attached to these carbon atoms. A recent "third law" investigation of the entropy of propane[3] has demonstrated the reliability of the potential estimated for this molecule. The value of the entropy at the boiling point calculated using the estimated barrier agrees with the observed value within 0.2 cal. per deg. per mole. It might also be pointed out that the evidence cited by Kistiakowsky and Wilson showing a lower potential barrier for the 2-butenes than for ethane really supports the calculations in question since the barriers used are quite in accord with these data.

(3) Kemp and Egan, to be published.

The determination of most of these potential barriers was not "arbitrary" but based upon experimental thermodynamic data in conjunction with the method of calculation mentioned above. As a result the uncertainties in using this method of calculation depend not on a detailed understanding of "the laws of force responsible for the hindrance of internal rotation" but rather upon the accuracy of the thermodynamic and molecular structure data employed.

CHEMICAL LABORATORY
UNIVERSITY OF CALIFORNIA
BERKELEY, CALIFORNIA
KENNETH S. PITZER
J. D. KEMP

RECEIVED FEBRUARY 21, 1938

NEW BOOKS

Calculations in Quantitative Chemical Analysis. Second edition. By JOHN A. WILKINSON, Ph.D., Professor of Analytical and Inorganic Chemistry at Iowa State College. McGraw-Hill Book Company, Inc., 330 West 42d St., New York, N. Y., 1938. x + 154 pp. 14.5 × 21 cm. Price, $1.75.

Weakness in the calculations of arithmetic and algebra afflicts a large proportion of any elementary chemistry class, and is far from rare among those who reach Quantitative Analysis. This solid little book should be of great assistance to such troubled students. Its twenty-three chapters furnish clear and logical discussions of principles, well-chosen and worked out illustrative examples, and numerous problems of varied types: on chemical formulas and equations, factors, indirect analysis, percentages of constituents sought, analytical errors in gravimetric analysis, as well as on volumetric calibrations, standardizations of solutions, acidimetry, precipitation titrations, differential and oxidation–reduction titrations, and the calculation of volumetric results.

As stated in the Preface, changes from the first edition appear chiefly in the chapter on "Calculations from Equations," in the revision and rewording of many of the problems, the use of ml. instead of the older cc., and the recalculations necessitated by the atomic weight changes of the last ten years.

ALLEN D. BLISS

The Retardation of Chemical Reactions. By KENNETH C. BAILEY, Sc.D., Litt.D., F.I.C., Professor of Physical Chemistry in the University of Dublin. Edward Arnold and Co.: Longmans, Green and Company, 114 Fifth Avenue, New York, N. Y., 1937. viii + 479 pp. 15.5 × 23.5 cm. Price, $8.00.

A feature of this book is the eighty-seven page bibliography, with cross references to related investigations and to the discussions in the text. It is evident from the titles of the articles that this compilation could not be made by an investigator merely by consulting such headings as retardation or negative catalysis in abstract journals.

The author states in the preface: "The order of the chapters has been decided by types of reaction. An arrangement according to mechanisms of retardation would be more logical, but is scarcely possible in the present state of our knowledge." In the book many instances are noted in which the experimental results are incomplete or even contradictory.

Two-thirds of the text is devoted to reactions of oxygen with various substances, and the discussion is not restricted to retardations. The types of oxygen reactions are as follows: reactions with phosphorus and hydrogen Chapters 3, 4 and 6; with hydrocarbons or other substances in the gaseous phase, two chapters; with solutions or liquids, six chapters; and with solids, one chapter. Anti-knock compounds, the protection of rubber, and the prevention of metallic corrosion are discussed in the next three chapters. In some of the remaining chapters, which deal with other types of reaction, oxygen appears in the role of an inhibitor, *e. g.*, in the reaction of hydrogen with chlorine or bromine.

The development of the idea of chain reactions is traced in Chapter 5, and in the later discussions many of the reactions involving oxygen are cited as examples.

The interruption of reaction chains is, of course, not a universal explanation for all retardations. Some of the other theories discussed and illustrated by the author are: destruction or activation of positive catalysts, action at solid surfaces, action at liquid surfaces, the conduction away of heat, and the absorption of light or radiation.

