

This has now been carried out. Three hundred millimeters of an equimolecular mixture of acetaldehyde and acetaldehyde-d₄ (99.5%, from Norway) has been decomposed at 535° and the products submitted to infrared examination on the instrument in this Laboratory [Gershinowitz and Wilson, *J. Chem. Physics*, **6**, 197 (1938)]. For comparison purposes a similar sample with 0.04% added oxygen was decomposed at 435° and analyzed in the same way. The results show clearly that in the case of the pure acetaldehydes there is very slight absorption in the regions of characteristic CD₃H and CH₃D frequencies (1100–1300 cm.⁻¹, 2205 cm.⁻¹), whereas there is very pronounced absorption in these same regions for the

mixture to which the trace of oxygen had been added.

These findings demonstrate that there is little or no mixing of the hydrogen and deuterium in the methanes during the thermal decomposition of the acetaldehydes, and therefore that the decomposition must proceed substantially by a molecular mechanism. A preliminary estimate indicates that a minimum of 80% and possibly 100% of the reaction undergoes molecular decomposition.

The experimental details and infrared plates will be presented in a later paper.

CHEMICAL LABORATORIES

HARVARD UNIVERSITY

CAMBRIDGE, MASSACHUSETTS

J. CARRELL MORRIS

RECEIVED AUGUST 22, 1941

NEW BOOKS

Free Radicals as Intermediate Steps in the Oxidation of Organic Compounds. Volume XL, Art. 2, pages 37–132 of the *Annals of the New York Academy of Sciences*. By L. FARKAS, MANUEL H. GORIN, L. MICHAELIS, OTTO H. MÜLLER, MAXWELL SCHUBERT, and G. W. WHELAND. The New York Academy of Sciences, care of the American Museum of Natural History, New York, N. Y., 1940. 96 pp. Illustrated. 15.5 × 23.5 cm. Price, \$1.25. This monograph is one of several, which, if purchased as a set, may be had at a reduced price.

This volume of six papers, presented at a conference of the Physics and Chemistry section of the New York Academy of Sciences in November, 1939, represents an excellent review of our current knowledge in the field of semiquinones. The title is misleading, however, for the roles of "ordinary" free radicals and semiquinones in organic reaction kinetics are only occasionally touched upon.

The paper by Michaelis, the leader in this field, occupies over one-third of the volume. It gives a broad presentation of the definitive studies that have been carried out in his laboratory together with a detailed presentation of the important principles involved. Twenty figures of experimental data are given and the paper is accompanied by a complete bibliography of 53 titles with the subject matter of each reference indicated. This article is undoubtedly the best review available on the existence of semiquinones, their equilibria with the reduced and oxidized forms and the dimeric meriquinones, their detection by potentiometric, magnetometric, and spectrophotometric methods; and the role of resonance in determining their stability. Michaelis presents the challenging thesis that every (organic) oxidation can proceed only in steps of univalent oxidation.

In an interesting paper Schubert explores the analogy between electron and proton removal from organic compounds. Cases of apparent simultaneous ejection of two protons are rare, but fairly clear-cut examples in titrations of N-alkyl thiazolium and pyridinium compounds are discussed. Reference is made to the significant studies of Schwarzenbach on the state of ionization, symmetry, and resonance of dyestuff molecules; it is regrettable that practically no work has been done along these lines with the semiquinones themselves.

Müller discusses in detail the possibilities of the polarograph in studying semiquinone formation and supports the theories with experimental examples. This technique offers good prospects for extending the potential range into the overvoltage field and for studying systems incompletely reversible. Farkas considers the experimental feasibility of determining the presence of small concentrations of semiquinones by the measurement of the rate of conversion of para-hydrogen to equilibrium hydrogen. This method should give estimates of the semiquinone formation constant *k* when it is considerably less than the present lower limit of measurement of 0.01, corresponding to about 5% of dyestuff in semiquinone form.

Free radicals are discussed in two papers. Gorin evaluates the standard free energy of the free radical HO₂ in aqueous solution as -3.5 kcal. and that of O₂⁻ as 9.5 kcal. from estimations of the strengths of electron-pair and three-electron bonds between oxygen atoms. These values, 6 kcal. below the estimates in use derived from kinetic reasoning, are of great importance in interpreting the kinetics of oxygen and peroxide reactions. Wheland reviews qualitatively the calculation of the stability of hydrocarbon free radicals; mathematical difficulties have so far pre-

vented, however, the extension of the estimates to molecules with other atoms than carbon in the resonating circuit.

