

From the facts given above, it is clear that allomerization is dehydrogenation brought about by the oxygen of the air. It is interesting that the dehydrogenation of a very easily oxidized group in chlorophyll is without pronounced effect on the color, although marked changes in color, as a rule, accompany the oxidation of a colored substance. The unusual behavior of chlorophyll in this respect is due to the fact that the chromophoric group is not the most easily oxidized group. A theory of photosynthesis has been recently suggested⁴ which is based on the presence of this easily dehydrogenated group in chlorophyll.

CHEMICAL LABORATORY OF
HARVARD UNIVERSITY
CAMBRIDGE, MASSACHUSETTS
RECEIVED MARCH 23, 1931
PUBLISHED APRIL 6, 1931

J. B. CONANT
S. E. KAMERLING
C. C. STEELE

NEW BOOKS

Fundamentals of Chemistry. By CARL WILLIAM GRAY, CLAUDE W. SANDIFUR and HOWARD J. HANNA. Revised and enlarged edition. Houghton Mifflin Company, 2 Park St., Boston, Massachusetts, 1929. xiv + 650 pp. 201 figs. 13 × 19.5 cm. Price \$1.80.

This book is a revised and enlarged edition of a high school text, first published in 1924.¹ The order of presentation of the subject matter, used in the first edition, remains one of the original features of the book. This unusual order is characterized in part by the introduction of metals in Chapter III, metallic oxides and ores in Chapter VI, and the introduction of carbon as the third element considered. A new chapter on the structure of matter has been introduced before the chapter on ionization, obviating one criticism of the first edition. These two chapters now constitute a good elementary presentation of the electron concept, which, however, is not afterward utilized even in discussing such topics as the periodic classification and storage batteries, and only a limited use is made of this concept in the chapter on oxidation and reduction which has been added in this edition.

Other new chapters are entitled "The Atmosphere," "Paints, Varnishes and Lacquers," and "Chemistry in Agriculture." These titles indicate that the method of treatment and the subject matter are those conventionally associated with courses for school students not in the college preparatory group. However, it cannot be said that the fundamental generalizations have suffered. The illustrative material and the order of treatment constitute the chief differences from the conventional text.

⁴ Conant, Dietz and Kamerling, *Science*, 73, 268 (1931).

¹ Reviewed in *THIS JOURNAL*, 47, 592 (1925).

Preparatory school teachers, seeking this type of textbook, will find this volume well worth consideration. It is, in general, logically and clearly written, well illustrated and attractively arranged for student use, with outline summaries, questions and exercises at the close of each chapter.

C. R. HOOVER

Inorganic Chemistry for Colleges. A Textbook for Students of Second Year Chemistry.

By WILLIAM FOSTER, Ph.D., Professor of Chemistry in Princeton University. Second Printing, 1930. D. Van Nostrand Company, Inc., 8 Warren Street, New York, 1929. viii + 837 pp. 212 figs. 14 × 22 cm. Price, \$3.90.

A second printing a year after its publication indicates that this book has been well received. It is designed for students who have passed chemistry for entrance to college. The words, "A Textbook for Students of Second Year Chemistry," appear on the title page. While this book presupposes an elementary knowledge of the common elements, the descriptive side of chemistry has not been neglected; nor have the many applications of the science been slighted. The essential difference between this book and the average elementary college textbook lies in the more comprehensive treatment of fundamental laws and theories.

The book is divided into four parts, namely: Part I, (112 pages) is given to fundamentals, such as the laws of chemical combination, symbols, formulas, equations, the gas laws, the kinetic theory, the internal structure of crystals. Then an important and logical departure from the usual order of topics as found in other textbooks of this character: in Chapter IV, nearly 20 pages, the radioactive elements are studied in some detail in order to lay an experimental foundation for the study of atomic structure, which is considered in the following chapter on the classification of the elements.

Part II (386 pages), the non-metals, includes the usual descriptive matter, with separate chapters on solution; molecular and atomic weights; energy and chemical change; chemical equilibrium; the ionic theory and some of its applications; acids, bases and salts; oxidation and reduction from an electronic standpoint; colloid chemistry. While carbon is discussed in this part, organic compounds proper are left for Part IV.

Part III is devoted to the metals, the periodic classification being closely followed. A chapter on electrochemistry is placed between the tin and arsenic groups in the discussion of the metals.

Part IV (71 pages) called the supplementary part, is devoted entirely to organic compounds. The closing chapter is on The Food of Plants and of Animals. At the end of this section there is a good set of 144 problems with answers to most of them, which illustrate the principles taken up in the entire book.