Each topic is treated historically. In discussions of negative catalysis considerable space is given to early theories which assumed the regeneration of the inhibitor in a homogeneous medium. The author rejects this type of

theory, but not for the reason that the regeneration of the inhibitor requires the reversal of an essential step in the process.

WILLIAM C. BRAY

Laboratory Technique in Organic Chemistry. By AVERY ADRIAN MORTON, Associate Professor of Organic Chemistry, Massachusetts Institute of Technology. International Chemical Series. McGraw-Hill Book Company, Inc., 330 West 42d Street, New York, N. Y., 1938. x + 261 pp. 122 figs. 14.5 × 21 cm. Price, $2.50.

The author's purpose, as stated in the Preface, is "to improve the student's understanding of ordinary laboratory manipulations, and to widen the research worker's knowledge of the apparatus at his command." Professor Morton has included in his book a well-chosen group of discussions of fundamental operations of the organic laboratory which should enable any thoughtful student to gain a clear understanding not only of the physical chemistry upon which these operations are based, but also of the best present-day methods and modern means of conducting them.

The melting point, boiling point, fractional distillation, vacuum distillation, steam distillation, crystallization, filtration, adsorption, extraction, and special apparatus and methods, are treated in successive chapters. A series of eighteen experiments, designed to illustrate the general principles previously discussed, makes up the concluding chapter. Each chapter contains an excellent bibliography, which, although not exhaustive, contains enough important references to enable the student to seek further guidance, and find more complete discussions of the various operations.

A series of experiments, like those at the end of the book, designed to illustrate the excellent earlier discussions of laboratory technique, and modified to fit individual needs, should, if conscientiously studied, produce a student well trained in the "art" of modern organic chemistry. The book should be available to all advanced students of organic chemistry. Print, paper and binding are good, and the illustrations are numerous, and well done.

NATHAN L. DRAKE

Fermente-Hormone-Vitamine, und die Beziehungen dieser Wirkstoffe zueinander. (Ferments, Hormones and Vitamins, and Their Mutual Relationships.) By ROBERT AMMON, Dr. med. habil., University of Breslau, and WILHELM DIRSCHERL, Dr. med. habil., Dr.-Ing. habil., University of Frankfort-on-Main. Georg Thieme Verlag, Rossplatz 12, Leipzig C 1, Germany, 1938. xvi + 451 pp. 71 figs. 17.5 × 24 cm. Price, RM. 30; bound, RM. 32.

Biochemical research has in recent years led to the recognition of close chemical relationships between certain of the enzymes, co-enzymes, vitamins and hormones. Examples of such relationships are that between lactoflavine and Warburg's yellow enzyme; that between the antineuritic vitamin and co-carboxylase; the steroid character of the antirachitic vitamins and the sex hormones. Moreover, in at least one instance (ascorbic acid) a vitamin for one species must be regarded as a hormone for another. The appearance of a comprehensive treatise in which these various classes of substance are discussed in a single volume is therefore timely and welcome.

In the book under review the authors describe, in the comparatively small compass of four hundred and forty pages, the chemical and physiological properties of every important member of the three groups comprised in the title. In the first section (144 pages) the chemistry of enzymes receives careful and scholarly treatment. Individual enzyme systems are, wherever possible, classified according to chemical function, and the importance of linked reactions in biochemical processes is clearly brought out. The second section (170 pages) treats of hormones with an emphasis on physiological behavior rather than on the chemical nature of the biologically active products. The third section (92 pages) comprises detailed descriptions of the physiological action and the chemical constitution, so far as they are understood, of the various vitamins, including plant growth promoters. In a brief final section (34 pages) the authors have essayed, none too successfully, to correlate the biochemical properties of individual ferments, hormones and vitamins.

The book as a whole is to be regarded not as a work of reference, but as a textbook, composed on a generous scale, for the instruction of chemists and physiologists; in it the chemist will find a wealth of highly specialized physiological information, and the physiologist much equally specialized organic chemistry. However, readers of both types will regret the absence of precise references to the original literature, the inclusion of which would have added greatly to the value of the work.

HANS T. CLARKE

Die Diffusionsanalyse am Blutplasmagel. Ein neuer Weg der Blutforschung. (Analysis by Diffusion in Gels of Blood Plasm. A New Method of Investigating Blood.) By RUDOLF BUCHER. Benno Schwabe and Company, Verlag, Klosterberg 27, Basel, Switzerland, 1937. 123 pp. 70 figs. 16 × 24 cm. Price, 30 Swiss francs.