The equilibrium aspects of semiquinone chemistry are in a highly satisfactory state, and the clarification of structural-chemical principles is well in progress, as shown in these articles. A major problem demanding attention from chemists is the elucidation of the detailed role of semiquinones in solution kinetics.

These papers are on the whole clearly written and stress the experimental point of view. Typographical errors are fairly common. The subject matter is a timely one and the treatment is thoroughly up to date. The papers should prove of interest, in roughly the order reviewed, to all chemists working with organic "redox" systems or interested in the tremendous breadth of application of semiquinone theory in the fields of chemical equilibrium and oxidation potentials, reaction kinetics, and organic and structural chemistry.

CHARLES D. CORYELL

Grundriss der Farbenlehre der Gegenwart. (Foundations of Modern Chromatics.) Band 51 der Wissenschaftliche Forschungsberichte, Naturwissenschaftliche Reihe. By Dr.-Ing. MANFRED RICHTER, Staatl. Materialprüfungsamt Berlin-Dahlem Abteilung Faserstoffe. Verlag von Theodor Steinkopff, Residenzstrasse 32, Dresden-B1., Germany, 1940. 226 pp. 120 figs. 15 × 22.5 cm. Price, RM. 11.25; bound, RM. 12.38.

The problem of color description, measurement and specification is an exceedingly complex one. The physical causes of the appearance of color are capable of exact analysis and measurement. They are a division of the broad subject of radiation and radiometry. The steps by which the precise data of radiometry are translated into color appearance are, however, complicated by the behavior of the physiological and psychological apparatus and processes which account for human vision. As Helmholtz long ago pointed out, in a famous remark, the eye is a very poor optical instrument from the standpoint of an optical designer. As he also pointed out, it has many compensatory features, and achieves, in spite of its imperfections, a range and variety of performances which would be lacking in a more precisely designed instrument. This is true in the case of color vision. The interpretation of the physical stimulus, which can be precisely measured, depends upon the level of the stimulus and upon fortuitous conditions, such as the surroundings, and upon the individual characteristics of the observers, who all deviate more or less from a norm.

Color science in the last few decades has been noteworthy for a breaking away from the domination by the physiological-psychological school, which overemphasized the variations of color appearance under abnormal conditions of observation, thereby introducing a defeatism into the problems of color measurement and specification; and a return to the physical viewpoint of Young and Maxwell. The starting point for modern color measurement and specification is the spectrophotometer, and the basis for transforming the data of that instrument to color appearance (under chosen standardized conditions) is furnished by the phenomena of color mixture, in particular of tri-

chromatic color mixture, stemming from the work of Thomas Young.

In conformity with the trend, this textbook on color science by Manfred Richter treats the physical basis of color and the phenomena of color mixture in its earliest chapters. Physiological and psychological factors are given adequate discussion in succeeding chapters (by I. Schmidt) to inform the student how they complicate the problem. Two chapters treat fully the methods of physical measurement and of algebraic and graphical methods for transforming these data to trichromatic specifications. The analysis of color according to the arrangement suggested by progressive differences of appearance, such as the Munsell System, is given a chapter. Following this is a discussion of heterochromatic photometry (by A. Dreisler) which might more appropriately have been treated earlier. The final chapters cover illumination, and various applications of color, such as color photography and television.

The book provides well balanced and accurate information in the field it is intended to cover, which excludes the aesthetics of color and the chemistry of coloring-materials. One criticism may be made: researches and methods are ascribed with great uniformity to the first Germans to work in the field, and the references are predominantly to German articles, although in many cases the significant pioneer work was elsewhere. While this does not detract from the technical accuracy of the material presented, it gives a wrong picture to any interested in the history of the subject.

HERBERT E. IVES

Identification of Pure Organic Compounds. Tables of Data on Selected Compounds of Order I. By ERNEST HAMLIN HUNTRESS, Ph.D., Professor of Organic Chemistry, Massachusetts Institute of Technology, and SAMUEL PARSONS MULLIKEN, Ph.D., Late Professor of Organic Chemistry, Massachusetts Institute of Technology. John Wiley and Sons, Inc., 440 Fourth Avenue, New York, N. Y., 1941. 14.5 × 22.5 cm. 691 pp. \$7.50.