At the end of each chapter a set of exercises is given and references for supplementary reading. The appendix contains the usual tables, also a four place table of logarithms, and the book closes with a bibliography of over one hundred titles.

HERMAN SCHLUNDT

General Chemistry. By HARRY N. HOLMES, Professor of Chemistry in Oberlin College, Revised edition. The Macmillan Company, 60 Fifth Ave., New York, 1930. x + 654 pp. 167 figs. 15 × 22.5 cm. Price, \$3.50.

The revised edition of "General Chemistry" is a decided improvement over the first edition.

The author has succeeded in arranging the presentation of facts and theories in such a way that the student will never become "fed up" on one type of material. He has also included a good description of the various chemical processes that have become of great industrial importance and there is no better way of stimulating the interest of a Liberal Arts College student in chemistry than that of showing its relation to his own happiness and well-being.

His method of presenting the oxides of nitrogen before nitric acid is rather unusual. In fact his nitrogen question is rather confused but with this exception the book is very well written and should appeal to the teacher of General Chemistry.

It is not too hard for the student who has not had any previous training in chemistry and yet the introduction of considerable material in fine print makes it possible to arrange a course so that the student entering college with a good High School course in chemistry will find plenty to keep him busy.

This edition as well as the earlier edition will especially appeal to some teachers because the author has the courage to write equations at the beginning of the book. Teaching chemistry without equations is like trying to teach a language without a vocabulary. Equations should be introduced as soon as the first element is discussed.

The placing of Carbon and its oxides in Chapter IX and Sodium and Sodium Hydroxide Bases in Chapter XV is a help but leaving Equilibrium until Chapter XXIII is a decided weakness. Equilibrium conditions are encountered with the preparation of oxygen and it is regrettable that the author did not have the same courage with respect to equilibrium as he showed in writing equations.

The Periodic Table showing the Atomic Numbers in red is a particularly good feature.

It is a good text and the student will find it understandable as well as very interesting.

JOHN B. ZINN

Laboratory Manual of General Chemistry. By HARRY N. HOLMES, Professor of Chemistry in Oberlin College. Third edition. The Macmillan Company, 60 Fifth Ave., New York, 1930. x + 163 pp. 34 figs. 14.5 × 22.5 cm.

This laboratory manual is of the interleaved type. The subject matter is that usually found in a laboratory manual of first year college chemistry. The material is well arranged and the experiments are sufficient in number so that it is possible for the individual instructor to adapt the book to almost any type of laboratory course. Some of the experiments, marked with an asterisk, are rather difficult and well suited to those students who have had some previous training in chemistry.

In preliminary exercises, the time spent on the balance seems rather ill advised, but the chapter on Colloids would be a decided addition to any laboratory manual. The chapter on solutions is also very good and the set-up for the determination of the molecular weight of water on page 44 would keep the best student interested. The experiment using the Law of Du-Long and Petit is something different and a good addition.

The preparation of atomic models with toothpicks, chewing gum and soft wax seems rather childish. The chapter on equilibrium is very good but rather late in the course.

The book is especially well adapted to mixed classes made up of those who have had some training in chemistry and those who are studying chemistry for the first time.

On the whole it is a very good manual and is well worthy of the careful consideration of all teachers of General Chemistry.

JOHN B. ZINN

Chemistry in Daily Life. By SAMUEL GLASSSTONE, D.Sc., Ph.D., F.I.C., Lecturer in Chemistry at the University of Sheffield. E. P. Dutton and Company, Inc., 286-302 Fourth Avenue, New York, 1929. vi + 250 pp. 21 figs. 13 × 19.5 cm. Price \$2.25.

This book can be described as a textbook for the general reader. The author is content to chronicle in simple language the wonderful accomplishments of chemistry without attempting to present them as sensationally romantic. The content of the book can be judged by listing a few chapter headings: "The Beginnings of Chemistry"; "The Structure of Matter"; "Electricity and the Atom"; "Air and its Gases"; "Carbon and its Oxides"; "Our Daily Food"; "Chemistry of Digestion"; "Catalysts and Enzymes"; and "Medicines and Perfumes." In short, the twenty chapters of the book cover the usual range of subjects included in popular chemistry, but they also include topics sometimes omitted.

The book is very sparsely illustrated, and, compared with some of our American school text and popular books on chemistry, would appear to be dry reading, but the clarity and simplicity of its style and the wide variety

of general information presented compensate for this. In the opinion of the reviewer, it is a good reference book for the elementary student and of interest to the graduate who wishes to review his general knowledge of chemistry.