The author has had the energy and persistence to ascertain the experimental conditions necessary for the production of well-defined and reproducible Liesegang rings of silver chromate in the gel of blood plasm. This phenomenon, whatever theory we may adopt for its explanation, will always be governed by the conditions essential for the formation of a new solid phase in a (mostly) liquid medium, and these conditions will vary greatly with extremely small changes in the composition and in other properties of the medium. Hence it is no wonder that Mr. Bucher is able to discover by his method the very small differences in the bloods of different species of animals and of different human beings, as well as the differences in the same blood caused by illness or by the introduction of foreign substances into the blood, etc.

It is a great pity that we know so little about the formation of solid nuclei, else the changes observed might allow valuable conclusions concerning the nature of these changes in the blood plasm. Out of a number of interesting observations, one may in particular be mentioned: In the blood

plasm of the fetus of a calf whose concentration as to colloids is small, instead of Liesegang rings, streamers are formed very similar to those found in the phenomenon of intertraction.

Mr. Bucher demonstrates his experiments by a large number of most beautiful colored plates. When reading the book, the reviewer frequently regretted that the author had not used a more simple and lucid language.

H. FREUNDLICH

A Brief Introduction to the Use of Beilstein's "Handbuch der Organischen Chemie." By ERNEST HAMLIN HUNTRESS, Ph.D., Associate Professor of Organic Chemistry, Massachusetts Institute of Technology. Second edition, revised. John Wiley and Sons, Inc., 440 Fourth Avenue, New York, N. Y., 1938. x + 44 pp. 15 × 22.5 cm. Price, $1.00.

This well-known and very useful pamphlet "is intended as a brief explanation of the method of classification of organic compounds used in the fourth edition of Beilstein's *Handbuch der Organischen Chemie*. Since its original publication, twenty-seven more volumes of Beilstein have appeared completing (1938) both the main and first supplementary series for compounds of established structure in the acyclic, isocyclic and heterocyclic divisions."

"In the second edition of this pamphlet the original intention to keep its content as brief as consistent with adequate clarity has constantly been kept in mind. The author has brought up to date the charts comprising the nucleus of the exposition and has inserted some new text, particularly with respect to the treatment of heterocyclic compounds. The original very brief list of drill problems has been replaced by a more generous selection of type questions. Opportunity has been taken to correct certain typographical errors."

HENRY GILMAN

Semi-micro Qualitative Analysis. By PAUL ARTHUR and OTTO M. SMITH, Oklahoma Agricultural and Mechanical College. McGraw-Hill Book Co., Inc., New York, N. Y., 1938. vii + 198 pp. 8 figs. 14 × 21 cm. Price, $2.00.

In many schools and colleges, qualitative analysis is taught as a part of the course in general chemistry during the latter part of the year. This book is intended for such a course and the theoretical treatment is brief.

The book is divided into four parts. Part I (14 pages) gives details concerning apparatus and laboratory technic. Instead of standing up and performing laborious filtrations with relatively large volumes of liquids, the student usually sits at a flat topped desk, uses a centrifuge instead of a filter and carries out his tests with a few drops of solution. After every precipitation, the precipitate is collected at the bottom of a centrifuge tube, the mother liquor is withdrawn with a medicine dropper and a little of the precipitate or a few drops of the solution are used for making each individual test.

Part II (56 pages) is a discussion of the theory of analysis and would apply equally well to any course in qualitative analysis. Methods of calculation involving molar and normal solutions are explained and the following topics are discussed briefly—mass action law, Arrhenius theory of electrolytes, hydrolysis, *p*H, solubility relations, solubility products, colloidal solutions, complex ion formation, common ion effect, strong and weak electrolytes, amphoteric hydroxides, oxidation and reduction, balancing equations, co-precipitation, mixed-crystal formation and the Debye–Hückel theory of the so-called "salt effect." Considerable attention is paid to the hydronium ion on pages 59 to 62 and *p*H is defined as log $1/(H_3O^+)$. Werner's valence theory is touched upon and also the Bayer strain theory. Except on the three pages mentioned, no other mention of the hydronium ion is made and the purpose of introducing the Bayer theory is not altogether clear, because the book is intended for beginners in chemistry.