The announcement that a new edition of Mulliken's "A Method for the Identification of Pure Organic Compounds" is in preparation is good news to all organic chemists. The first volume of the new work leaves no doubt that the revision is being done well. This book is, however, much more than a second edition. In fact, the treatment of the compounds is essentially new.

This volume supersedes Volume I of the old work. It conforms to the original classification, being devoted to the compounds of Order I, that is, those that contain carbon and hydrogen or carbon, hydrogen and oxygen. A total of 1364 such compounds is described. These have been selected with great care and include only substances that are readily available. The data listed are extremely accurate and well chosen. Moreover, there are many references, and these too have been selected with the utmost care.

The book is intended to accompany a system of identification (soon to be published) and contains a short outline of this system. The appearance of this and other volumes now contemplated will be awaited with great interest. In

the meantime the present volume will be of inestimable value as a reference book.

REYNOLD C. FUSON

Experiments in Organic Chemistry. By LOUIS F. FIESER, Sheldon Emery Professor of Organic Chemistry, Harvard University. Second edition. D. C. Heath and Co., 285 Columbus Avenue, Boston, Mass., 1941. x + 488 pp. 79 figs. 14.5 × 22.5 cm. Price, \$2.80. Parts I (\$2.00) and II (\$1.50) also available separately.

The second edition of this well-known work has been expanded significantly over the first edition [reviewed by N. L. Drake, *THIS JOURNAL*, 57, 1513 (1935)].

Part I contains 52 experiments, sufficiently diversified to meet all reasonable requirements for a general laboratory manual. Among the newer experiments are sulfanilamide, vitamin K₁ and related compounds, and the isolation of abietic acid from rosin.

Part II is an extraordinarily successful presentation of procedure and technique for advanced students. Chapter I, "Suggestions for advanced work," includes a description of the literature of organic chemistry. Chapter II, "Apparatus and methods," has among its sections the following: determination of melting points; manipulation of small quantities of material; chromatographic adsorption; and glass blowing (by E. B. Hershberg). Chapter III, "Solvents, reagents and gases," has the following sections: solvents; drying agents; alkylating agents; acylating agents; other reagents; and inorganic gases. The sections in Chapter IV, "Reactions," are: acylation; the Grignard reaction; the Friedel and Crafts reaction; reduction; oxidation; catalytic hydrogenation; and dehydrogenation. Chapter V is devoted to the semimicro-determination of carbon and hydrogen. Each of these sections has pertinent references to the very recent literature, and the author has wisely drawn on experiences in his laboratory. The wealth of material in the 183 pages which go to make up Part II would be more accessible if the Table of Contents contained page references to the several sections of the chapters.

The separate availability of Parts I and II is a happy idea, and the author and publishers are to be congratulated on producing one of the best laboratory manuals in organic chemistry.

HENRY GILMAN

A Textbook of Qualitative Chemical Analysis. By ARTHUR I. VOGEL, D.Sc. (Lond.), D.I.C., F.I.C., Head of Chemistry Department, Woolwich Polytechnic; Lately Bert Scientific Research Fellow of the Imperial College. Second edition. Longmans, Green and Co., 55 Fifth Avenue, New York, N. Y., 1941. Illustrated. xi + 486 pp. 13.5 × 21.5 cm. Price, \$2.75.

The second edition of this text retains the general order and arrangement of the original, but adds a number of features not included in the first edition. The most significant of these additions, especially in view of current trends in analysis, appear to be the sections dealing with the technique of micro analysis and the inclusion of many special tests of micro or semimicro nature in addition to the stand-

ard reactions of ions. Such tests have been selected carefully and the technique of their application, the preparation of the reagent solutions, and the interferences in each test are very carefully stated. All such tests are given in small print and if desired may be omitted from the course without in any way changing the standard, excellent procedures.

Although this text is not intended as a reference text, it does go further into analysis than many of our American texts. This is especially true with respect to the chapter on the less common elements, and in the analysis for the anions. On the other hand, no questions or exercises have been set either in connection with the theoretical or the analytical sections. This we consider a real drawback from the teaching point of view. Nevertheless, the book is sound and straightforward and is a valuable contribution to the field of Qualitative Analysis.

