES

**Optische Methoden der Chemie. (Methods of Photochemistry.)** By FRITZ WEIGERT, Professor at the University, Leipzig. Akademische Verlagsgesellschaft m. b. H., Leipzig, 1927. xvi + 632 pp. 341 figs. 24 × 16 cm. Price, unbound, M. 36; bound, M. 38.

For nearly a quarter of a century Weigert has been an indefatigable contributor to the periodical literature of photochemistry. Now the sum total of his experience, backed by intimate knowledge of the work of his contemporaries, has been applied to the production of a book certain to prove of great value to all who contend with the difficulties and exasperations peculiar to the subject.

All the important topics, with numerous ramifications, are included: optical instruments, light sources, ray filters, photographic operations, spectroscopy, photometry, spectrophotometry, colorimetry, nephelometry, measurement of color, radiometry, photochemical measurements (in the special sense), refraction, polarized light, scattered light, luminescence.

The author's sound and practical discussion is more frequently concerned with general principles than with the details of special procedures. He succeeds in giving, throughout, distinctly more than orientation and introduction, and much of the material included could scarcely be found elsewhere. The quantitative point of view predominates. A thousand references, more or less, direct the reader further without adding unreasonably to the thickness and price of the book. These references are commendably up to date, and include a great deal of non-German research. In the reviewer's opinion a considerable expansion of the list would be justified; eight brief citations, for instance, scarcely do justice to the achievements of Coblenz.

Those who have the will to turn out research of permanent value can go far with the help of this book. The semi-quantitative photochemist—may his tribe decrease—will find here both the incentive and the path to reform.

G. S. FORBES

**Phosphoric Acid, Phosphates, and Phosphatic Fertilizers.** By WM. H. WAGGAMAN, Scientist in Fertilizer Investigations, Bureau of Soils, U. S. Department of Agriculture, assisted by Henry W. Easterwood, formerly Chemist, Bureau of Soils, U. S. Department of Agriculture. American Chemical Society Monograph Series. The Chemical Catalog Company, Inc., 419 Fourth Avenue, at 29th Street, New York City, 1927. 370 pp. 58 figs. 15.5 × 23.5 cm. Price \$7.50.

This monograph brings together in convenient form a great deal of information—chemical, economic and technologic—with reference to phosphoric acid, phosphates and phosphatic fertilizers. The introductory chapter is a long one, including a variety of topics such as a brief review of the elementary chemistry of phosphorus; the role of phosphorus in life processes; the phosphorus requirement of soils; naturally occurring phosphates, etc. Chapter 2 deals with phosphate deposits in the United States, and Chapter 3 with phosphate deposits in foreign countries. Chapter 4 deals with so-called available phosphates, while those which are water-soluble are discussed in Chapter 5. Chapter 6 is devoted to a discussion of the sulfuric acid method of preparing phosphoric acid, while Chapter 7 is concerned with the volatilization process of preparing phosphorus and phosphoric acid. Chapter 8 deals with phosphate baking acids and powders; Chapter 9 with the use of phosphates as water softeners, and Chapter 10—the final chapter—with miscellaneous uses of phosphoric acid. Forty-three pages at the end of the book are devoted to a digest of the United States patents covering processes for the production of soluble and available phosphates by various methods.

A monograph of this sort should be judged as a whole and from this standpoint we believe that the authors have produced a book of considerable merit. Criticism of the book can be made only in a limited number of

specific instances which do not detract from its value as a whole. To the present reviewer there seems to be a lack of balance in certain of the parts and certain instances of poor judgment in choosing illustrations. For example, we may point out that the Liljenroth Process is dismissed with less than half a page, whereas a considerable number of pages are devoted to describing and discussing the experimental unit which was set up and operated at Arlington Farms. With regard to illustrations, we suggest that those on pages 64, 111, and particularly the one on page 243, might well be omitted.

While not up to the standard of some of the monographs in the American Chemical Society Series, we believe that the present one falls well within the average and that the authors are to be congratulated on its production.

HARRY A. CURTIS

**Contemporary Developments in Chemistry.** Lectures by Eminent Chemists. Columbia University Press, New York, 1927. 464 pp. Illustrated. 23.5 × 16 cm. Price \$11.00.

This is a collection of twenty-five lectures delivered at Columbia University in a special course given during the Summer Session of 1926, on the occasion of the opening of the Chandler Laboratories. The subjects of the lectures and the names of the lecturers are as follows:

Synthetic Organic Chemistry in the Study of Odorous Compounds, by Marston T. Bogert; Chemical Reactivity, by James F. Norris; Chemical Relationships of Sugars, Optically Active Amino Acids, Hydroxy Acids and Halogen Acids, by Phoebus A. Levene; Reversible Oxidation-Reduction Reactions in Organic Systems, by W. Mansfield Clark; Crystal Structure in its Relation to Chemical Problems, by Ralph W. G. Wyckoff; Catalysis and the Mechanism of Chemical Reactions, by Hugh S. Taylor; Carbohydrates, by Sir James Colquhoun Irvine; Oxidative Catalysis in the Body, by Edward C. Kendall; Immunology as a Branch of Chemistry, by H. Gideon Wells; Rare Gases of the Atmosphere, by Richard B. Moore; Synthetic Organic Chemistry, by E. Emmet Reid; Permeability and Electric Phenomena in Membranes, by Leonor Michaelis; Radicals as Chemical Individuals, by Charles A. Kraus; The Influence of Pressure upon Chemical Transformations, by Ernst Cohen; A Development in the Chemistry of Sanitation, by John Arthur Wilson; The Direct Measurement of Osmotic Pressure, by J. C. W. Frazer; Chemistry of Bacteria, by Treat B. Johnson; Contact Catalysis, by Wilder D. Bancroft; Water-Soluble Vitamins, by Elmer V. McCollum; Quantitative Research in the Chemistry of Nutrition, by Henry C. Sherman; Theory of Velocity of Ionic Reactions, by J. N. Brønsted; Physico-Chemical Principles in Electro-Metallurgical Research, by Colin G. Fink; Reactions in Liquid Ammonia, by E. C. Franklin; Agricultural Chemistry,