Part III (70 pages) deals with the reactions of the cations. The scheme for analysis is essentially the well-known Fresenius scheme as modified by A. A. Noyes and others except that many of the confirmatory tests are made with organic reagents. In most cases the student is given little information concerning the chemistry involved in making the identification test and is not expected even to know the formula of the reagent. Thus to test for lead the student is told to take a drop of the lead chloride solution, add hydrogen peroxide and benzidine acetate. If lead is present a blue color results and the student is told that most oxidizing substances give the test but lead is indicated at this stage of the procedure. Of sixty-nine reagents used, at least thirty-three are carbon compounds.

Part IV deals with tests for anions. In the Appendix are oxidation–reduction potentials, solubility products, ionization constants, list of apparatus, list of reagents and directions for making test solutions and unknowns. Numerous equations are given to cover all of the common reactions, there are many questions for home study and a list of sixty-five references. It is tacitly assumed that the instructor will have sense enough not to hand out difficult unknowns such as alkaline earth phosphates, fluorite, tinstone or alloy steel.

The book is well written and easy to understand. The theory is sound and reasonably up-to-date. Considering the emphasis placed on spot tests it is rather remarkable that no reference is made to the excellent and comprehensive book by Feigl of which the second edition has been translated into English.

WILLIAM T. HALL

Photoelements and their Application. By Dr. BRUNO LANGE, Consulting Engineer, Berlin-Dahlem. Translated by Ancel St. John, Ph.D., New York. Reinhold Publishing Corporation, 330 West 42d Street, New York, N. Y., 1938. 297 pp. 67 figs. 15.5 × 24 cm. Price, $5.50.

The original German edition of this volume has already been reviewed in THIS JOURNAL [*Die Photoelemente und ihre Anwendung*. Part I. Development and Physical Properties, **58**, 536 (1936); Part II. Industrial Application, **58**, 2078 (1936)].

The use of photoelements in chemical analysis, control and research is increasing so rapidly that the appearance

of this translation is indeed timely. The excellent illustrations of the original edition have been retained and the German text appears to have been rendered into clear and idiomatic English.

ARTHUR B. LAMB

Organic Chemistry, an Advanced Treatise. By HENRY GILMAN, Editor-in-Chief, and Twenty-seven Contributors. In Two Volumes. John Wiley and Sons, Inc., 440 Fourth Avenue, New York, N. Y., 1938. 1890 pp. + index. 16 × 24 cm. Price, $15.00.

What the book contains is best shown by the list of chapter headings, authors, numbers of pages and references: 1. Alicyclic compounds and the theory of strain, Reynold C. Fuson, 51 pp., 84 refs. 2. Theory of the structure and reactions of aromatic compounds, Louis F. Fieser, 98 pp., 208 refs. 3. Stereoisomerism, R. L. Shriner, Roger Adams and C. S. Marvel, 256 pp., 406 refs. 4. Organometallic compounds, Henry Gilman, 83 pp., 143 refs. 5. Free radicals, Werner E. Bachmann, 53 pp., 111 refs. 6. Unsaturation and conjugation, C. F. H. Allen, 67 pp., 175 refs. 7. Open-chain nitrogen compounds, Charles D. Hurd, 111 pp., 304 refs. 8. Molecular rearrangements, Everett S. Wallis, 82 pp., 156 refs. 9. Comparison of chemical reactivity, Homer Adkins, 56 pp., 74 refs. 10. Natural amino acids, H. T. Clarke, 89 pp., 469 refs. 11. The Chemistry of Pyrimidines, purines and nucleic acids, Treat B. Johnson, 70 pp., 355 refs. 12. Alkaloids, Lyndon Small, 96 pp., 175 refs. 13. The Anthocyanins and the flavones, Karl Paul Link, 24 pp., 34 refs. 14. Carotenoids: The Polyene pigments of plants and animals, Marston Taylor Bogert, 82 pp., 253 refs. 15. The Sterols, bile acids and related compounds, William H. Strain, 179 pp., 478 refs. 16. Carbohydrates I, Melville L. Wolfrom, 78 pp., 281 refs. 17. Carbohydrates II, Albert L. Raymond, 57 pp., 51 refs. 18. Carbohydrates III, Cellulose, Emil Heuser, 61 pp., 118 refs. 19. Modern electronic concepts of valence, John R. Johnson, 117 pp., 117 refs. 20. Constitution and physical properties of organic compounds, 67 pp., 109 refs. 21. Rotary dispersion, P. A. Levene and Alexandre Rothen, 71 pp., 57 refs. 22. The Significance of resonance to the nature of the chemical bond and the structure of molecules, Linus Pauling, 41 pp., 35 refs.