E. B. KELSEY

The Primary Process in Photochemistry. Volume XLI, Art. 3, pages 169-240 of the *Annals of the New York Academy of Sciences*. By W. ALBERT NOYES, JR., E. W. R. STEACIE, HUGH S. TAYLOR, EDWARD TELLER and W. WEST. The New York Academy of Sciences, care of The American Museum of Natural History, New York, N. Y., 1941. 71 pp. Illustrated. 15.5 × 23.5 cm. Price, \$1.25. This monograph is one of several, which, if purchased as a set, may be had at a reduced price.

This volume contains a series of papers presented at a conference on, The Primary Process in Photochemistry, held by the Section of Physics and Chemistry of the New York Academy of Sciences, May 3 and 4, 1940. In addition to a brief Introduction by W. Albert Noyes, Jr., the papers were: "Asymmetric Vibrations Excited by an Electronic Transition," by Edward Teller; "Photosensitization Experiments with Various Metal Vapors," by E. W. R. Steacie; "Primary Processes in Fluorescence and Photosensitization, with Particular Reference to Simple Aromatic Compounds," by W. West; and "Photolysis of Metal Alkyls and their Significance in Photoprocesses," by Hugh S. Taylor.

ARTHUR B. LAMB

National Research Council. "Report of Committee on Drug Addiction 1929-1941 and Collected Reprints 1930-1941," Washington, D. C. 1581 pp.

This volume contains reprints of articles published under the auspices of the Committee on Drug Addiction of the National Research Council; also a brief Final Report of that Committee. Of its sixteen hundred-odd pages, five hundred and seventeen are devoted to reprints of the articles dealing with the chemistry of the opium alkaloids which have appeared in *THIS JOURNAL* and the *Journal of Organic Chemistry*. The remainder of the articles, concerned chiefly with pharmacological and clinical studies of these alkaloids, have appeared mostly in the *Journal of Pharmacology and Experimental Therapeutics*, *Public Health Reports* and *Mental Hygiene*. Four publications are not included which have appeared in book form,

nainely, *The Chemistry of Opium Alkaloids, Studies on Drug Addiction, The Pharmacology of Opium Alkaloids and The Indispensable Use of Narcotics.*

This volume will certainly be of great convenience to workers in this field. It signalizes the splendid achievements of the Committee.

ARTHUR B. LAMB

Die Methoden der Fermentforschung. (Methods of Investigation of Enzymes.) Edited by Prof. Dr. EUGEN BAMANN, Tübingen, and Prof. Dr. KARL MYRBÄCK, Stockholm. Lieferung 7. Georg Thieme Verlag, Rosspatz 12, Leipzig C1, Germany, 1941. 20 × 27.5 cm. 67 figs. 415 pp. Price, RM. 31.20.

Lieferung 7 describes various sorts of fermentations, after which come glycolysis and related enzymes, while the latter part of the volume includes many varieties of oxidizing enzymes. What a wealth of material has been discovered concerning the multitude of chemical reactions which take place in plants and animals! The reviewer has gained information of value from such articles as that of Boyland on glycolysis, of Theorell on the yellow enzyme, of Franke on the oxyhydrases, or aerobic dehydrogenases, and of Rough-ton on carbonic anhydrase. Only two errors have been observed. On page 2259 glucose-6-phosphate is called "Cori ester" and on page 2488 purified laccase is stated to contain 34% of copper.

The subjects covered in Lieferung 7 are: The Modified Forms of Fermentation; Phytochemical Reductions; Enzymatic Condensations; Inhibition Phenomena in Alcoholic Fermentation; The Direct Fermentation of Disaccharides; Selective Fermentation; Glycolysis; An-oxidative Bacterial Fermentations; The Acceptor Methods for Dehydrogenases; Codehydrases I and II and their Respective Dehydrogenases; Succinic Dehydrogenase and the C₄-Dicarboxylic Acids; Hydrogenlyases; Cytochrome; The Schardinger Enzyme; Nucleic Acid Dehydrogenase; The Alloxazine Proteins (Yellow Enzymes); The Oxydehydrogenases; A General Discussion of Respiratory Quotient, Pasteur-Meyerhof Quotient and Inhibition Phenomena; Oxidative Fermentations; Chromo Oxidases; Uricase, Allantoinase, Allantoicase; Luciferase; The Iron-containing Respiration Ferment, Indophenol-Cytochrome Oxidase; Hexose Phosphorylase; The Enzymes of Phosphorylating Degradation; Aldolase; Carboxylase; Amino Acid Decarboxylases; Bacterial Decarboxylases; Organ Decarboxylases; Carbonic Anhydrase; Enolase; The Hydration Enzymes; The Mutases; Glyoxalase.