C. R. HOOVER

A Laboratory Manual of General Chemistry. By WILLIAM J. HALE, Director, Organic Chemical Research, Dow Chemical Company. Revised by William G. Smeaton, Professor of General and Physical Chemistry, University of Michigan. Revised edition. The Macmillan Company, 60 Fifth Avenue, New York, 1930. x + 530 pp. Illustrated. 13 × 20 cm. Price, \$2.50.

"Eleven reprintings since this manual was first published in 1917 testify to its merit." It provides a series of experiments which can be coördinated with any standard textbook in general chemistry. The amount of experimental work given in the book is far more than can be covered in the first year course in general chemistry. The authors recognize this in the closing sentence of the preface: "By judicious selection from the experimental material offered, an instructor can organize a practical course of elementary general chemistry to meet any reasonable requirement."

After a chapter on general directions, Chapters II to XVII contain experiments on the common elements with one chapter on ionization and applications of the ionic theory. In this section of the manual a good balance is maintained between qualitative and quantitative experiments, but the latter are rarely required to be performed in duplicate. Chapter XVIII gives a systematic scheme for the identification of negative radicals. Chapters XIX to XXVI outline experiments on the metals. The final chapter contains notes on the procedure in qualitative analysis with a diagrammatic scheme for the identification of the common cations. The appendix contains seven very useful reference tables.

A notebook is not required as most of the pages are printed on but one side. This feature conserves the student's time for doing some thinking, which is demanded for intelligent performance of the experiments.

HERMAN SCHLUNDT

Principles of Chemistry. An Introductory Textbook of Inorganic, Organic and Physiological Chemistry for Nurses and Students of Home Economics and Applied Chemistry. With Laboratory Experiments. By JOSEPH H. ROE, Ph.D., Professor of Chemistry, George Washington University Medical School. Second edition. The C. V. Mosby Company, 3523-3525 Pine Boulevard, St. Louis, Mo., 1929. 427 pp. 13.5 × 20.5 cm. Price, \$2.50.

This book is designed to meet the requirements of the short course in chemistry generally offered to nurses in training. There are 28 chapters of text, each followed by review questions, in Part I, and 35 appropriately selected laboratory exercises in Part II. The book presents elementary

chemical theory, very brief reference to elements other than oxygen, hydrogen nitrogen and carbon; few chemical formulas; and a simplified discussion of structural organic chemistry. Special emphasis is placed on the application of chemistry to life processes by the introduction of chapters on blood, internal secretions, digestion and metabolism.

Anyone who has attempted to teach the rudiments of chemistry to prospective nurses, undergoing the strenuous practical training of the average hospital course, realizes the need for making such a chemistry course as concise and practical as possible. The author has succeeded well in this endeavor.

It is not perhaps in accord with accepted educational methods of nurses' training to attempt to do more than the author has done to stimulate curiosity, originality and individual responsibility, but it seems that the average graduate nurse might well acquire more of these attributes in some part of her professional education.

C. R. HOOVER

Qualitative Analyse mit Hilfe von Tüpfelreaktionen. Theoretische Grundlagen und praktische Ausführung. (Spot Reactions in Qualitative Analysis. Theory and Their Practical Applications.) By DR. FRITZ FEIGL, Lecturer at the University of Vienna. Akademische Verlagsgesellschaft m. b. H., Schlossgasse 9, Leipzig C 1, Germany, 1931. xii + 387 pp. 12 figs. 2 colored plates. 16 × 24 cm. Price, unbound, M. 26.40; bound, M. 28.

Although the methods of qualitative inorganic analysis have not changed very much during the last century, the system is still far from being perfect. Therefore, any attempt to improve the situation must be welcomed by anyone interested in this field. Dr. Feigl has established his name in analytical chemistry by the discovery of a great number of qualitative and partly quantitative reactions for the detection and determination of various inorganic ions. A summary of his work (and that of others) and the fundamental principles on which it is based are given in this book, which is a valuable contribution to qualitative analysis and which discloses a field for systematic search of new organic reagents specific for metal ions and anions. This part of Feigl's work seems to be of more fundamental importance than the development of spot reactions on a spot plate or on filter paper, since the latter procedure does not introduce a new principle, although it must be admitted that this micro method has proved to be useful in cases where only small amounts of material are available. The theoretical part of the book dealing mostly on the properties of complex compounds (Werner) is well worth reading; this is especially true of Chapters 7 and 8 dealing with the specific action of organic compounds as a result of the presence of characteristic groups and on the influence of various organic groups on the solubility of complex compounds. In the practical part

(270 pages) various spot reactions for metal ions and anions are described and their applications to a systematic analysis and to purity tests are given. This part covers the literature fairly completely although the diethyl dithiocarbamate test for copper (Callan and Henderson, 1929), dinitro-resorcinol for iron, copper and cobalt (Nichols and Cooper, 1923, 1925), thioglycolic acid for iron (Lyons, 1927), cysteine for cobalt (Michaelis and Yamagashi, 1928), aurintricarboxylic acid for aluminum, curcumin for beryllium and others might have been mentioned.