by Charles A. Browne; Completing the Periodic Table, by B. S. Hopkins.

The lectures, as a rule, are summaries of recent work in their respective fields in which the lecturer himself usually has been a productive investigator. Though presented in this way by specialists, they are nevertheless directed to the general chemical reader rather than to fellow specialists in the field. Such summaries are most useful and are all too rare. This collection is therefore a valuable addition to our chemical literature.

ARTHUR B. LAMB

**Elementary Organic Chemistry.** By LOUIS A. OLNEY, Sc.D., Professor of Chemistry and Dyeing, Lowell Textile School. Howes Publishing Company, 90 William Street, New York City, 1927. 191 pp. 4 figs. 14.5 × 20.5 cm. Price \$3.00.

"The author has found the publication of this book on Elementary Organic Chemistry necessary because up to the present time no other book has been published which fulfills the requirement of certain classes of students in the Lowell Textile School."

"Between the ten to twenty pages treating the subject of carbon compounds, which is inserted in most modern text-books on General Chemistry, and the three to five hundred page book on the subject, there appears to be no published text which gives the fundamental principles of Organic Chemistry, and a general discussion of the subject, in a space that would correspond to from fifteen to twenty lectures."

A careful reading of the text convinces the reviewer that it is unfortunate for a scientist to be forced in this way to write a text-book on a subject with which he is apparently not directly familiar. This is all the more serious since the users of short texts of this kind will usually not be specialists who are capable of correcting the mistakes.

In addition to many minor mistakes some of the more serious are the constant treatment of esterification as the "exact" equivalent of neutralization, the confusion of hydrolysis and dissociation and the discussion of the basic character of the hydroxyl group in the carboxyl group. A large number of errors in important formulas are apparently typographical but none the less dangerous. Among these are those of propylene, acetylene, diazonium salts and magenta.

No mention is made of such important and simple subjects as synthetic methanol, oxyacetylene cutting of steel and the air-oxidation of naphthalene.

The use of a bulb condenser in fractional distillation, as shown on p. 179, is hardly to be recommended.

In conclusion the reviewer would urge the recognition of a place for a short organic text to fill the needs of students who require only the barest smattering of the subject.

FRANK C. WHITMORE

**Handbuch der biologischen Arbeitsmethoden.** (**Handbook of Biological Procedure.**)  
Abt. III, Physikalisch-chemische Methoden, Teil B, Heft 3. Edited by Prof. DR.  
EMIL ABDERHALDEN. Urban and Schwarzenberg, Berlin N 24, Friedrichstrasse  
105 B, 1926. Pp. 385-594. 65 figs. 25.5 × 17.5 cm. Price, M. 9.30.

This is the first "Lieferung" of the volume of Abderhalden's handbook which deals with the methods of colloid research. It contains five articles as follows: Coagulation of Sols and Determination of the Isoelectric Point, by E. Bloch; Methods of Determining Adsorption, by H. Fodor; Methods of Biological Dispersoid Analysis, by V. von Hahn; Determination of the Structure of the Colloidal Micelle, by R. Riwin; and Ultrafiltration and Electro-ultrafiltration, by H. Bechhold. The article on coagulation of sols deals for the most part with the action of electrolytes on sols, mutual precipitation of sols and the methods of determining the degree of coagulation. The methods described for determining the so-called isoelectric point are; cataphoresis, coagulation, measurement of the displacement of  $P_H$  by the addition of an acid or base, osmotic pressure, swelling and viscosity. The section on adsorption gives numerous examples of adsorption of gases and adsorption from solutions both dilute and quite concentrated, chiefly with carbon as adsorbent. The significance of  $1/n$  in the Freundlich adsorption equation is discussed and a section is devoted to negative adsorption. The methods of dispersoid analysis discussed by von Hahn are filtration, diffusion, sedimentation, optical methods, coagulation and special methods. The chapter on the composition of the micelle gives chiefly the views of Pauli and Fodor on hydrous ferric oxide and albumin and of McBain on the soaps. Bechhold's chapter naturally deals primarily with his own work on ultrafiltration.

The articles in this volume give what appears to be a fairly comprehensive survey of the investigations of Europeans, especially the Germans, in the subject under discussion. Almost no attention is paid to American work. The important question of ionic antagonism in biological systems is passed over in a sentence, page 396, and in all the discussion of adsorption by charcoal there is no reference to the work of Coolidge or of Bartell and Miller on ash-free charcoals. Thirty pages (547-577) are devoted to the physical chemistry of the proteins but there is no reference to Loeb although his investigations doubtless furnished the inspiration for much of the work reported in this section.

HARRY B. WEISER