JAMES B. SUMNER

Chemistry of Food and Nutrition. By HENRY C. SHERMAN, Ph.D., Sc.D., Mitchill Professor of Chemistry, Columbia University. Sixth edition. The Macmillan Co., 60 Fifth Avenue, New York, N. Y., 1941. 65 tables. 46 figs. 14 × 21 cm. x + 611 pages. Price, \$3.25.

The character of the progress in the field of nutrition during the past four years is emphasized strikingly by comparing the newest edition of this book with its im-

mediate predecessor. Chemical names now appear in the titles of many of the chapters discussing the vitamins. Numerical quantities (many in weight units) replace the +, ++, +++ signs in the long table in the appendix which records the vitamin content of various foods. The human requirements for many of the vitamins are discussed extensively and on a quantitative basis. The newest additions, nicotinic acid, other water-soluble vitamins, and other fat-soluble vitamins, require three additional chapters for their consideration. The data on the proximate composition and the mineral element content of foods have been changed in many places. The discussion of sterols has been considerably reduced while the bile acids and sex hormones have been regarded as outside the scope of the book. The lists of suggested readings in original literature which follow each chapter and which have been very valuable features of preceding editions have received numerous additions and deletions. In spite of the numerous increases a slight enlargement of the surface area of the pages has permitted a reduction in their total number.

Those who have used earlier editions of this text, which first appeared in 1911, will find in the latest revision a tool of greatly increased value. To others it will have an appeal as an authoritative introduction to nutritional chemistry or a handy source of useful data.

HARRY C. TRIMBLE

Perkin and Kipping's Organic Chemistry. By F. STANLEY KIPPING, Professor Emeritus of Chemistry, University College, Nottingham, and F. BARRY KIPPING, University Lecturer in Chemistry, Cambridge. Third edition, in three parts. Thomas Y. C'fowell Company, 432 Fourth Avenue, New York, N. Y., 1941. 14 × 20 cm. 1029 pp. Price, \$6.00.

This widely used textbook, so familiar to the older generation of chemists, which first appeared in 1896 has again been revised. Despite many changes and additions, the authors have succeeded in retaining the general characteristics of the earlier editions. The introductory chapter on laboratory methods and technique has been kept, as well as the preparation of many typical compounds. Chapters on the theory of resonance and on electronic formulas have been added. The material on carbohydrates, sterols, and carotinoids has been brought up to date. A short appendix at the end contains questions and notes on consulting the literature.

D. E. WORRALL

Tratado de Quimica Organica. (Treatise on Organic Chemistry.) Vol. II, Part I. By Dr. ENRIQUE V. ZAPPI, Professor of Organic Chemistry in the Universities of Buenos Aires and La Plata. El Ateneo, Buenos Aires, Argentina, 1941. xvi + 520 pp. 15.5 × 23.5 cm.

This book is the first part of the second volume of a comprehensive treatise on Organic Chemistry which Dr. Zappi is writing primarily for his students at the Universities of Buenos Aires and La Plata but unavoidably for the benefit of the Spanish-speaking chemical world in general. When completed in the course of 1942, the work will consist of

two volumes of two parts each which will add up to a total of some 2000 pages.

The subject matter of the volume at hand is divided into thirteen chapters and is concerned with the aromatic series. The hydrocarbons and their substitution products, amines, diazo compounds, phenols, arsenic, phosphorus, bismuth, mercury and other metallo-organic derivatives are fully treated. The closing chapters deal with dyestuffs and medicinals. The newer drugs of the sulfanilamide group are briefly but adequately handled. The modern theories of organic chemistry and their applications are comprehensively discussed and the volume as a whole is a scholarly piece of work, clear in its exposition and thorough in its presentation. For a book covering such a wide field, a fuller index would have been a valuable addition.