This book is a real achievement and will be of great service to graduate students attempting the impossible task of getting a comprehensive view of organic chemistry; its more than 4000 references will be valuable to specialists. The Editorial Board is to be commended and thanked for the enormous amount of labor here represented. The topics are well chosen and are treated by specialists who give authority and character to the chapters. This makes for a pleasing variety. The topics are of current interest and are treated from present-day points of view. Less than 10% of the space is devoted to aromatics instead of the 70% of older compendiums.

The title is the only thing with which one may find fault; it is a collection of monographs—several of them full grown — on special topics rather than a systematic treatise. It is to be hoped that a number of similar volumes will follow, covering many other fields. The reviewer naturally feels that an organic chemistry is not complete without a mention of sulfur compounds. Dyes, which were formerly the center of interest, are still important and the theory of color is now even more interesting since we have electrons.

E. EMMET REID

Handbuch der Lebensmittelchemie. A. BÖMER, A. JUCKENACK and J. TILLMANNS. Zweiter Band. Allgemeine Untersuchungsmethoden. Zweiter Teil. Chemische und biologische Methoden. (Handbook of Food Chemistry. Vol. II. General Research Procedures. Part II. Chemical and Biological Methods.) Edited by A. BÖMER. Verlag von Julius Springer, Linkstrasse 22-24, Berlin W 9, Germany, 1935. xvi + 1190 pp. 331 figs. 17.5 × 26 cm. Price, RM. 145; bound, RM. 146.80.

With the appearance of Part II of volume 2 of a contemplated nine-volume exhaustive treatise on the chemistry of foods another step toward the objective, the preparation of a standard treatise on this subject which was to have crowned the life work of the late Alois Bömer, successor to Joseph König ("Chemie der Menschliche Nahrungs- und Genussmittel") in this field and for some 38 years editor of *Zeitschrift für Untersuchung der Lebensmittel*, has been completed. This book, like the others which have preceded it, is the work of a group of scientists. In this instance twelve authors have written the 17 chapters which it contains. Of this number, three are directed to biological methods.

The chapter headings under the section devoted to chemical methods and the authors responsible for the contents of each are: nitrogen compounds (69 p.) and fats (10 p.) by A. Bömer; water (28 p.) by A. Bömer and R. Grau; alcohols (46 p.), aldehydes and ketones (51 p.), organic acids (106 p.), coloring matter (30 p.), and mineral constituents (65 p.) by A. Bömer and O. Windhausen; elementary analysis (30 p.) by K. Täufel; serological methods for the differentiation of proteins (34 p.) by C. Griebel; enzymes (117 p.) by E. Waldschmitz-Leitz and A. K. Balls; carbohydrates (142 p.) by J. Grossfeld; isolation and detection of poisons (165 p.) by A. Gronover; mathematical analysis of experimental data (14 p.) by A. Timpe and J. Grossfeld.

The subject matter of the biological methods section is presented under the headings of vitamins (86 p.) by A. Scheunert and M. Schieblich; mycological examinations (109 p.) by C. Griebel; and digestibility of foods (12 p.) by A. Bömer.

Space does not permit a review of each chapter—there are several which are of monograph proportions—so suffice it to state that the treatment of the several subjects is uniformly excellent and that illustrations have been generously used. The whole work reflects the progress of organic chemistry and biochemistry in respect to the influence which each has exerted upon the development of food chemistry and the expansion of the field which the latter covers. Those who have a set of "König" on their shelves would do well to add to it this work. It can hardly be regarded as a competitor; rather as an adjunct in which are described and discussed by experts the modern aspects of food chemistry.

H. A. SCHUETTE

The Elements of Quantum Mechanics. By SAUL DUSHMAN. John Wiley and Sons, Inc., 440 Fourth Avenue, New York, N. Y., 1938. 452 pp. Price, $5.00.