Without hesitation, Feigl's book can be recommended to anyone who is interested in the development of qualitative inorganic analysis. However, the reviewer wishes to point out that the book gives the impression that the results of the spot analysis may be favorably compared with those of micro-crystal reactions. But it should not be overlooked that the observation of the crystal form and a study of the crystal properties enables one to conclude with absolute certainty whether or not a certain constituent is present, whereas the simple color spot tests, useful as they may be, will never reach this degree of reliability and perfection.

I. M. KOLTHOFF

Elements of Chemical Engineering. BY WALTER L. BADGER, Professor of Chemical Engineering, and WARREN L. McCABE, Assistant Professor of Chemical Engineering, University of Michigan. McGraw-Hill Book Co., Inc., 370 Seventh Ave., New York, 1931. xvii + 625 pp. Illustrated. 15.5 × 23.5 cm. Price, \$5.00.

The recognition of chemical engineering as a distinct branch of engineering with its own peculiar body of facts and principles has been rapid since the widespread acceptance of the idea of the fundamental unit operations as its nucleus. The well-known book by Walker, Lewis and McAdams was the pioneer in breaking away from the traditional type of text. The latter was essentially either a collection of facts and illustrations taken from trade catalogs or a description, accompanied by flow sheets and chemical reactions, of processes used in industry, many of which were obsolete. This book represented the first serious attempt to treat chemical engineering wholly from the standpoint of unit operations and to apply, in a comprehensive manner, fundamental principles of mathematics, physics, chemistry and economics to develop adequate quantitative theories of these basic operations.

The new text by Badger and McCabe covers nearly the same ground as the older book, but in a manner that is better suited to the needs of the beginner. All of the essential mathematical theory of the unit operations is included, but the approach to it is by an easier grade. The fundamental ideas upon which the mathematical development is based are more clearly explained and illustrated. It is the more elementary of the two texts, not in the sense that the more difficult theory has been omitted, but only that

it has not been extended to so many different cases and more pains have been taken to present the underlying principles in a logical and orderly fashion so that they are more readily grasped by minds unaccustomed to thinking in abstract terms.

Practically all of the important unit operations of chemical engineering are covered, one chapter being devoted to each. An excellent balance is maintained between the theory of each operation and the practical art. The most important of the tools available to the chemical engineer in the practice of his art are well described with the aid of a large number of illustrations, which are clearly one of the outstanding features of the book. These are all line drawings, especially made for the book and have been admirably executed to show clearly the essential features of construction and to explain the principle of operation. The fact that there are somewhat more than half as many figures as there are pages in the book is convincing evidence of the extent to which visual aid to instruction has been utilized.

We venture to predict that this book will be widely adopted as the standard text for beginning students in chemical engineering and even for some more advanced courses. But one should not infer from this that its appeal is only to the student. On the contrary, its general excellence in both the theoretical and practical side of the subject is such that no one who has any contact with the technical side of chemical industry can afford to be without it.

BARNETT F. DODGE

Veröffentlichungen des wissenschaftlichen Zentral-laboratoriums der Photographischen Abteilung—AGFA. (Publications from the Scientific Laboratories of the Photographic Division—AGFA.) Vol. I. Issued by the I. G. Farbenindustrie Aktiengesellschaft. Verlag von S. Hirzel, Königstrasse 2, Leipzig C 1, Germany, 1930. vii + 155 pp. Illustrated. 94 figs. 17.5 × 24.5 cm. Price, RM. 10.

This first volume of a series to be issued by the I. G. Farbenindustrie Aktiengesellschaft contains a number of fairly elementary articles of interest to the spectroscopist, the photo-chemist, the color photographer, the Röntgenologist and the tone-film engineer, all treated from the standpoint of photographic technique. Articles by Eggert, Arens and others, on the theory of the latent image, the laws of blackening of the photographic emulsion and color sensitometry, are followed by a brief discussion of infra-red photography by Dieterle. Then come pages devoted to the use and control of photographic film in the talking movies. The next articles deal with x-ray problems, the first discussed being that of taking stereoscopic x-ray photographs, while the Agfa-Röntgen film dosimeter and its use constitute another.