The typography is excellent. Even the most complicated formulas failed to give any trouble to the printer, who was evidently well provided with all the characters necessary to the printing of modern organic texts.

It is a great pity that the barriers of language will prevent this excellent work from being widely read in this country. More than any description of courses in university catalogs, it would bear eloquent testimony to the quality of the training being given to prospective chemists in the southern half of the Western Hemisphere.

J. ENRIQUE ZANETTI

BOOKS RECEIVED

July 10, 1941–August 10, 1941

- "Die Methoden der Fermentforschung." Edited by EUGEN BAMANN and KARL MYRBÄCK. Lieferung 8. Georg Thieme Verlag, Rossplatz 12, Leipzig C 1, Germany. 459 pp. Rm. 34.50.
- "The Amphoteric Properties of Proteins." Vol. XLI, Art. 4 of the Annals of the New York Academy of Sciences. By R. KEITH CANNAN, A. KIBRICK, JOHN G. KIRKWOOD, L. G. LONGSWORTH, A. H. PALMER and JACINTO STEINHARDT. The New York Academy of Sciences, care of the American Museum of Natural History, New York, N. Y. 87 pp. \$1.25.
- C. C. CLARK, C. A. JOHNSON and L. M. COCKADAY, "This Physical World." The McGraw-Hill Book Co., 330 West 42nd Street, New York, N. Y. 528 pp. \$3.25.
- NATHAN L. DRAKE, Editor. "Organic Syntheses," Vol. 21. John Wiley and Sons, Inc., 440 Fourth Ave., New York, N. Y. 120 pp. \$1.75.
- RALPH H. ESPACH and H. DALE NICHOLS. "Petroleum and Natural Gas Fields in Wyoming." Bulletin 418, U. S. Dept. of the Interior, Bureau of Mines. U. S. Gov't. Printing Office, Washington, D. C. 185 pp. + folio of maps. \$2.25.
- HARRY N. HOLMES, "General Chemistry." Fourth edition. The Macmillan Company, 60 Fifth Ave., New York, N. Y. viii + 172 pp. \$3.75.
- MORRIS B. JACOBS, "The Analytical Chemistry of Industrial Poisons, Hazards and Solvents." Interscience Publishers, Inc., 215 Fourth Ave., New York, N. Y. 661 pp. \$7.00.
- K. K. KELLEY, "The Entropies of Inorganic Substances." IX of Contributions to the Data on Theoretical Metallurgy. Bulletin 434, U. S. Dep't. of the Interior, Bureau of Mines. U. S. Gov't. Printing Office, Washington, D. C. 115 pp. \$0.15.
- I. M. KOLTHOFF and J. J. LINGANE, "Half-Wave Potentials of Inorganic Substances." (A reprint of the appendix of "Polarography.") Interscience Publishers, Inc., 215 Fourth Ave., New York, N. Y. 10 pp. \$0.75.
- IBERT MELLAN, "Organic Reagents in Inorganic Analysis." The Blakiston Company, 1012 Walnut Street, Philadelphia, Pa. 682 pp. \$9.00.
- QUINTINA MINGOJA, Docente de Chimica, Farmac. and Toxicol. na Universidade de Pavia, Director Quimico do Laboratorio Paulista de Biologia. "Quimioterapia Antibacteriana." Taken from published works during the years 1937–40. Henrique Scheliga and Cia. São Paulo, Brasil. 169 pp.
- "The Primary Process in Photochemistry." Volume XLI, Art. 3, of the Annals of the New York Academy of Sciences. By W. ALBERT NOYES, JR., E. W. R. STEACIE, HUGH S. TAYLOR, EDWARD TELLER and W. WEST. The New York Academy of Sciences, care of the American Museum of Natural History, New York, N. Y. 71 pp. \$1.25.
- HERBERT R. SIMONDS, "Industrial Plastics." Pitman Publishing Company, 2 West 45th St., New York, N. Y. xii + 385 pp. \$4.50.
- ROGER J. WILLIAMS, "An Introduction to Organic Chemistry." Fourth edition. D. Van Nostrand Co., Inc., 250 Fourth Ave., New York, N. Y. xiv + 628 pp. \$4.00.
- National Research Council, "Report of Committee on Drug Addiction, 1929–1941, and Collected Reprints, 1930–1941." 1581 pp.