It is now generally accepted that quantum mechanics forms the basis of practically all theoretical work in chemistry and physics. Even those who are not willing to accept the idea that the answers to all chemical problems could be obtained if only the mathematical difficulties of solving the wave equation were overcome must face the fact that it is necessary to be familiar with at least the elementary notions of quantum mechanics in order to understand not only the contemporary literature of theoretical chemistry but also much of the motivation and interpretation of present-day experimental research. Dr. Dushman has attempted to make the task of acquiring an elementary knowledge of quantum mechanics as easy as possible for the student without advanced mathematical training. To quote from his preface, "...the writer's aim has been to present the subject in such a manner that its essential concepts and logic may be readily comprehended by those who have not had any intensive training in mathematics beyond calculus."

The topics covered are necessarily limited by the fact that all mathematical steps are given in full detail, but they include discussions of reflection at potential barriers, the classical theory of atomic dynamics, the harmonic oscillator, the rigid rotator, hydrogen atom, van der Waals forces, perturbation theory, the helium atom and hydrogen molecule, as well as chapters on the vibrational and rotational states of the hydrogen molecule, valence theory and radiation.

On the whole the book should help the cause of spreading a knowledge of quantum mechanics among chemists even though it may not accomplish the difficult task of making the subject easy for everyone who has had no mathematics beyond elementary calculus.

E. BRIGHT WILSON, JR.

BOOKS RECEIVED

April 15, 1938–May 15, 1938

NEIL KENSINGTON ADAM. "The Physics and Chemistry of Surfaces." Second edition. Oxford University Press, 114 Fifth Ave., New York, N. Y. 402 pp. $7.50.

LOUIS J. CURTMAN. "Qualitative Chemical Analysis." Revised edition. The Macmillan Co., 60 Fifth Ave., New York, N. Y. 514 pp. $3.75.

J. C. L. DEFIZE. "On the Edeleanu Process for the Selective Extraction of Mineral Oils." D. B. Centen's Uitgevers-Maatschappij N. V., Amsterdam, Holland. 310 pp. $7.50.

FRITZ FEIGL. "Qualitative Analyse mit Hilfe von Tüpfelreaktionen. Theoretische Grundlagen, praktische Ausführung und Anwendungen." Third edition. Akademische Verlagsgesellschaft m. b. H., Sternwartenstrasse 8, Leipzig C 1, Germany. 554 pp. RM. 28; bound, RM. 30.

T. R. HOGNESS and WARREN C. JOHNSON. "Elementary Principles of Qualitative Analysis." Henry Holt and Co., 257 Fourth Ave., New York, N. Y. 325 pp. $1.40.

CLAUS KOEPPEL. "Feuerfeste Baustoffe: silikatischen und silikathaltigen Massen." Verlag von S. Hirzel, Königstrasse 2, Leipzig C 1, Germany. 296 pp. RM. 15.50; bound, RM. 17.

OTTO KRÖHNKE and GEORG MASING, Editors. "Die Korrosion von nichteisenmetallen und deren Legierungen." Verlag von S. Hirzel, Königstrasse 2, Leipzig C 1, Germany. 901 pp. RM. 66.50; bound, RM. 69.

HEINZ KURZ and FRITZ SCHUSTER. "Koks. Ein Problem der Brennstoffveredlung." Verlag von S. Hirzel, Königstrasse 2, Leipzig C 1, Germany. 382 pp. RM. 20; bound, RM. 21.40.

C. H. LEA. "Rancidity in Edible Fats." His Majesty's Stationery Office, British Library of Information, 270 Madison Ave., New York, N. Y. 230 pp. $1.10.

W. R. SCHOELLER. "The Analytical Chemistry of Tantalum and Columbium." Nordemann Publishing Co., Inc., 215 Fourth Ave., New York, N. Y. 198 pp. $5.50.

F. A. H. SCHREINEMAKERS. "Lectures on Osmosis." Nordemann Publishing Co., Inc., 215 Fourth Ave., New York, N. Y. 262 pp. $7.00.

J. H. WOFENDEN. "Numerical Problems in Advanced Physical Chemistry." Oxford University Press, 114 Fifth Ave., New York, N. Y. 227 pp. $2.75.

W. A. WOOSTER. "A Textbook on Crystal Physics." Cambridge University Press: The Macmillan Co., 60 Fifth Ave., New York, N. Y. 295 pp. $4.00.