The balance of the volume is taken up with a discussion of experiments on

the thermal and other physical properties of cellulose and its derivatives, as of interest in photography; and with certain problems of half-tone reproduction. While as to unity of material the volume is a typical "Contributions from the———Laboratory," it is well written and illustrated and nicely printed. A well selected bibliography accompanies each article.

GEORGE R. HARRISON

Chemical Calculations. By ERNEST L. DINSMORE, A.B., Chairman of the Chemistry Department, Boys High School, Brooklyn, New York. Globe Book Company, New York. vi + 182 pp. 7 figures. 12.5 × 19 cm.

The fourteen chapters of this book provide a "wealth of material in chemical calculations." In Chapters I to X inclusive the problems are arranged by types in the order in which the corresponding subject matter occurs in standard elementary texts on chemistry. Each chapter is introduced by some theoretical matter, definitions of chemical terms employed, and by the solution of one or more typical problems. A few study questions generally precede the numerical problems. Chapter XI comprises miscellaneous problems covering all the different types previously presented. Chapter XII includes 272 problems grouped under the chapter headings of the average textbook. These will be of special service in connection with review work, and will be helpful to teachers in the preparation of examination papers. Chapters XIII and XIV consist of 54 problems selected mainly from recent examination questions of the College Entrance Examination Board. No answers are given.

Some of the exercises in Chapter X, Solutions, deal with normal and molar concentration but problems based on Raoult's laws have been omitted. And there are no exercises on electrolysis—Faraday's laws—ionization constants, solubility product, P_H values, and calculations based upon oxidation–reduction reactions.

HERMAN SCHLUNDT

Reactions and Symbols of Carbon Compounds. A Textbook of Organic Chemistry. By T. CLINTON TAYLOR, Ph.D., Associate Professor of Chemistry, Columbia University. The Century Company, 353 Fourth Avenue, New York, 1930. x + 704 pp. 14.5 × 22 cm. Price, \$4.00.

It should be stated at the outset that this is not "just another organic text." Professor Taylor has gone further than any other author your reviewer is aware of in presenting a course in theoretical organic chemistry on the basis of experiment. Despite the obvious difficulty of the undertaking, he has managed, in the main, to accomplish what he aimed to do. Students who really learn a considerable part of the material presented will know what reagents are actually employed to achieve certain ends, some-

thing, alas, which those brought up on the more conventional texts are liable to have altogether too little appreciation of.

The most glaring discrepancies in the book, and it must be admitted there are several, are evidently due to too hasty proof-reading. At least three proper names are misspelled, and other errors of spelling are easily discoverable. Too many formulas are incomplete, or actually wrong; for example, that for thymol indicates it to be an aldehyde, and nerolin is said to be an ethyl ether. Furthermore, the statement appears that "no acid chlorides (of oxalic acid) are known," and this despite the fact that each set of the decennial indices to *Chemical Abstracts* presents numerous references to oxalyl chloride, which has been known for over fifteen years at least. The author, regrettably, consistently utilizes the term "symbol" where "formula" is the conventional designation, and offers no explanation for this eccentricity; also there are too many instances of the use of a term not yet explained, sometimes never explained, such as olefin, to cite a rather notable example. Sometimes where a preferable name, such as glycerol or pinacol, is mentioned by the author, he will subsequently content himself to use the older or less desirable nomenclature, which if we ever hope to arrive at a general usage of the preferable term is at least unfortunate. The modern interpretation of the Beckmann rearrangement is not given, and the formula for strychnine is, unhappily, not that on which Robinson's recent work has put the stamp of approval. The book is rather difficult reading at times because of the author's use of parenthetical expressions and references injected into the text; but, more particularly, footnotes are employed to an excessive extent, in one sentence characters appear referring the reader to three separate footnotes. One extraordinary instance of lack of balance is evident; carbohydrates and rather closely related substances are given 82 pages out of 687 of actual text; whereas proteins are disposed of in 13. One may be excused for riding an important hobby to the limit, but to back a favorite 6-1 is rather overdoing it.

It is always easy to find faults in anything and one should not infer from the foregoing that this text lacks attractive features. Those who have sought, too frequently in vain, for a good structural formula for mercurochrome, will be glad to find one included here. Electronic equations constitute a noteworthy feature of this text and are consistently and remarkably successfully employed.

When Professor Taylor's book appears in its next edition, more carefully proof-read, it will furnish a unique and thoroughly worth-while presentation of organic chemistry for college students.

G. ALBERT HILL